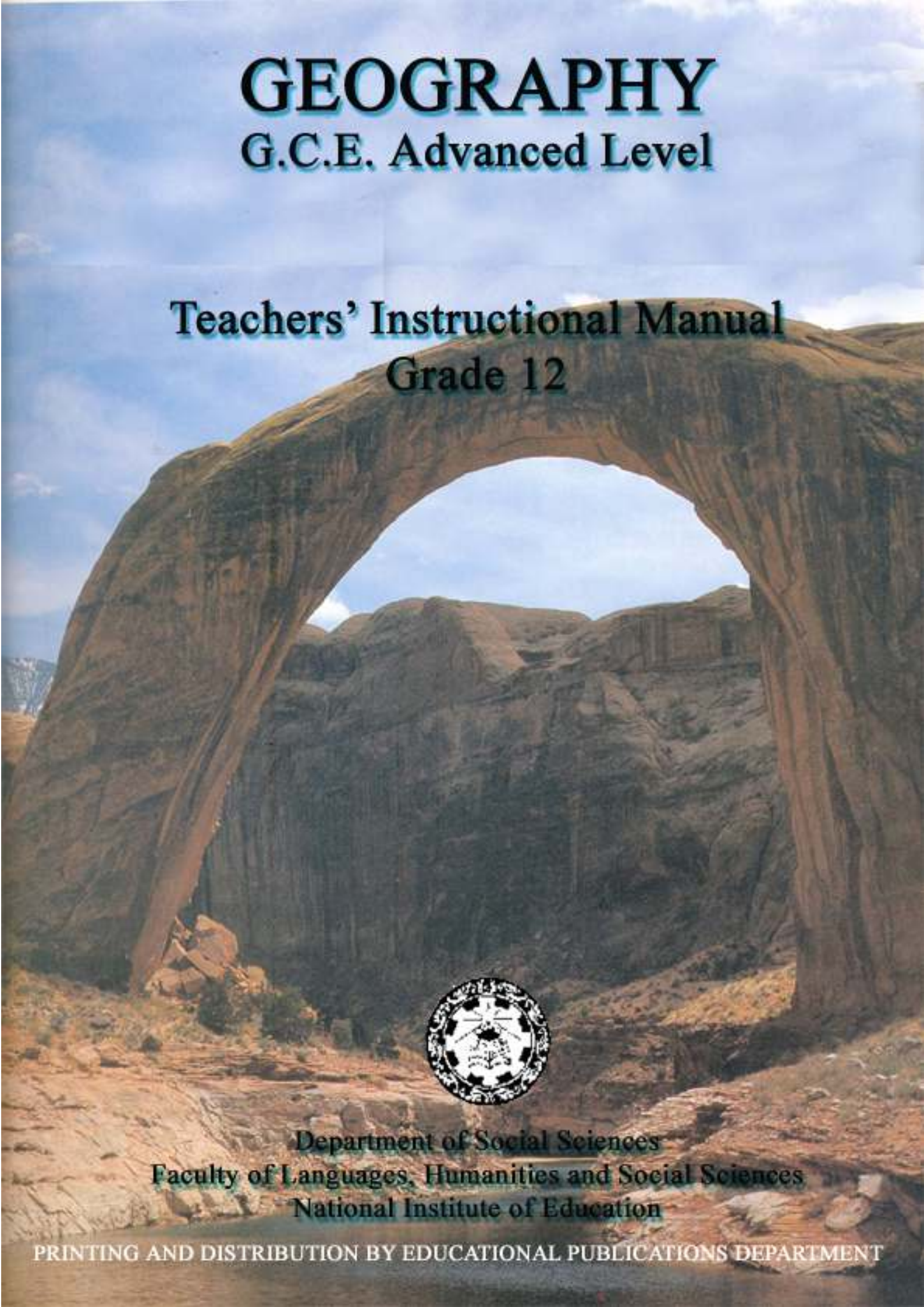
# GEOGRAPHY

## G.C.E. Advanced Level

## Teachers' Instructional Manual
## Grade 12



Department of Social Sciences
Faculty of Languages, Humanities and Social Sciences
National Institute of Education

PRINTING AND DISTRIBUTION BY EDUCATIONAL PUBLICATIONS DEPARTMENT

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**Geography**
Teachers' Instructional Manual
Grade 12 – 2009



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National Institute of Education
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# FOREWORD

The competency based teaching-learning approach that was introduced to Grades 6 and 10 in the year 2007, was also introduced year by year to the curriculum of Grades 7, 8 and 11 and the curriculum developers of the National Institute of Education have been successful in extending it to the relevant curriculum of G.C.E. (A/L) classes in the year 2009. Therefore the relevant detailed information viz syllabi, the Teachers' Instructional Manuals, competencies that should be developed in pupils and the levels of competencies related to various subjects of Grades 12 and 13 have been forwarded. This information will be of immense help to the teachers in preparing their teaching learning activities relevant to their subjects.

When preparing the Teachers' Instructional Manuals for the G.C.E. (A/L) subjects I would like to specify that the curriculum developers have followed an approach different from what they have followed for the Junior Secondary Curriculum. Though the teachers were guided to a desired structural approach in the teaching and learning process of subjects in Grade 6, 7, 8, 9, 10 and 11, when preparing the syllabus and the Teachers' Instructional Manual for G.C.E. Advanced Level classes, the teachers are given the opportunity to select the best possible method at their discretion and to operate accordingly. What is expected from the teachers at this stage is to use a method which they desire out of the proposed methods here and develop the competencies and competency levels relevant to each subject or lesson. The teachers should also apply the selected teaching approach satisfactorily and efficiently and should reach the expected competencies and competency levels. I would like to mention here that the decision of giving this freedom to the teachers was taken after considering the importance of the G.C.E. A/L Examination and the sensitivity of all persons in the education system towards this Examination. May this Teachers' Instructional Manual be an exemplary Handbook to the teachers. I also believe that the information, methodology and instructions given in this Manual will guide our Teachers to enlighten our students.

**Professor Lal Perera**
*Director General*
*National Institute of Education*

# PREFACE

This Teachers' Instructional Manual will be useful for the teachers to organize the teaching-learning process for Grade 12 from the year 2009.

This syllabus that is taken as the base for the compilation of this book is distinct from the syllabi that were in effect earlier. You, who will concentrate on it will realize that it is a competency based syllabus. It is not expected that the achievement of every competency seen here should be gained in the same grade. Sometimes it may take a longer time. However, the competency levels and the learning outcomes indicated under each of the competency levels have to be achieved during that grade itself. Hence those competency levels and learning outcomes will be of immense use to you in planning the relevant lessons for the grade. It is expected that you should draw your attention in using them as criteria when preparing each of the aims in the teaching-learning process as well as in setting the evaluation tools to be used in the classroom. This Manual will be very useful to you in making the students aware of the supplementary books that have to be read in learning this subject as well as the web-sites to be surfed.

Consider these activities proposed here with the expectation that you will act as a creative teacher. It is especially expected that you will be able to create a student-centred classroom process by changing the teacher-centred class room process that prevailed. Hence you should make an attempt as far as possible to create learning situations where students are motivated to refer various books and to lead them in exploration by using the internet. In teaching, instead of giving notes as traditionally done, you should present principles with the new knowledge in an attractive manner. In this regard use of communication strategies in the class where technology is included as far as possible. It requires some creativity to use new technological instruments as far as possible.

Explain this curriculum to your students who start learning this subject in Grade 12. If you could introduce the plan of teaching for the whole year it will motivate them. Students will be attracted to attend school to cover up the syllabus. We make a request from you to awaken your creative abilities with the help of these proposed activities and also the relevant syllabus in order to make a change in the teaching-learning process.

I offer my thanks to all the Educationists, teachers and all the officers in the National Institute of Education who contributed in compiling this Instructional Manual. I offer my special thanks to Professor Lal Perera, the Director General who guided us in this task as well as the Commissioner General of Educational Publications Department including his staff who undertook the responsibility of doing all the printing and distribution of books to the schools.
I shall be grateful if you could direct any creative suggestions regarding the information included here.

**Wimal Siyambalagoda**
*Assistant Director General*
*Faculty of Languages, Humanities and Social Sciences*
*National Institute of Education*

## Message of the Commissioner General

While the Government provides textbooks free to all the students, Teachers' Instructional Manuals are also provided free to all the teachers. The aim is to make the process of teaching-learning more fruitful and effective.

The Teacher is the mediator who monitors and directs the students to achieve the competencies contained in the syllabus. Hence, it is your responsibility to understand your duties well and use this Teachers' Instructional Manual to achieve a substantial knowledge of the teaching process. This will enable you to make the students knowledgeable and motivated to derive the maximum benefits from the competency based learning process.

I hope that this Teachers' Instructional Manual will assist the teachers who shoulder the solemn duty of moulding the student population enabling them meet the challenges of contemporary society.

**W. M. N. J. Pushpakumara**
Commissioner General of Educational Publications

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# CONTENTS

# Geography I
# Physical Geography

## Competency - 1

## Examines the nature and processes in the environment where one lives and contributes in protecting its equilibrium.

**Competency Levels :**

**1**.1 Defines the main elementary features in a Geo system (14 periods)

1.2 Explains the nature and significance of the atmospheric system.

1.3 Explains the nature and significance of the hydrosphere

1.4 Explains the nature and significance of the lithosphere

1.5 Shows the nature and significance of the biosphere

**Learning Outcomes :**

- Explains the types of systems
- Introduces the main sub-systems in the Geo system
- Analyses the mutual relationship among systems
- Explains the structure of the Lithosphere
- Explains the nature and importance of the bio-sphere

## Introduction

It is important that man who depends on the environment feeding himself on the environment has obtained an understanding about the nature and processes of the environment he lives.

Environment is the geo-system on earth. This geo system includes all living and non-living parts, the interior of the earth, and the atmosphere around the earth. All these in combination act as a system.

A system exists as a whole in a collection of material or objects. They are bound together due to the properties of the objects and materials. Hence it is important to study it as a system because of the mutual relationship among the earth, the atmosphere around it and the other elements.

In the present day world, a disturbance in the equilibrium of the environmental system is seen because mans' interference on geo-systems is very strong.

Hence, in this grade, it is expected to examine the main characteristics of geo systems with reference to information.

**A guidance to clarify subject content**

# Introduction to types of systems

A system is a circuit built up logically within a system within which there are inputs, storage process and output. Systems can be classified into three according to the manner in which they absorb energy and matter.

1. Isolated system
2. Open system
3. Closed system

- **Isolated system**

  It is a system which produces the energy and matter relevant to its functions within the system itself. For eg. Solar system

- **Closed System**

  A system which obtains the required energy and matter for its functioning from another system and releases the energy and matter after its processes. For eg. River system

- **Open system**

  A system that operates obtaining only the energy and not the matter required for its functioning and releases the energy back after operating. For eg. Atmospheric system

## Geo system

Due to the inter relationship among the earth, the atmosphere around it and all its living and non-living components, it can be named a geo system as a whole. This can be divided into 4 main sub-systems.

- atmospheric system
- hydroscopic system
- lithosphere system
- biosphere system

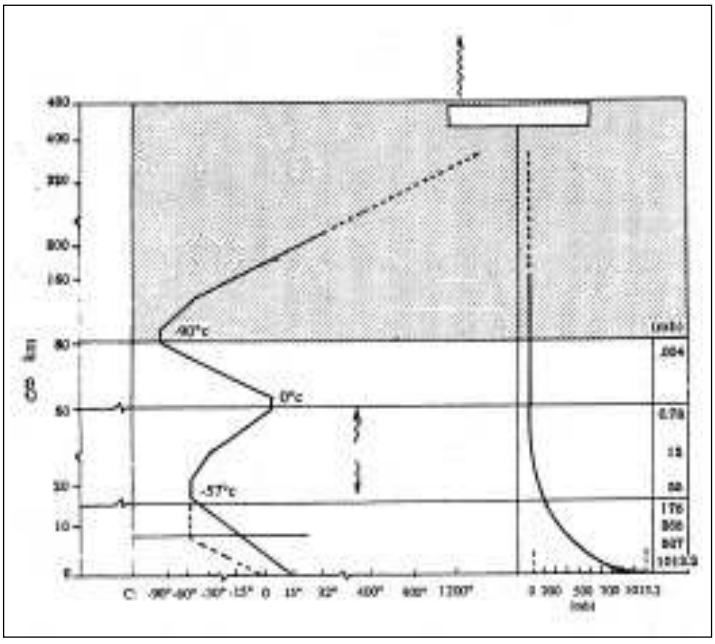
## Atmospheric system

The air envelope covering the earth is known as the atmosphere. Within that diverse gases, dust, smoke, salt particles are combined together as a system and function.

**Atmospheric Composition**

| Types of gases | Symbol | Volume |
|---|---|---|
| Nitrogen | $N_2$ | 78.08 |
| Oxygen | $O_2$ | 20.94 |
| Argon | Ar | 0.93 |
| Carbondioxide | $CO_2$ | 0.03 |
| Helium, Neon, Methane | He, Ne, $CH_4$, Kr, $O_3$ | 0.02 |
| Krypton, Ozone and other gazes | | 100.00 |

**Atmospheric Stratification (Structure)**



**Troposphere**

- This is the lowest layer in the atmosphere
- It extends to about 16km up near the equator while at the poles it extends up to 8km
- About 80% of the gases are distributed in the troposphere
- Most of the biotic processes take place in the troposphere
- Lapse rate occurs within the troposphere

**Tropopause**

- The upper limit of the troposphere is the tropopause
- This is the boundary which separates the troposphere and the stratosphere

**Stratosphere**

- This is situated above the tropopause
- The upper limit of the stratosphere is about 50 km
- An air layer of ozone gas which is very essential for living beings is prevalent at about 30-35 km up
- About 10% of the composition of the atmosphere are contained here

**Stratopause**

- Situated above the stratosphere
- This is the boundary which separates stratosphere and Irnosphere
- The pressure in this region is of a low value of about 0.004 millibars
- It is low in dust, smog and salt particles
- The temperature is lower

**Irnosphere**

- Irnosphere is seen after passing the upper limit of the stratosphere
- Irnosphere can be divided into two
  - Mesosphere
  - Thermosphere
- Although these are discussed separately due to the interrelationship among them it functions as one system.
- Atmosphere contributes in the existence of life. The landscape which is essential for man's existence is created by the action of the atmosphere.

## Hydrospheric system

All the sources of water on the surface of the earth belong to the hydrospheric system. The total quantity of water in the earth is about 1360 million cubic kilometres.

Hydrospheric distribution means the extension of expanses of water . This can be considered under 2 main parts

1. distribution of fresh water
2. distribution of sea water

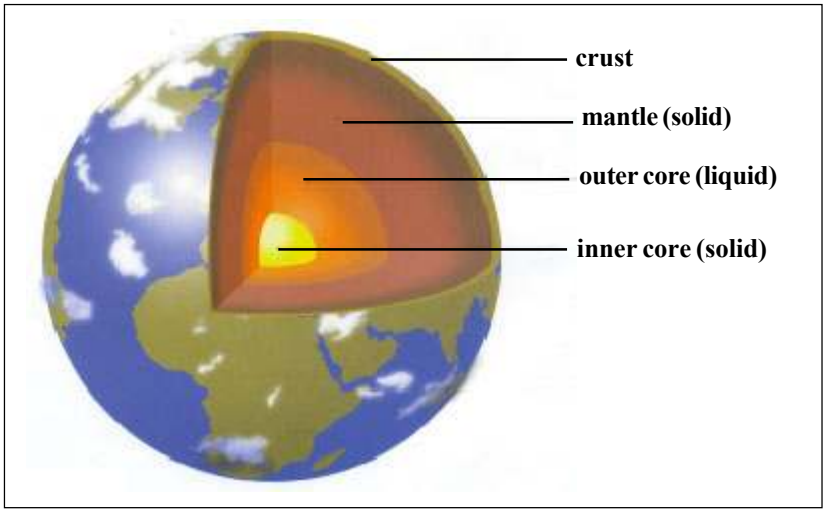
Hydrosphere is in 3 states as solid, gaseous and ice.

## Lithosphere System

Lithosphere is the largest and the most dense sub system in the earth environment. It consists of a few layers.

- crust
- mantle
- core — outer core
  - interior core

**Layers of the lithosphere**




Suource: Essential Atlas of Physical Geography

### Crust

- Layer on the surface of the earth
- It is about 10 km thick and at certain places it is about 15 km thick
- The crust consists of 2 layers as sial and sima
- The most abundant rock type is granite
- The earth crust consists of major plates and a few minor plates.
- Lithosphere exists as a non-liquid state and mostly it is solid.

### Mantle

- It is the layer underneath the crust of the earth
- It extends to about 2900 km
- It is a zone of high temperature
- Elements like silica, iron, aluminium and magnesium turn into lava or magma as a result of very high temperature

### Core

- The core consists mainly of nickel and iron is found in a small quantity
- The core consists of 2 parts as the outer core and the inner core
- The inner core is composed of solid materials while its radius is about 1250 km
- The outer core is about 2200 km thick

## Biosphere system

The biosphere can be recognized as the part where activities are taking place all the time and where life occurs or the layer with living beings (plants, animals, micro organisms)

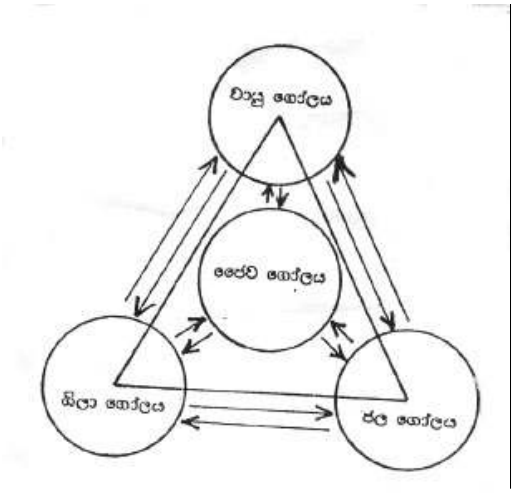
## The limits of the biosphere

The biosphere is the region under limits as given below.

**Lithosphere**– soils (the limit where the roots of a plant spreads and bacterial action is taking place)

**Hydrosphere**– Water (the limit where sunlight is received which is necessary for the process of photosynthesis)

**Atmosphere** – Air (The maximum limit with air necessary for existence of life)



**There are a few organizing levels in the biosphere**

- **Living being**

  Any living being belonging to any species living in a particular place is known as a living being. For example fly, bird, stag, elephant, cactus, grass etc.

- **Population**

  A group of living beings belonging to the same species and living in a definite land area for a definite period. Population is the organized level just above the living organism. It is a collection of plants or fauna belonging to the same species. Population also acts as a single unit. For example elephant population in Yala Sanctuary, the total population in Sri Lanka in 2001.

- **Biotic community**

  The community is the level just above population in the order of organized levels. Any assemblage of population of living organisms in a prescribed habitat or area is termed a biotic community.A biotic community is a naturally occuring assemblage of plants, animals, micro organisms that live in the same environment. A biotic community may be large or small. The size is decided by the number of plant or animal population and the quantity which compose that community.

- **Eco system**

  The organized level just above the community is eco-system. An eco-system is a sum total of living organisms, the environment and the processes of interaction between and within all parts of the system including the non-living environment.

- **A biome**

  A biome is a regional community of plants and animals of similar evolutionary status and similar life pattern. Any biome is named according to its main characteristics. For example Tropical Rain forest biome, fresh water and salt water biome, wetland biome. Biosphere is created by the interaction of all these biome.

There are 2 components which influence the functions of the biosphere

1. Living components
2. Non-living components

The continuation or existence of the biosphere is determined by the interaction between living and non-living factors.

There are 4 main elements in the biosphere which are important. For eg. hydrogen, carbon, oxygen, nitrogen. The above elements are essential for the existence of living organisms.

Soil, atmosphere and hydrosphere are all essential for the functioning of the biosphere.

Plant leaves produce food utilizing air in the atmosphere, water from the hydrophere and energy from the sun. This process is known as photosynthesis.

There is an exchange of energy between the organic and inorganic systems in the biosphere. Hence biosphere is an open system.

No organism can live isolated within the biosphere since an inter-dependence is seen.

The energy required for the activities in an ecosystem are obtained totally from the sun. Apart from this, a small quantity of energy is supplied by the breaking down of some chemical substance.

The energy stored in plant is received by various trophic levels through food chain in relation to photosynthesis.

| **Eco System** | **Trophic levels** | | | |
|---|---|---|---|---|
| | **Primary producers** | **Primary consumer** | **Secondary consumers** | **Tertiary consumers** |
| 1. Home garden | Shrubs including types of grasses and Mimosa pudica (nidikumba) plants including, hedysarum, desmodium mangoes, cashew, guava trees types of flowers | grasshopper<br>butterfly<br>parrot<br>sunbird<br>flower pecker<br>bee<br>bat<br>rabbit | frog<br>lizard<br>myna<br>babbler<br>magpie<br>cock<br>fox-bat<br>crow pheasant | sirpine<br>eagle<br>owl<br>mongoose<br>crow pheasant |
| 2. Fresh Water Pond | water lilies<br>lotus<br>plant plankton | fish for eg.<br>gurami<br>darb<br>snail<br>tadpole<br>water skater | lila<br>frog<br>water snake<br>kingfisher | lila<br>heron<br>kingfisher<br>watersnake<br>cormorant |

## Food Chains

- A food chain is the order in which various trophic relations take place through the flow of energy in an eco-system
- Energy flows from one trophic level to the next trophic level due to the process of obtaining food.

## Food webs

There are a number of food webs in an eco-system. Since some animals are used to taking food from a number of food chains, food webs are created. Hence food chains are mutually connected. As a result of this, within an eco system a web of trophic relations are built up.

## Ecological pyramid

Ecologists have presented the trophic relationship that exists among various trophic levels in an eco-system. This is shown in the form of a graph. Since this bar graph takes the shape of a pyramid, it is known as an ecological pyramid.

There are 3 types of ecological pyramids

1. Numerical pyramid
2. Bio-mass pyramid
3. Energy pyramid

- In the present day world, with the complexity in human activities the impact of man on the environment is very strong.
- This has resulted in disturbing the equilibrium in the biosphere
- Hence it is our main duty to protect the eco system because a lot of harm will be exerted on the existence of man if that happens.

## Reference:

Environmental Geography – Dept. of Educational Publications

# Teaching-Learning Activities

## Activity - 1

Explain the basic features of systems through a brain-storming discussion

- Make use of pictures, photographs, diagrams and computer presentations to explain the special features of atmosphere, hydrosphere, lithosphere and biosphere systems.
- Do evaluation work based on learning outcomes.

## Activity -2

Preparation of a magazine with the participation of all the students. Give a topic to each of the students during the period allowed and get them to write the articles. Here it is expected that the final product, the magazine will be finished. Obtain the articles for the magazine under the following headings.

- Introduction to the types of systems
- The main sub-systems of the earth:
  - atmosphere
  - hydrosphere
  - lithosphere
  - biosphere
- Organized levels in the biosphere
- How the biosphere works
- Food chains
- Food web
- Energy pyramid
- The significance of protecting the equilibrium in the eco-system and numerical pyramid
- Its is required that information as well as drawings and diagrams relevant to the heading should be included.
- The magazine should be finished in an attractive way within the given time and handed over .
- Appreciate student skills. Identify their weaknesses and give guidance to minimize them.
- Do the evaluation work based on learning outcomes.

## Competency - 2

## Concentrates on conservation while enquiring into the components, characteristics and processes in the physical landscape of the earth.

**Competency Levels :** **2**.1 Explains the structure and composition of the earth in relation to facts

(10 periods)

**Learning Outcomes :**

- Describes the structure and composition of the earth
- Presents facts about the interior of the earth
- Draws a diagram of the cross-section of the earth where the parts are named
- Presents facts about the classification of rocks giving examples

## Introduction

Solar system is a part of the universe. The earth which is the habitat of man can be recognized as a special planet in the solar system. From the information about the location, size, rotation, revolution and satellite of the earth which had its origin about 4600 million years ago, it can be identified as a planet with mediocre (moderate) qualities. At present though it has been identified that the earth is the only planet in the solar system where living beings live, it is believed that there may be such planets in the Universe. In future man on earth will be able to establish such beliefs.

The structure of the earth can be simply interpreted as the way the whole of the earth is composed of. In a cross-section of the earth, the crust, mantle and core can be mainly recognized as its interior parts. The study of these parts can be stated as the study of the structure of the earth.

The earth is composedof the lithosphere, hydrosphere, atmosphere and biosphere on its surface.

It is expected to study the structure of the earth, its composition, lithosphere and its dynamic nature in this unit.

### A guideline to clarify subject content

**The structure and composition of the earth**

- interior of the earth
- crust of the earth
- formation of rocks
- types of rocks

**Interior of the earth**

- Facts about the earth's interior have been found on diverse direct and indirect evidences.

- Direct evidence – By drilling to about 300 metres (3 km) for example gold deposits of Kola in Mysore and gold mines of Witwaterstrand in South Africa

  – Mohel Project which had drilled the earth up to the upper mantle

- Indirect evidence – from the solar system. Other examples are meteorites, earthquake waves, volcanic materials geo-heat gradient and magnetic field.

**A few basic facts about the interior of the earth**

- As one goes towards the interior of the earth there is a rise in temperature at the rate of $9^0$C to every 300 m. Yet this does not happen at a uniform gradient.

- The fact that solid rocks are found at a depth of 700km shows that the increase in temperature does not take place at a uniform gradient.

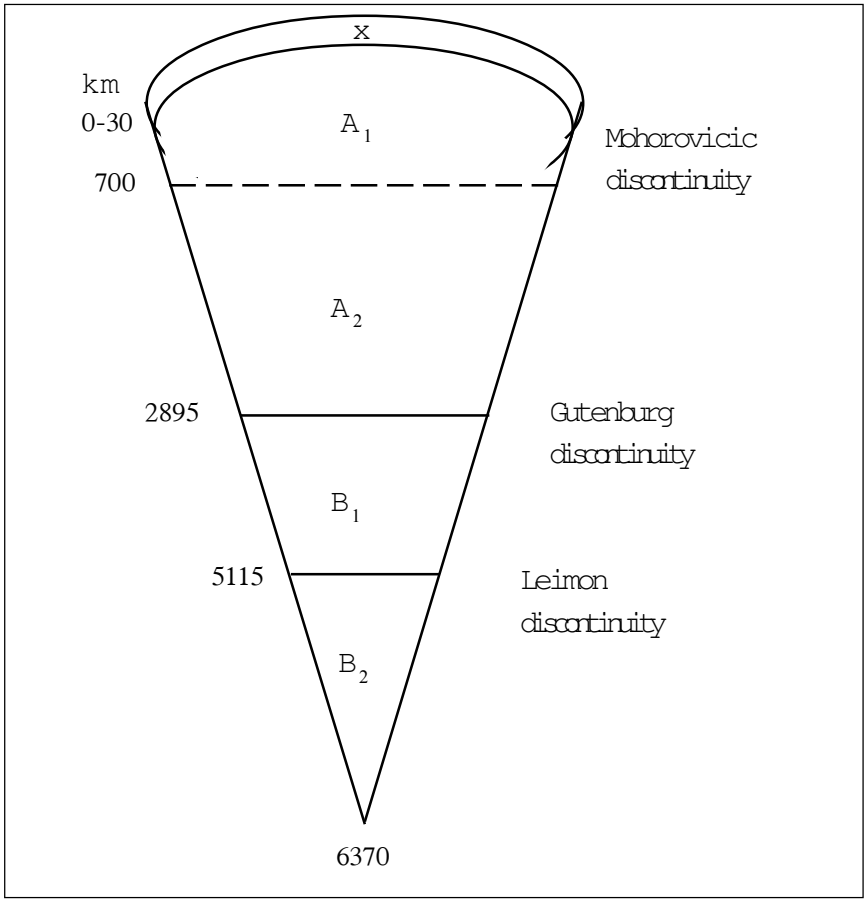
- At the boundary of the core of the earth this temperature exceeds $6000^0$C.

- It is said that such a high temperature is created due to radioactive elements in the rocks of the interior of the earth. However diverse theories are presented about the presence of very high temperature in the interior. Further research is being carried out regarding this. The earth's crust and mantle consists of solid rocks.

- Presure also increases towards the interior of the earth. It is mentioned that pressure at the centre of the earth is 3.15 million kg.

- It has been found that the rocks in the outer core of the earth are in a liquid form and those of the inner core are in solid form.

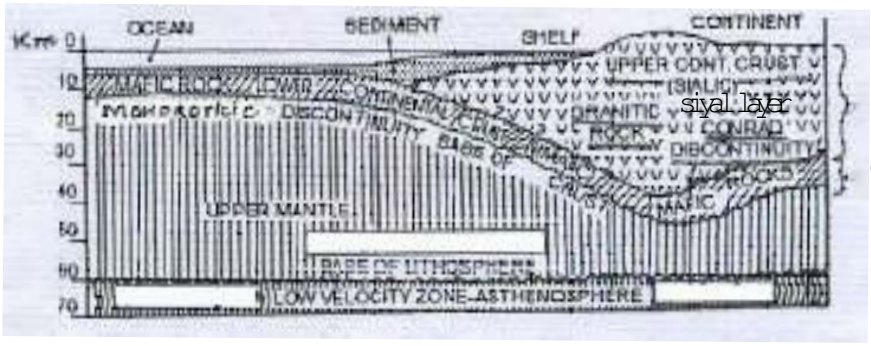
**A cross section of the earth**




| Zone | Features and other facts |
|---|---|
| X = crust | Consists of sial and sima layers.<br>It extends to a depth of about 16–40 km |
| A = Mantle | Consists of silicate rocks abundant with iron and magnesium<br>There are 2 layers here according to the nature of rocks<br>$A_1$ - upper mantle<br>$A_2$ - Lower mantle |
| B = Core | Consists of iron and nickel.<br>Here the outer core ($B_1$) consists of Ni and Fe (nickel and ferrous)<br>$B_2$ – or the inner core consists of Ni (nickel) and Fe (ferrous) |

## The Earth's Crust

The earth's crust is a thin narrow layer on the surface of the earth. If the earth is like an orange, the outer peel of it can be called the crust. This crust consists of sial and sima layers.




A cross-section of the lithosphere showing the crustal areas in the continents and sea bottom.

**Sial layer** – Consists of acidic granite rocks abundant with silicon and aluminium (Si + Al) oxides. Examples are Kaduganawa gneiss of Sri Lanka
– Under mountain areas sial layer extends to a greater depth while in the oceanic areas it is thin. The density of this layer is about 2.6-2.7.

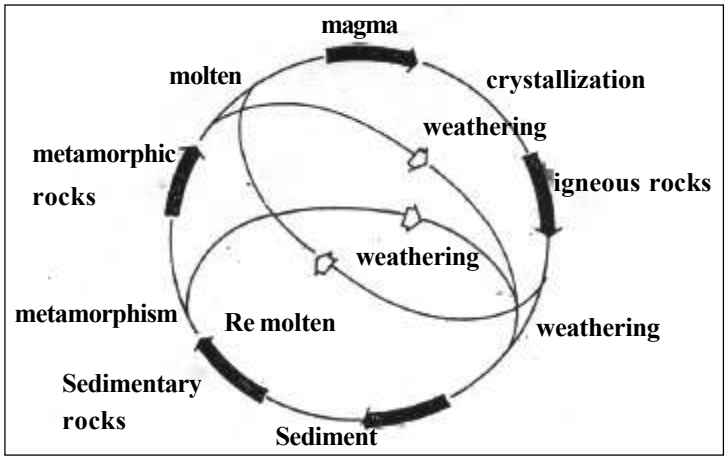
**Sima layer** – is situated under the sial layer while the Conrad Discontinuity is between these two layers
– Sima layer consists of basaltic rocks abundant with silican and magnesium
– At the ocean bottom, the base is composed of the sima layer

## Formation of Rocks

- The lithosphere is composed of rocks abundantly seen on the surface of the earth. These rocks and their properties influence the formation of diverse landforms and the formation of the human landscape on the surface of the earth. These rocks composed of a collection of minerals perform a special function within the total environment.

- Rocks are classified into three types on the basis of their place of origin and the physical conditions:
  Igneous rocks
  Sedimentary rocks
  Metamorphic rocks

These rocks undergo changes constantly under the internal and external processes on the earth. Under such conditions one type of these rocks may change into another type. This is a cyclical process.




## Types of rocks

**(1) Igneous Rocks** – In the interior of the earth due to very high temperature rocks are in a molten liquid state. This is known as magma. Magma flows up on to the earth's surface through various joints and clefts. This process is also known as volcanism. The volcanic rocks were formed when molten material poured out on to the earth's surface and cooled. The igneous rocks were formed in this manner.

**Extrusive igneous rocks**– when magma flows out on to the surface of the earth it is known as lava. When lava gets cooled and solidified extrusive igneous rocks are formed.

**Intrusive igneous rocks** – On its way to the earth's surface sometimes magma gets cooled inside chambers in the crust forming intrusive igneous rocks.

Intrusive igneous rocks are of 2 sub types –

(a) Plutonic rocks

(b) Hypabyssal rocks

**A simplified classification of Igneous rocks**

Igneous rocks are classified – according to colour

– according to composition and percentage of silica present in them.

**According to colour**

If dark in colour – It is called Basic rocks abundant with ferrous and magnesium minerals (Fe, Mg) for eg. gabro, dolomite

If light in colour – It is called Acid rocks with less Fe and Mg. For example granite.

If the colour is intermediate – It is called Intermediate rocks.

**According to chemical composition**

– Igneous rocks constitute various chemical substances. The main substances are ferrous, magnesium, silicon, olavine.
Igneous rocks can be classified on the percentage of silica and iron contained in lava–

1. Acidic igneous rocks – Si percentage > 65%
   Fe 20% – 25% examples are granite, diorite, dosedian
2. Basic igneous rocks – Si percentage < 55% and
   Fe about 45%
   Examples are gabro, basalt
3. Intermediate igneous rocks – Si percentage 65% – 55%
   e.g. andecite
4. Para basic rocks –Si percentage is < 45% and
   Fe > 50% eg. peridotite

## (2) Sedimentary Rocks

- Rocks decay with the passage of time due to exogenic factors. The decayed rock particles are deposited at another place or near the country rock as a result of erosional process. This decayed material is known as sediments

  These sediments are collected as layers or strata and undergo high pressure and high temperature to become rocks. They are known as terrigenous clastic sedimentary rocks.

  These sediments lie in horizontal layers due to the pressure of overlying sediments.

- When materials are precipitated in a non-mechanical manner also sedimentary rocks are formed.

  They are known as chemically – precipitated sediments.

  For example, rocks are formed when the residual carbon ate is accumulated after water is vapourized in an area of shallow sea water. They are known as non-clastic sedimentary rocks.

- Non clastic sedimentary rocks are formed by the organic process also. They are also known as organic deposits.

A simplified classification of sedimentary rocks

(1) Clastic sedimentary rocks/ mechanically formed/ physically formed
- shingle – graved/ till/ conglomerate
- arenaceous – sand/ sandstone/ grit
- argillaceous – mud/ clay/ slates/ mudstones

(2) Chemically precipitated sedimentary rocks
- saline rocks/ jasper/ flint
- haematite/ limonite/ siderite

(3) Organic sedimentary rocks (organic deposits)
- calcareous sediments/ limestone
- organic sediments – coal, lignite

(3) **Metamorphic Rocks**– When igneous and sedimentary rocks have changed their original state these rocks are called metamorphic rocks. When the original structure and composition which is considered as the original state is changed a new kind of rock is formed. These changes occur under high temperature and pressure. When these rocks are metamorphosed a stronger resistivity than in the original rock is seen.

**A simplified classification of metamorphic rocks**

| **Original rock** | | **Metamorphic rock** |
|---|---|---|
| Granite (igneous) | → metamorphism | gneiss |
| Sandstone (sedimentary) | → metamorphism | quartzite |
| Limestone (sedimentary) | → metamorphism | marble |
| Slate (sedimentary) | → metamorphism | schist |

## Teaching learning Activities

### Activity

- Presenting facts about the interior of the earth through a group assignment

- Group the class as suited. Give the following topics as suited.

  Group I – Presenting evidence found about the Interior of the earth

  Group II – Presenting basic facts about the Interior of the earth

  Group III – Drawing a diagram of a cross-section of the earth with the parts named

  Group IV – Presenting facts about the earth's crust

- Give the chance to each of the groups to present the facts they had collected.

- After each of the groups present their facts the teachers should evaluate them in a review session stating the correctness and suitability of the information.

**Competency Levels :** **2** 2 Examines about the formation of rocks, minerals and soils of Sri Lanka

(10 periods)

**Learning Outcomes :**

- Shows the geological zones on a map of Sri Lanka and gives details about them.
- While introducing what are minerals presents details about minerals of Sri Lanka
- Collects facts about formation and properties of soils by a soil profile
- Presents information about the classification of soils in Sri Lanka

## Introduction

It is accepted that Sri Lanka is one of the oldest landmasses of the world. It is believed that most of the rocks were formed before 3000 million years ago. Most of these rocks were formed during the Archaen Era or Pre – Cambrian era. More than 90% of the island consists of metamorphic rocks. It is believed that they were metamorphosed about 550 million years ago. In Sri Lanka 3 main rock types have been identified based on their origin, metamorphosed condition and structure.

1. Highland series
2. Vijayan series
3. Miocene limestone belt

### Highland Series

- Consists of metamorphosed sedimentary and metamorphosed igneous rocks
- Metamorphosed sedimentary rocks for eg marble/ quartz/ dolomite
- Metamorphosed igneous rocks for eg. charnokyte/ metamorphosed acidic types/ metamorphosed basic types. It is found that these are the oldest rocks.
- The Highland series extends from a narrow strip around Trincomalee to the Central Hill country and makes a wide zone including Rakwana Hills. Kataragama Hills too consists of Highland Series.

**Vijayan Series**

- This complex is formed of metamorphosed igneous rocks
- Also consists of metamorphosed granite and migmatite rocks
- This Series of rocks is distributed to the east of the Highland Series of the Central Hill Country and in the north-western region.

**Miocene Limestone Belt (organic limestone)**

- Consists of sedimentary rocks which are not metamorphosed
- The main rock is limestone and is distributed as a narrow belt from Puttalam to Jaffna.
- Since it has its origin about 26 million years ago during the Miocene Period, it is so named as Miocene limestone.

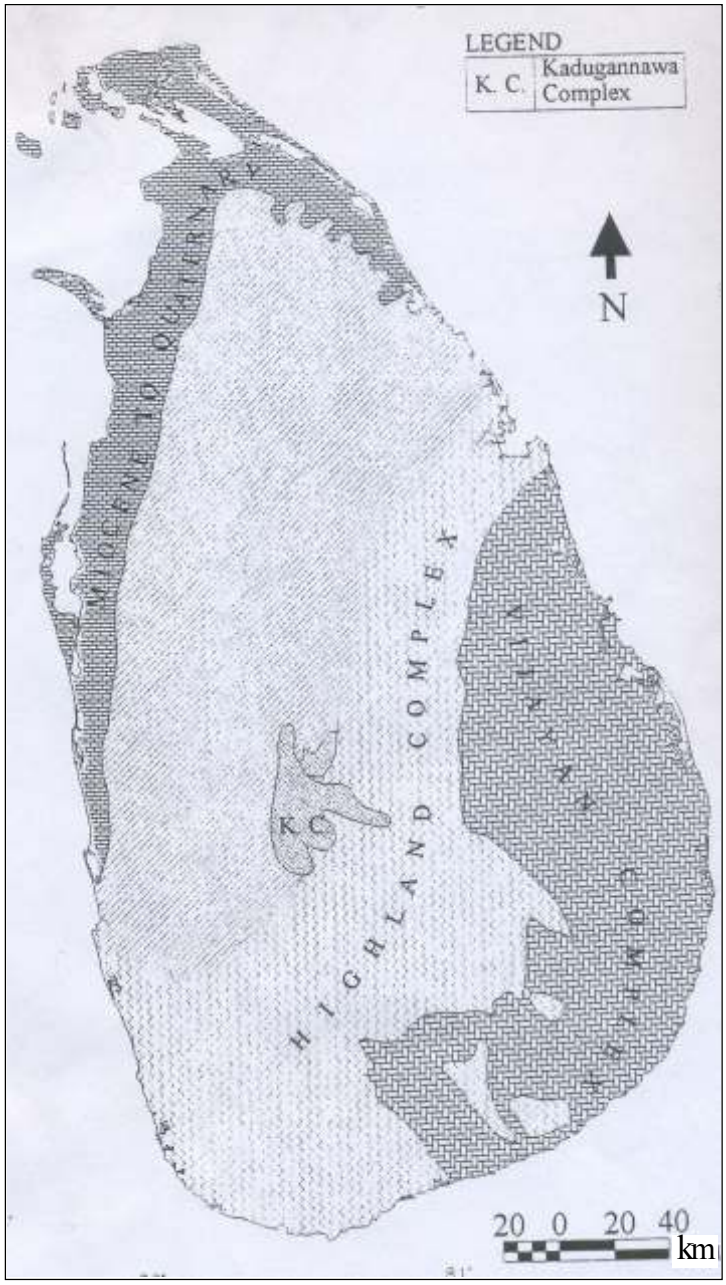
In addition to these, a few slate and sandstone deposits formed during the Jurassic period are found in the fault basins of Tabbowa, Andigama and Pallama areas.

## The Formation of Rocks of Sri Lanka according to the Geological Time scale

| ERA | PERIOD | EPOCH | Geological Time Scale in millions of years | The main Geological Incidents - Origin of Rocks |
|---|---|---|---|---|
| Archaeozoic 600-7500 million years | Pre-cambrian | Pre-cambrian<br>Recent<br>Pre-cambrian | <br>2500-4500><br>600->2500 | Deposition on the ancient geosynclines, regional metamorphism of Highland Series and Kataragama rocks complex.<br>The base of Vijayan gneiss rocks - Kadugannawa gneiss, Dambulla, Habrana gneiss and migmatite. |
| Paleozoic 225-600 million years | Primary | Cambrian<br>Ordovician<br>Silurian<br>Carboniferous<br>Permian<br>Triassic | 600<br>500<br>440<br>400<br>350<br>270<br>225 | Rock types of Vijayan Series - Bintenna gneiss, Vanni gneiss, Thonigala granite.<br><br>Granite and granatic gneiss of the south western region Pegmatite. |
| Mesozoic 70-225 million years | Secondary | Jurassic<br><br>Cretaceous | 180<br><br>135 | Deposition of non-marine deposits - those in Thabbowa, Andigama and Pallama, on the ancient crystalline landmass of Sri Lanka.<br>The breaking down and disintegration of the Gondwanaland, continental drift. Deposition between Sri Lanka and India. It is considered that the Dolerite dyke of Kantalay, Trincomalee and Matugama formed during the Cretaceous period. |
| Cainozoic 70 million years to present day | Tertiary | Paleocene<br>Eocene<br>Oligocene<br>Miocene | 70<br>60<br>40<br>25 | -<br>-<br>-<br>The region between India and Sri Lanka went under the sea (subsidence), Sri Lanka got separated from India. |
| | | | 12 | The formation of Miocene limestones. Minihagalkanda deposits formed. |
| | | | 2< | Uplift and erosion, sea level rose to about 1-2 metres. Hence deposits of limestone and shells. |
| | Quarternary | Pleistocene<br>Holocene | 01-Present day | Formation of haematite pebbles on a base of red soil pebbles, Laterites of the south west and Ratnapura deposits formed.<br>Formation of the present continental drift; new uplifted coast, recent alluvium, formation of lagoon marshes. |

Source: 1. P.G. Cooray - 1967, An Introduction to Geology of Sri Lanka.
2. B. Swan - 1993, An Introduction to the Coastal Geomorphology of Sri Lanka.

**Geological Map of Sri Lanka showing the main rock strata**




Source: P.G. Coory 1967 An Introduction to Geology of Ceylon

## Minerals

### Definition

- A mineral can be defined as an inorganic substance which is formed naturally and constitutes a definite chemical composition.
- Minerals – solid, liquid and gaseous } form
- Solid minerals – e.g. plumbago/ diamond/ limestone
  liquid mineral – e.g. petroleum
  gaseous – e.g. natural gas
- Very often solid minerals are seen as crystals
- A crystal is a solid object formed in nature with plane facets and edges and having a definite internal atomic formation
- A number of crystalline minerals are seen in rocks
- Some of these minerals seen in rocks are silicate, carbonate, haliote, oxide and sulphate.
- Out of the minerals found in the crust of the earth 95% are silicate minerals

### The Physical properties of minerals are

- colour
- brightness
- hardness
- crystalline shape
- joint planes
- specific gravity
- magnetic quality

### The Minerals of Sri Lanka

- Though Sri Lanka is a small geographical region, she possesses a considerable amount of mineral resources
- Most of these minerals are non-alloys
- Non-metallic minerals are – gems, ilmenite, rutile, zircon, mica. limestone, clay, phosphate, silica
- The minerals of Sri Lanka can be classified into 3
  1. Fuel minerals
  2. Metallic (alloy) minerals
  3. Industrial minerals
- Among the energy producing minerals of Sri Lanka, the main minerals are peat, radioactive uranium and thorium

- Peat is the primary state of coal. Peat is a deposit that is formed when plants in ponds, and marshes remain in a semi – decayed state for a long period. For eg. the peat deposit of Muthurajawela (the peat deposit in Sri Lanka has no economic value)
- Gems, mica, plumbago, limestone, clay, mineral sands, phosphate rocks, feldspar, silica sand and ornamental rocks are the industrial minerals of Sri Lanka.

## Soil formation and properties of soil

Soil can be simply defined as denuded remnants and organic substances which are formed by the weathering of rocks. After undergoing soil forming processes for a long period of time, this soil is seen on the surface of the earth as a thin layer. This soil layer is capable of making a direct impact on the bio system of the earth.

### Formation of soil

- The factors that influence the formation of soil
  1. parent rock
  2. climate
  3. relief
  4. organic system (soil organism/ natural vegetation)
  5. time

The influence of each of the factors in soil formation has to be explained.

Parent rock – Influences the minerals, colour structure and composition of the soil.

Climate – Temperature and rainfall which are the main climatic elements influence the formation of soil. Soil temperature and soil moisture influence disintegration of the parent rock and soil processes.

Relief – Topographical features in a region such as the nature of slope and the lowlands influence the formation of soil. The nature of the land influences the erosional and depositional processes especially which in turn influences the formation of soil.

Organic system – The influence of the action of soil organisms and the nature of natural vegetation on the formation of soils is great. The acceleration or slowing down of soil formation depends on such factors. A fertile soil profile is formed within a very short period in environments where organic system is active.

Time – A certain period of time is required for the above – mentioned factors to activate any process. Hence the factor of time is significant in the formation of soil. Though a long period is required for the formation of soils, soil generating processes only determine the length of that time.

## The main properties of soil

The diverse characteristics of soils can be studied under two headings such as physical properties and chemical properties

- Physical properties of soil
  - soil colour
  - soil structure
  - soil moisture
- Chemical properties of soil
  - Acidity
  - salinity

**Soil colour** - Soil colour is determined by the amount of organic substances, the proportion of minerals and types, and chemical elements and amounts,

- If the organic substances are abundant, soil is dark brown or black in colour.
- If calcium, potassium and gypsum are abundant, the soil is grey in colour.

**Soil texture** - The nature of soil particles determines the soil texture.
The proportion of sand, clay and silt determines the softness or the rough nature in the texture.
Thus according to the diameter of the soil particles,

| | | |
|---|---|---|
| rough sand (pebbles) | – | > 2 mm diameter |
| medium sand (rough sand) | – | 2 mm – 0.2 mm |
| soft sand | – | 0.2 mm – 0.02 mm |
| silt | – | 02 mm – 0.002 mm |
| clay | – | < 0.002 mm |

**Soil structure** - The soft sand, clay and silt get combined together to form soil crumbs (particles). Soil structure shows how soil particles are combined together, soil moisture, air and organic action take place on this structure.

**Soil moisture** - Soil water can be 3 types according to the manner water is deposited in the soil

1. Hydroscopic water
2. Gravitational water
3. Capillary water

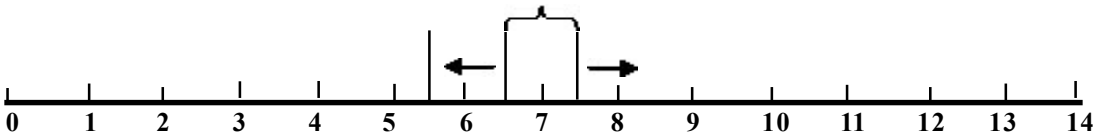
**Hydroscopic** water – This is the water that gives moisture to the soil but which cannot be absorbed by plants. This moisture cannot be eliminated from the soil easily. It is said that even if the soil is dried, 100% of this part of water will not be eliminated.

**Gravitational water** – This is the part of water that permeates downwards following gravity. This part of water gets collected as ground water.

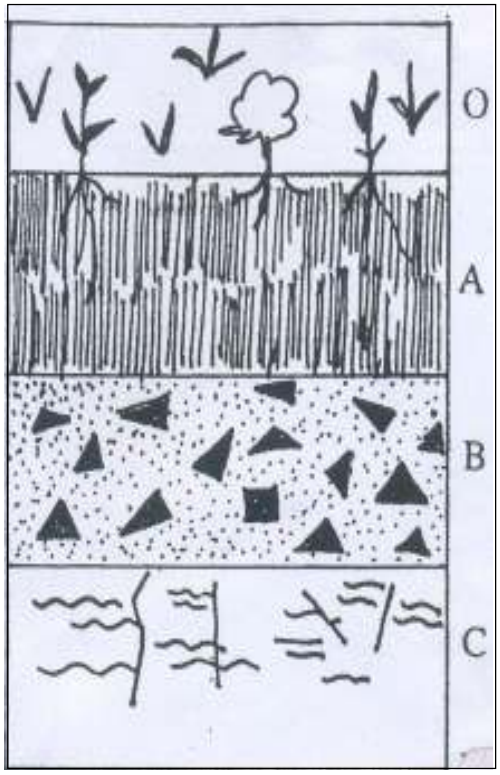
**Capillary water** – Particles of capillary water is retained inside the fissures in the soil. Roots of plants absorb this water.

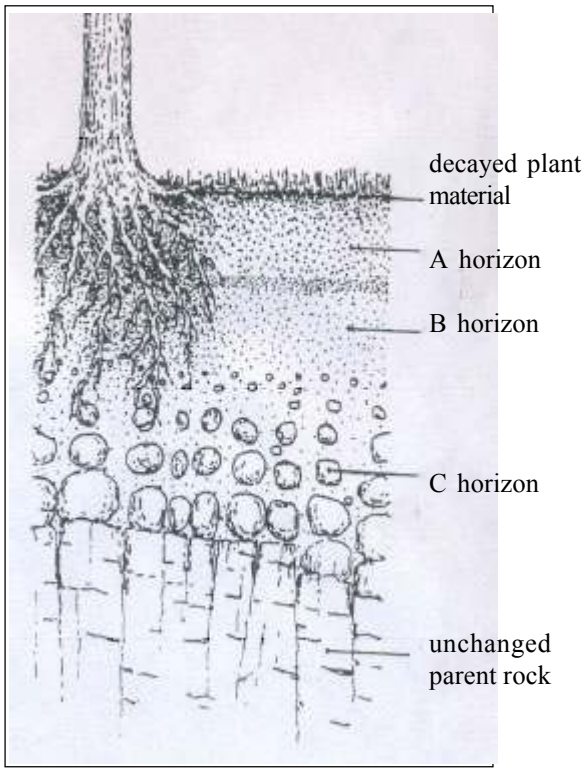
**Chemical properties of soil**

- acidity and salinity in soil
- The amounf of $H^+$ (hydrogen ions) determines the acidity or salinity in soils. The pH (pH scale is used to measure this $H^+$. This scale extends to a range from 1.0 to 14.



## Soil Profile




O – Generally this layer is thin. Organic substances are abundant. In the upper part though there are new organic particles, below that are weathered organic substances.

A – This is the main layer in the soil. It contains decayed organic matter and such substances are reduced with depth. This layer is dark in nature with abundant soil organisms. Also contains weathered material of the parent rock.

B – Weathered parent rock material is distributed. Salts and different clay types which permeates from the A horizon get deposited in this layer. Mineral types such as iron, aluminum are also seen in this layer. The colour of the B horizon is of a lighter colour than that of A.

C – Decaying parent rock material are seen. It consists of disintegrated soil parts. Ground water too is seen in this layer. These are situations when the roots of large trees are extended up to this layer.
Under this layer are found the parent rock which is not weathered.

## Soil classification of Sri Lanka

It was Dr. Joachim in 1935 who did a study of the soil in Sri Lanka for the first time. He introduced 07 soil groups while in 1961, Dr. Panabokke presented a classification of soil introducing 14 soil groups. It is this classification that is accepted now.

The Great Soil Groups of Sri Lanka

- The soil types in the Wet Zone
    1. Reddish brown Latasols
    2. Reddish yellow Podzols
    3. Meadow Podzolic soil
    4. Bog and half bog soil

- The soil types in the Dry Zone
    1. Red brown earths
    2. Non-Caleric Brown soil
    3. Red yellow Latazols
    4. Grummusols
    5. Immature brown loamy soil
    6. Solidized Solonetz

- The soil types found in both wet zone and dry zone
    1. Low Humic soils of low drainage
    2. Alluvial soil
    3. Regosols

## The Distribution of Great Soil groups of Sri Lanka


Source: The conservation of Bio Diversity in Sri Lanka, (1999),
The Ministry of Forest Resources and Environment

It is adequate to explain only the 3 Great Soil Groups here.

1. Red and yellow Podzolic soil – limited to the wet zone.
2. Red brown soil – limited to the dry zone
3. Alluvial soil – common to both the wet and dry zones

**Red and Yellow Podzolic Soil**

- This is the most abundant soil type in the wet zone of Sri Lanka.
- It is a well-drained deep soil.
- Since this is a region rich in natural vegetation, the thickness of the soil horizon is great.
- The Kabook soil of the wet zone also come under this soil type.
- The soil type is distributed in the Districts of Ratnapura, Badulla, Nuwara Eliya, Kandy, Matale, Galle and Matara.
- In the regions where this soil type is found, tea is cultivated in upper elevations, rubber in medium heights and coconut in flat lands.

**Red Brown Soil**

- This is the most abundant soil type in the dry zone of Sri Lanka.
- The A horizon of this soil group is of a dark brown colour while the B horizon is well – drained.
- In this soil are found minerals such as quartz, mica and limonite.
- Mixed evergreen and mixed deciduous forests are seen in relation to this soil.
- This soil type is mostly distributed in the Districts of Anuradhapura, Polonnaruwa, Trincomalee, Moneragala and Vavuniya.
- In these areas, vegetables, grains and other crops such as cane and tobacco are grown using irrigated water .

**Alluvial Soil**

- Distributed along coastal areas and low river valleys.
- This soil consists of silt, sand and organic matter which is not weathered.
- Mostly used for cultivation of paddy .

**References**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2. Environmental Geography – Educational Publications Department
3. Minerals, Rocks and Environment – Department of Geology
4. The physical features of the Earth – A.H. Dhanapala

## Learning-Teaching Activities

**Activity**

Presenting facts by a group assignment after doing a practical study of the rocks, minerals and soil in one's environment.

- Group students as suited provide the activity shown below.

1. Group I – Preparation of soil sample classified according to soil texture and presenting it.

2. Group II – Naming a sample of a mineral found in one's place and presenting it.

3. Group III – Identifying a few main rock types and presenting samples with names.

- Since this is an activity to be done in the field, give about one week.
- Do not spend school time for this field work.
- Help the students to sort out the material found in the field and classify them.
- Consider that teacher mediation is very important in presenting group work and reviewing them.
- Evaluate the students based on criteria relevant to learning outcomes.

## Competency - 3

## While enquiring about the processes in the physical landscape acts in an environmentally sensitive manner

**Competency Levels :**

**3**.1 States with examples the Endogenic forces that influence the process of landforms

(14 periods)

3.2 States with examples the Exogenic forces that influence the process of landforms

(20 periods)

**Learning Outcomes :**

- Identifying the exogenic and endogenic actions separately and names them.
- Tabulates the landforms that are created by exogenic and endogenic forces.
- Marks and names on a map of the world the geo tectonic plates given in the theory of plate tectonics.
- Draws the landforms created by endogenic and exogenic forces (three dimensional and two dimensional)
- Explains with the aid of diagrams how various landforms are formed.
- Marks and names on a map of Sri Lanka the Districts where landslides occur frequently.
- Discusses what man can do to minimize the hazards of landslides (from newspapers, magazines and internet)

## Introduction

Many landform features could be seen on the surface of the earth. Some of them are continents, oceans, plateaus, mountains, valleys, sanddunes, as well as volcanoes. These features are created by exogenic and endogenic forces.

Diverse landforms in the physical environment are classified according to their magnitude as landforms of the first order, second order and third order of magnitude. Landforms created by endogenic forces such as continents, landmasses, ocean basins, shields (plateaus), and mountains are being transformed by the action of exogenic forces such as running water, wind, glaciers and waves.

The above landform factors have been acting from ancient times. Even now they could be seen in the field in their actual form.

The aim of this unit is to study the landform features on the earth and how they are created and how those processes influence the human activities.

## A guideline to clarify subject content

There are two forces which create various landforms seen on the earth.

- **Endogenic forces** (act in the interior of earth)
- **Exogenic forces** (act outside the earth's crust)

There are a number of **endogenic forces**

- Plate tectonic action and earthquakes
- Vulcanicity
- Earth movements

The effects of **exogenic forces** are called gradation. Gradation means both the wastage of earth surface as well as deposition. Gradation too works in 2 ways

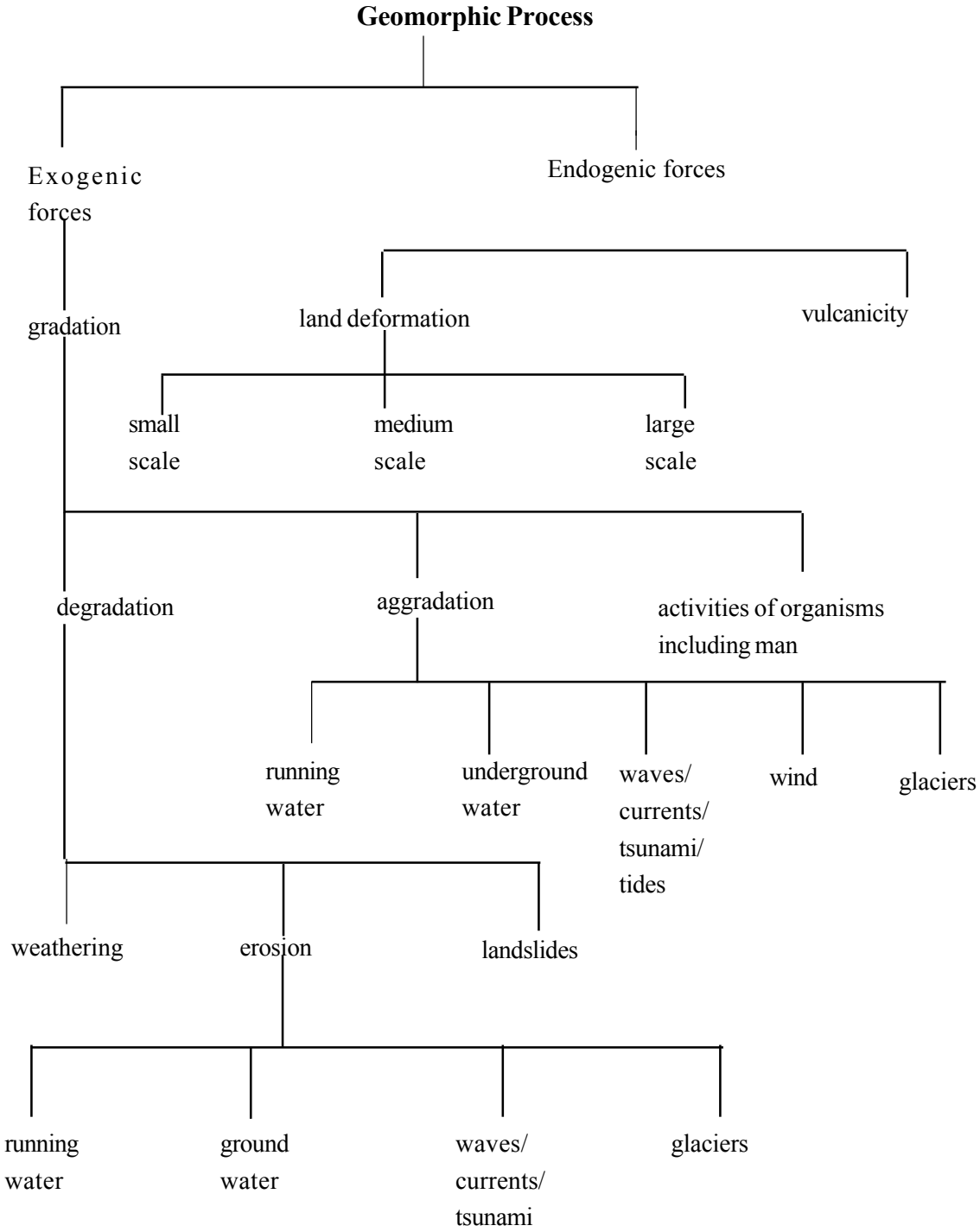
- degradation
- aggradation

The levelling down of the land surface by some processes is called degradation while aggradation is the development of land surface by some forces.

Degradation includes weathering, landslides and erosion (includes transportation too).

**There are a few exogenic forces** (denudation factors) as

- running water
- wind
- glaciers
- waves
- landslides


Geomorphic Process
Exogenic forces
Endogenic forces
gradation
land deformation
vulcanicity
small scale
medium scale
large scale
degradation
aggradation
activities of organisms including man
running water
underground water
waves/ currents/ tsunami/ tides
wind
glaciers
weathering
erosion
landslides
running water
ground water
waves/ currents/ tsunami
glaciers

## Geological Time Scale

- Geomorphic process can be divided into two as endogenic forces and exogenic forces while the original landscape has been carved out by endogenic forces.
- During certain geological eras landforms of large scale were formed while in the present day the relative importance of endogenic forces has been limited to smaller regions of the earth.
- The study of the geological time scale enables the study of geomorphic process.
- The whole geological history is divided into 5 Eras.
  1. Pre-Cambrian or Archaen Era
  2. Paleozoic or Primary Eta
  3. Mesozoic or Secondary Era
  4. Cainozoic or Tertiary Era
  5. Pleistocene or Modern Era
- The above geological history is subdivided into periods and ages.
- The interval between each of these periods is not the same.
- The Table below shows each of the Eras and periods that followed.

| **Era** | **Period** | **Millions of years ago** |
|---|---|---|
| Quarternary | Holocene (modern)<br>Pleistocene (Ice age) | |
| Tertiary or Cainozoic | Pleiocene – Miocene)<br>(Alpine, folding<br>Oligocene – Eocene | <br><br>70 |
| Secondary or Mesozoic | Creataceous<br>Jurassic<br>Triassic | 135<br>180<br>225 |
| Primary or<br>Paleozoic | Permian – Hercynian folding<br>Carbonacious – glaciation<br>Devonian – Caledonian folding<br>Silurian<br>Ordovician<br>Cambrian | 270<br>350<br>400<br>440<br>500<br>600 |
| Pre-Cambrian or Archaen | Charnian folding<br>(mountain building) | <br>3500 |

## Introducing landforms according to magnitude

Just as on continental masses, there are mountain systems and minor relief features in the depth of the ocean.

1. Landforms of the First order of magnitude
2. Landforms of the Second order of magnitude
3. Landforms of the Third order of magnitude

### Landforms of the First order of magnitude

This includes continental masses and ocean basins.

## Landforms of the second order of magnitude

This includes shield areas (plateaus) of continental masses and large scale mountain ranges. Examples of shields are Greenland, Lauration (Canadian) Guiana shield and Brazilian shield. Pyranees, Himalayan mountain systems, Rockies and Andes mountains belong to landforms of the second order.

In the ocean basins too there are landforms of the second order of magnitude.

1. Continental slope
2. Basin bottom
3. Mid-ocean ranges

### Landforms of the third order of magnitude

Small items of the landforms of the second order are landforms of the third order. Running water, wind, glaciers or waves carve out landforms of the third order.

## Theory of Continental Drift

- Ocean basins and continents are landforms of the first order of magnitude. The theory of Continental Drift has been presented to explain their present distribution.

- A Snider, an American in 1858, F.B. Taylor in 1910, and in 1915 Alfred Wegner have put forward facts to explain the present distribution of continents and oceans.

- According to Alfred Wegner, all the continents formed one major continent named by him as "Pangea". This Pangea was separated by the "Tethys sea". It comprised the Gondwanaland and the Angaraland.

- According to Wegner the continental masses of the Northern Hemisphere belong to the Angaraland block while the continental masses of South America, India, Australia, Antarctica belong to Gondwanaland.

- The greatest shortcoming in Wegener's theory is his inability to clearly explain the force which effected the Pangea to be broken into parts and drift apart.

- Yet he had presented numerous factors to prove that the continents existed as they are now in one block but later they broke and separated in the drift.

- Later in 1960's, evidences were presented regarding the distribution of ocean bottoms which made it easy to drop the above-mentioned shortcomings.

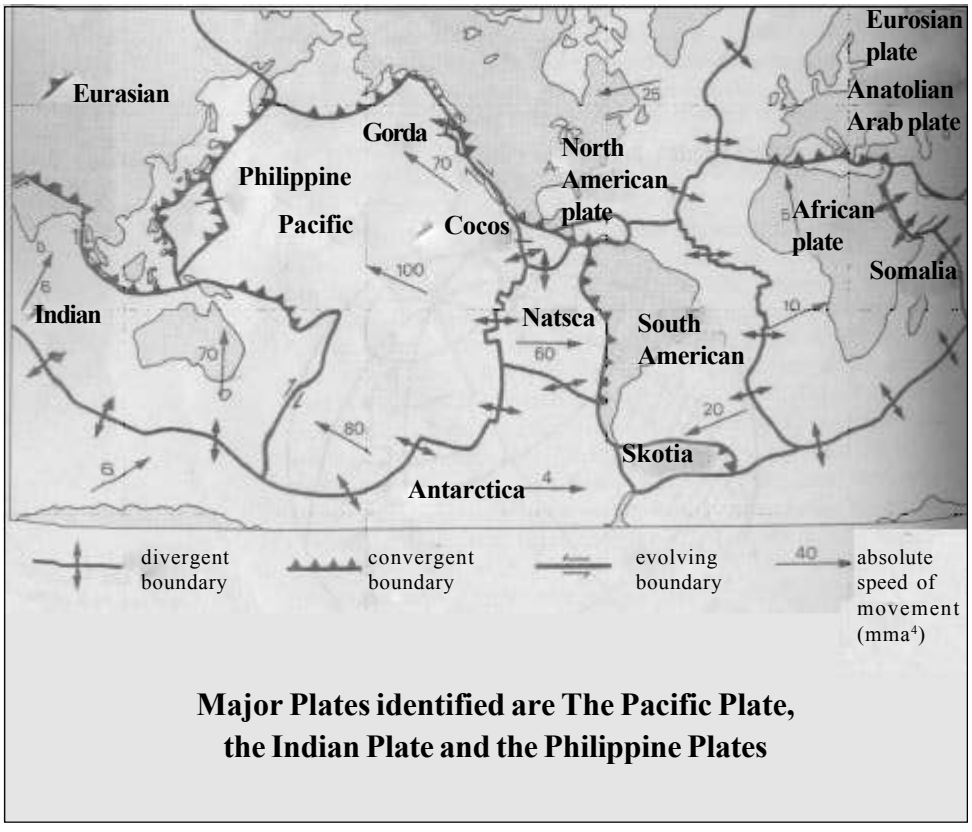
At a later date the theory of plate tectonics was presented to show the distribution of continental masses as seen today.

## Plate Tectonic Process

The lithosphere of the earth is composed of seven major Plates and a number of minor plates. The basic core of the plate tectonics process is that due to the revolution of the earth and convectional currents, these plates are pushing very slowly towards in various directions along the Mohorovicic discontinuity plane. The major Plates are

- Pacific Plate (the main ocean plate)
- Indian Plate (Indo-Australian plate_
- Philippine Plate
- North American Plate
- South American Plate
- Nasca Plate (Nasa)
- Eurasian Plate (a land plate)
- African Plate
- Arab Plate

**The map showing the Major Plates and Minor Plates**

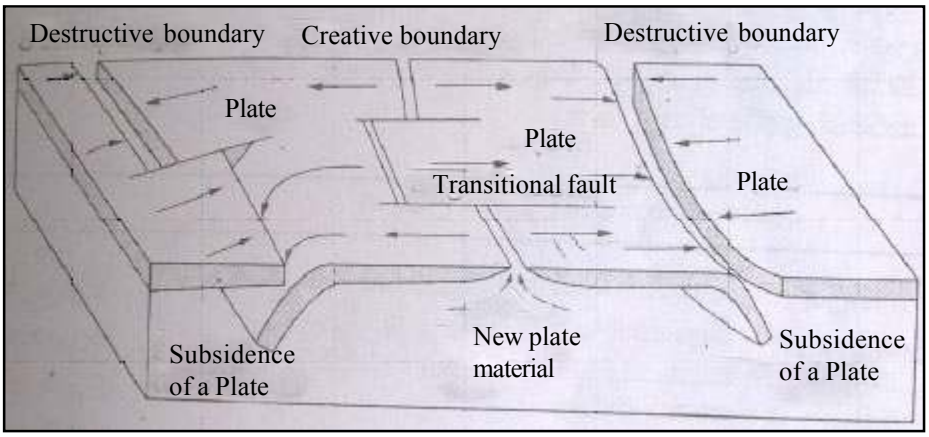



**Major Plates identified are The Pacific Plate, the Indian Plate and the Philippine Plates**

Volcanic activity and earthquakes occur at these plate boundaries. There are 3 such plate boundaries.

- divergent plate margins (creative boundary)
- convergent plate margins (destructive boundary)
- Transverse plate margins

## Plate boundary types




A few geomorphologic features can be identified along plate margins. Large changes occur on the earths' surface due to the movement of plates. The Table below shows plate margins and the landforms in relation to them.

## Types of Plate Margins and the features along them

| **Plate margin type** | **Stress** | **Oceanic Lithosphere** | **Oceanic continental, lithosphere** | **Continental Lithosphere** |
|---|---|---|---|---|
| Divergent | Tensional | Mid-oceanic ridge Volcanic action | | valleys/ volcanoes |
| Convergent | Compressional | Oceanic deeps Volcanoes, Islands arches | Oceanic deeps continental mountains and volcanoes | mountain ranges, limited volcanic activity |
| Transforming | Shear | mountain ranges and valleys similar to mountain axis | | fault zones no volcanoes |

M.A. Summerfield - 1999

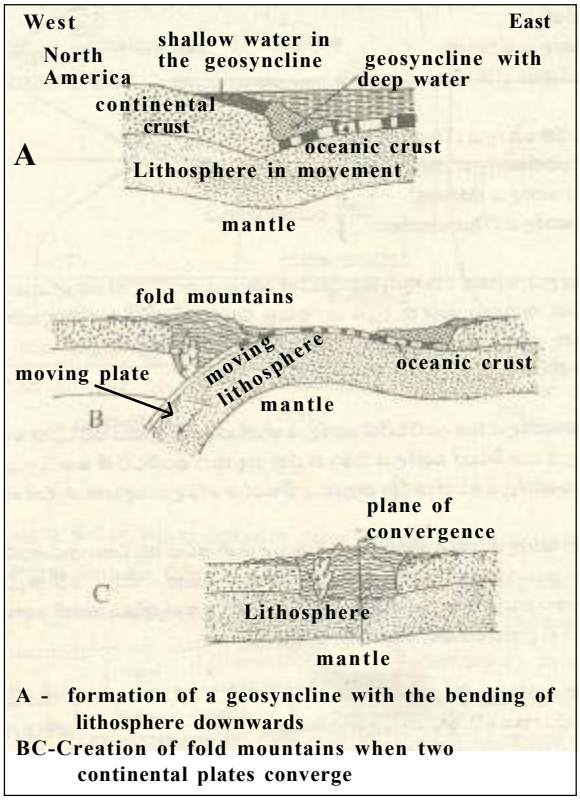
- There are occasions when the naked eye can see how the Plates (above – mentioned) actively move. Then, pieces of rocks falling could be seen at plate margins.

- In creative zones where two plates diverge it is seen how the new lithosphere is forming. Here, basalt comes to the surface from the upper part of the earth mantle and allows the formation of a new ocean bottom while flowing to both sides. This fact has been established by explorations in the ocean depth.

- For example Mid-Atlantic ridge
  Indian ocean slope
  Carlsberg ridge

- At the convergent plate margins when one plate subsides into another plate, a plate ridge is created. Shown below is a diagram which shows how a Plate ridge is formed.

**Formation of fold mountains at the convergent - plate margins**




**A - formation of a geosyncline with the bending of lithosphere downwards**
**BC-Creation of fold mountains when two continental plates converge**

**Source: Environmental Geography, Educational Publications Department**

## Earthquakes

- An earthquake is a sudden movement or tremor (shaking) on the earth's surface due to the sudden release of accumulated energy in the interior of the earth.

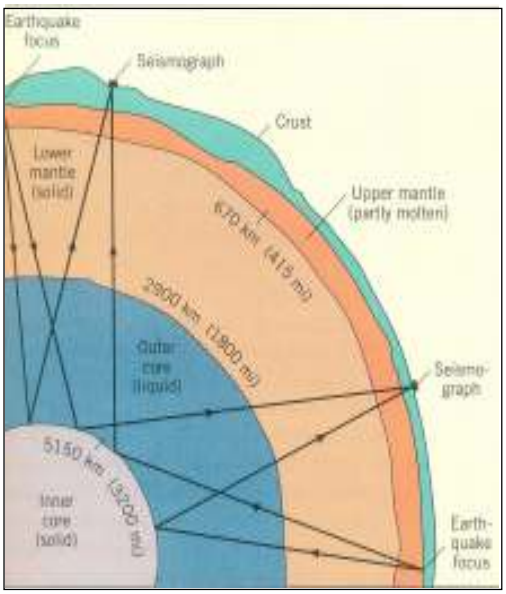
- The energy released flow on the earth's surface or through the earth's interior as primary (P) waves, secondary (S) waves and crustal (L) waves.

- The place at which the earthquake occurs inside the earth is known as the earthquake focus and the point just above it on the earth's surface is called the epicentre.

- Richter scale is a method discovered by Charles F. Richter, in 1936 to measure the magnitude of an earthquake.

  The scale is used to measure the energy released from the place where the earthquake occurred.

### How the earthquake waves travel



**Distribution of earthquakes and their impact**

- Many earthquakes occur in the destructive plate margins of the Pacific region and in other plate margins.
- As a result of an earthquake human life, property will be destroyed immensely.

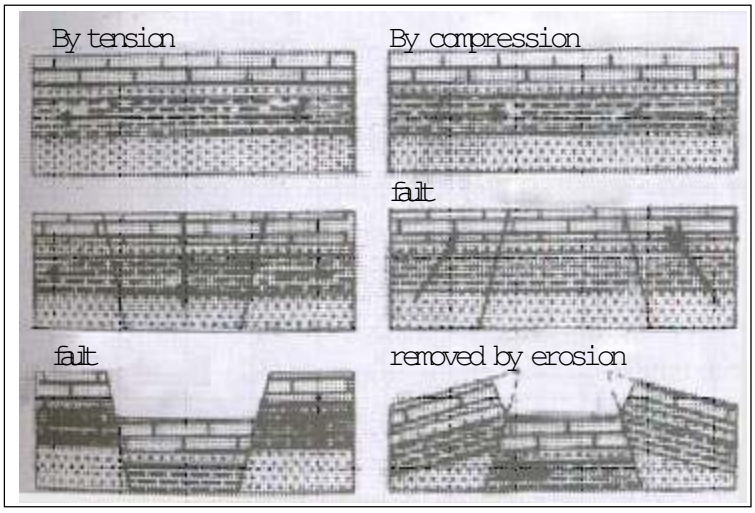
**Earth Movements**

- These are movements that occur in the earth's crust due to energy released by the convectional currents, geo-thermal radioactive minerals found in the interior of the earth. These earth movements are of 2 types.
  1. Horizontal movements (mountain building)
  2. Vertical movements (continental building)

  Horizontal movements too are of 2 types
  1. Compressional movements
  2. Tensional movements

  **Vertical movements cause folding and faulting -** There are a few types of folds
     - symmetrical fold
     - asymmetrical fold
     - isoclinal fold
     - recumbent fold
     - monoclinal fold
     - syncline
     - anticline
     - synclinorium
     - anticlinorcium
     - thrust fold

Anticline is also known as anticlinorium, a syncline is also known as synclinorium



- **Compressional movements** create not only fold mountains but also faults for e.g. reversed fault.

- **Tensional movements** also cause faults. A few such faults are–
  normal fault
  thrust fault
  reversed fault
  horst
  rift valley
  block faulting
  step faulting

## Vulcanism

- Vulcanisity means not only formation of volcanoes and eruptions. Every process involved in the flow of molten material in the interior of the earth to the surface of the earth and the action that follows are included under volcanic action. Volcanic cones, volcanoes as well as other features as dykes, sills that are formed in the interior of the earth are the results of volcanic action. Accordingly, the features of vulcanicity are of two types as extrusive and intrusive.
  - Intrusive vulcanicity
  - Extrusive vulcanicity (volcanic process)

## Intrusive volcanic action

Intrusive vulcanicity is formation of landforms through the deposition of lava in the interior of the earth. There are a few such features

- dykes
- sills
- laccolyths
- lopolyths
- pharcolyths

When the rock particles on the earths' surface are denuded, the landform features of intrusive vulcanicity could be seen.

## Extrusive vulcanism (Volcanic action)

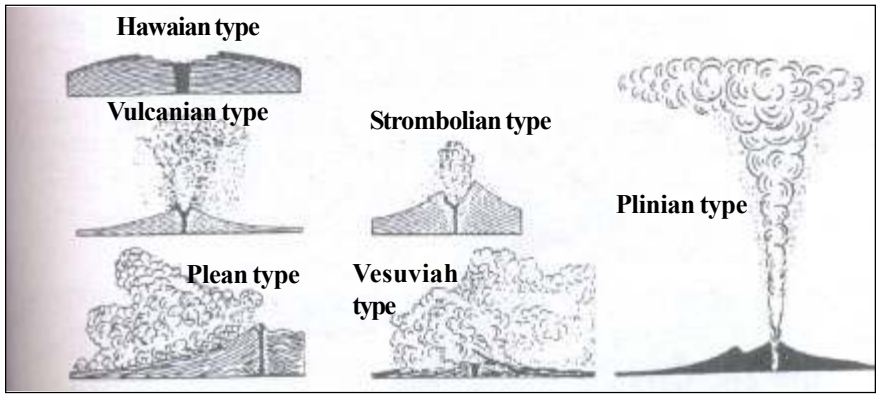
- The features formed by the eruption of volcanoes or action of volcanoes is known as extrusive volcanic action. A volcano is defined in this manner – An earth surface which emits liquefied or hot molten rocks with smoke is called a fissure. This surface may be a slope or a mountain built up of material that is exploded. Such a hill may be totally or partly conical in shape. Very often there is a depression on the crest of that hill.

- According to the chemical composition of the magma that flows from the interior of the earth, the nature of the volcano that is created on the surface of the earth, differs.
- There are two main minerals found in magma,
  - silica
  - iron
- If the silica content in magma is below 50% and if the iron percentage is more, this magma is in liquid form. They are called basic lava. Such a volcano is not very high.
- If the silica content in magma is more than 50% and if the iron percentage is less, this magma is in solid form. They are acidic lava. Such volcanoes are higher.
- There are 3 types of volcanoes based on their activity.

  Extinct volcanoes – They were active once but not now.
  Dormant volcanoes – At present they are still but may explode in future.
  Active volcanoes – The volcanoes that are emitting lava and smoke.
- According to the nature of volcanic eruptions there are a few types.

  Hawaian type
  Strombolian type
  Vesuvian type
  Vulcanian type
  Plinian type
  Plean type

**Types of volcanoes**




- There are a few extensive volcanic features
  - lava cones
  - composite cones
  - caldera
  - lava plateaus
  - lava hollows
  - lava plug

## Distribution of volcanic zones in the world

1. Circum – Pacific zone (Fiery Ring of the Pacific) the western and eastern margins of the Pacific Ocean
2. Mediterranean sea (Sicily, Italy, Greece, Asia Minor)
3. The region along the Mid-Atlantic Ridge which stretches in a north – south direction (Jammeyen Island in the north to Suretsi Island in the south)

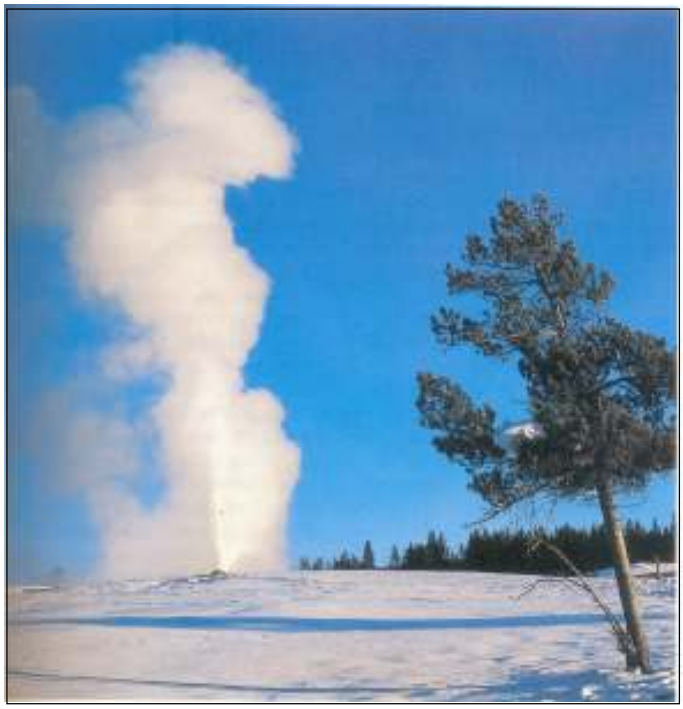
### The map of the distribution of volcanoes


Source: Waugh David (1995), Geography An Integrated Approach

## Geysers and Hot water Springs

- In regions where extrusive vulcanism is taking place, geysers and hot water springs can be seen. However all the hot water springs have not originated in lava regions where vulcanism is active.
- In almost every country hot water springs could be seen.
- Since temperature increases with the depth of the earth, water is super heated at depths. If a spring originates in proximity to magma or volcanoes, water gets heated more. When that water reaches the surface of the earth as an ejection it is known as a hot water spring.
- When all the water within the geyser pipe like channel gets heated steam is collected. When a considerable amount of steam is collected, water flows out as a result.

**Old Shakepool Geyser of the Yellowstone National Park in USA.**



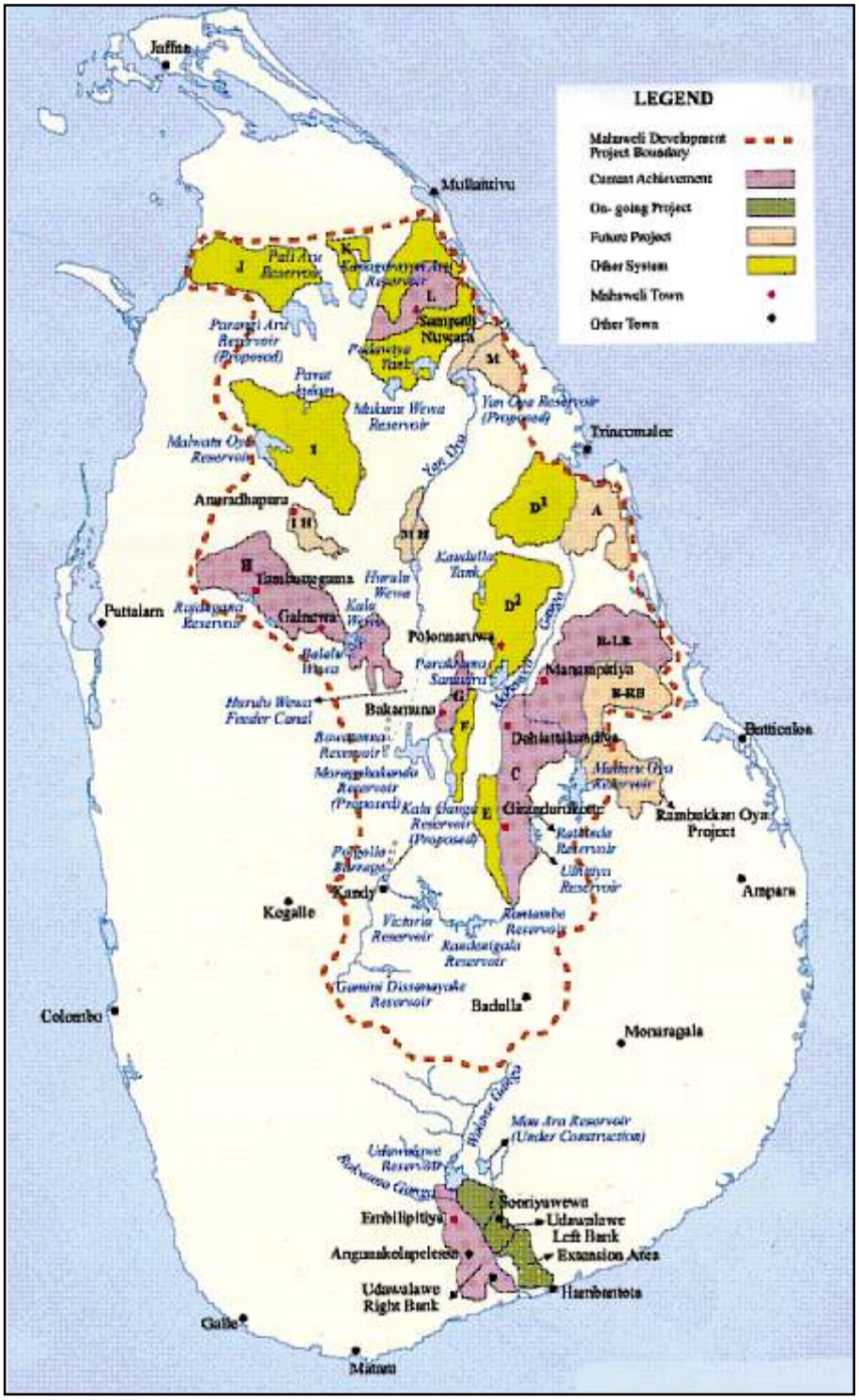
## Exogenic Processes

- The geomorphic process that occurs outside the earth's crust is called exogenic process.
- There are a number of processes that combine in carving out landforms. The most important ones are weathering, slopes, action of running water, action of waves, and glaciers.
- Both gradation and degradation occur by the processes of running water, ground water, waves, ocean currents, wind, glaciers.
- There are a few forms of landslides or (mass degeneration)
  1. soil creep
  2. sliding
  3. mudflow
  4. rock fall
  5. talus fall

### Action of running water

- Running water is expressed by the terms river, a stream, an oya, channel.
- If a line is drawn to the direction of water flow joining the points of origin of all the water that drains through the surface, water basin is the land area on a side of the drainage (catchment area). It is shown by the figure below.

**Area of Mahaweli Basin**



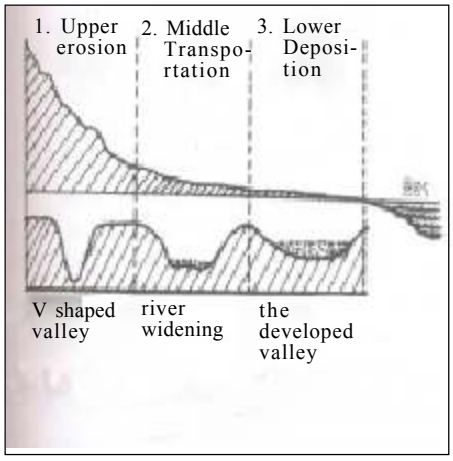
## River Action

- The origin of a river may be from a spring, a lake, water from a glacier or from an area which receives heavy rainfall.
- A river which has originated as stated above performs three functions.
  1. erosion 2. transportation 3. deposition
- A river performs the function of erosion up to the base-level. Erosion depends on a few factors
  1. natural slope 2. geological structure
  3. the nature of eroded material
- Erosion means wearing action of the earth's surface.
- River erosion has three actions
  1. corrosion 2. abrasion 3. hydraulic action
- Transportation is carrying the load of a river to another place.
- Transportation is effected in a few ways
  1. suspension 2. saltation 3. sliding 4. solution
- Deposition is putting down the load of a river in the river channel or in another place. It is due to the lowering of the velocity of flow of rivers.

## Topographical Features of running water

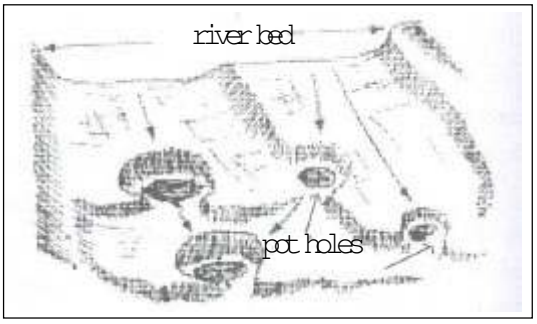
- The long profile of a river from the origin to the end is of three parts
  1. Stage of youth (the upper or hilly part of the river)
  2. Stage of maturity (the middle or valley)
  3. Stage of old age (lower or the plain)

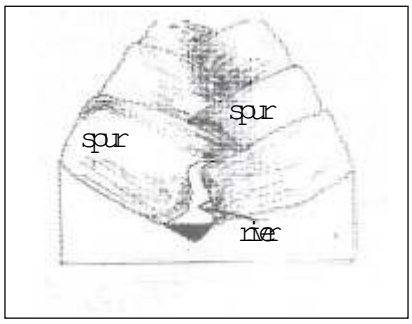
### The long and cross profiles of a river from its origin up to the mouth



- **A few topographical features seen in the stage of youth**
  1. Deep narrow valleys (V shaped)
  2. Pot holes
  3. Truncated spurs
  4. Waterfalls
  5. River capture

**Pot holes** **V shaped valley and truncated spurs**

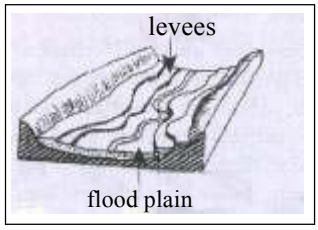


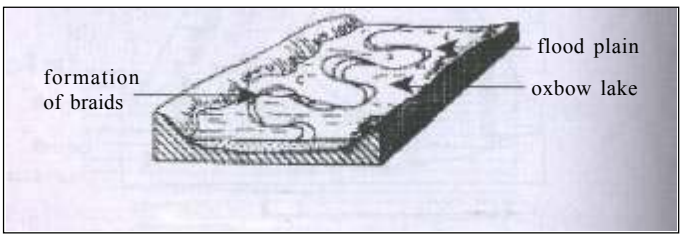

- **Topographical features seen in the mature stage**
  1. meanders
  2. river cliffs
  3. wide valleys

– A few features are seen in old age

1. flood plain
2. ox-bow lakes
3. alluvial fans
4. levees
5. delta
6. braided stream




**Formation of levees in the flood plain**

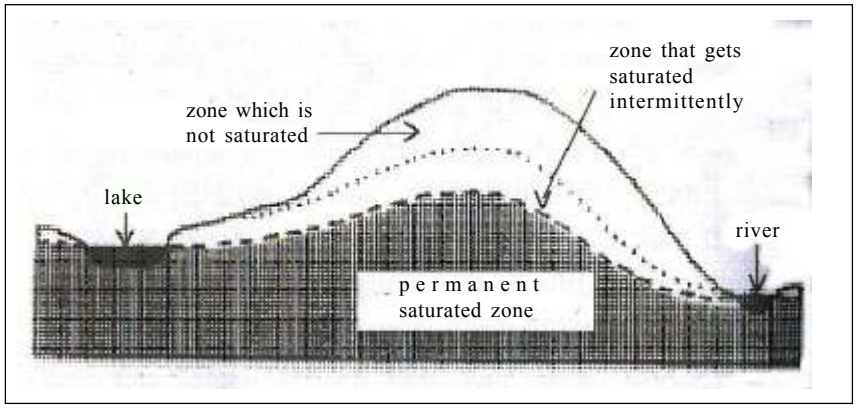



**Braided River**

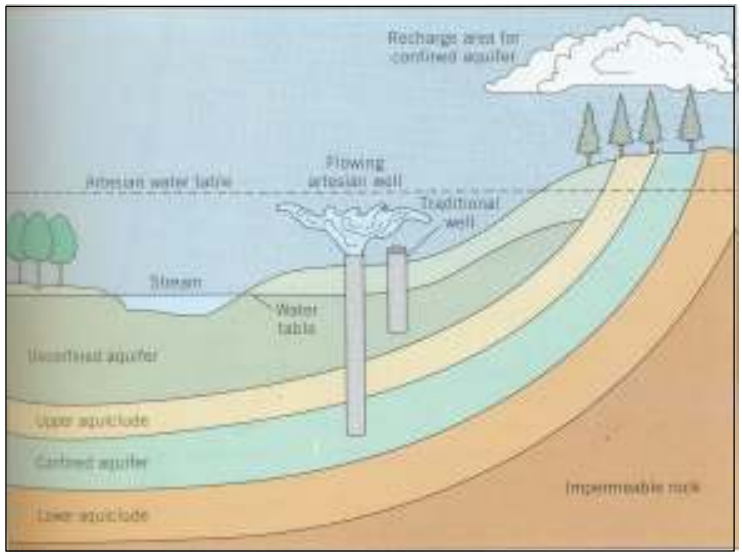
## Underground water and the Features

- Underground water is the water that is retained in the joints and crevices of rocks and soils when a considerable part of the water that falls as rainfall or snow is soaked into the ground.
- In the process of weathering and mass movements, this underground water performs a great function.
- Underground water is important as the store-house of water in the earth.
- Underground water flows on the surface of the earth in the form of springs and geysers.
- Aquifer is the permeable rock strata situated just above the impermeable rock strata in the interior of the earth which retains water .
- Saturated level is the surface water table and the depth of the water table changes from place to place.

### Water zones inside the land




- For human needs, this ground water too is drawn above as tube wells.
- Well water is the water obtained by digging the earth up to the permanent water level.
- The water that is stored in the joints, cracks and fissures in the crystalline rocks is pumped through tube wells.
- When a permeable layer is sandwiched between two impermeable layers, and the arrangement being bent into a downfold or syncline which forms a special topographical feature which retains water . It is through artesian wells that this water is drawn up.
- There are artesian wells in Wellawaya in Sri Lanka, Australia and U.S.A.

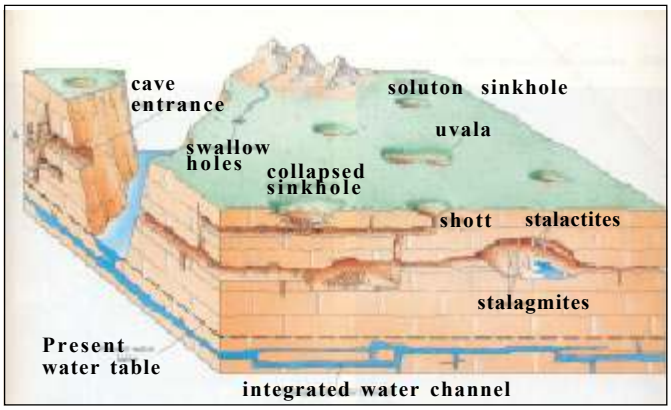



Source: Aquifers, aquicludes and their relationship to the water table and wells

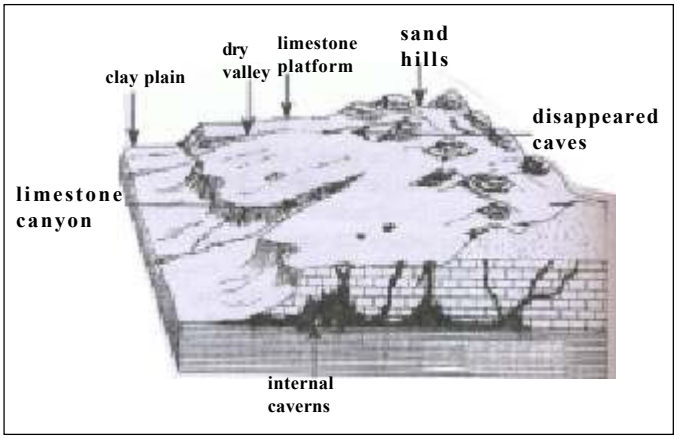
**Landforms created by underground circulation of water (limestone landscape/ Karst landscape)**

- Landforms are carved out in surface circulation of water as well as by underground water circulation.
- In underground circulation of water landforms are created when various stages of weathering such as disintegration, oxidization, carbonation and hydration are activated.
- Underground water acts as an agent of solution as well as an agent of deposition. This action of underground water can be clearly seen in limestone regions. Such landscape regions are known as limestone landscape regions. There are 2 areas where such landforms could be seen.
  1. Yukatan peninsular in Central America.
  2. Karst region in Yugoslavia
- In various regions limestones are formed organically and by chemical precipitates.
- In the Central Hill Country of Sri Lanka calcareous (organic) limestone strata can be seen. These were formed by shells or skeletons of marine organisms and later the land was uplifted.
- Limestones are formed by the evaporation of ocean water. When ocean water consisting of chemical substances such as calcium carbonate, magnesium sulphate and sodium chloride precipitate due to evaporation, limestones are formed. Limestone regions thus formed can be seen in various regions of the world.
- There are limestone regions stretching for a number of kilometres and a few metres in depth.

- In the Karst Region of Yugoslavia the limestone area is spread over a region of 640 kilometres in length and 100 km in width. Such limestones are formed in Jaffna area in Sri Lanka.
- The topographical features shown below are formed by the flow of water through joints and fissures in the limestone strata formed in the above manner.
  - grikes
  - swallow holes
  - doblines
  - uvala
  - polje
  - limestone caves
  - stalactites
  - stalagmites
  - columns




**Topographical features in a limestone region**




**Limestone landscape**

## Action of wind and the topographical features (Desert topographical features)

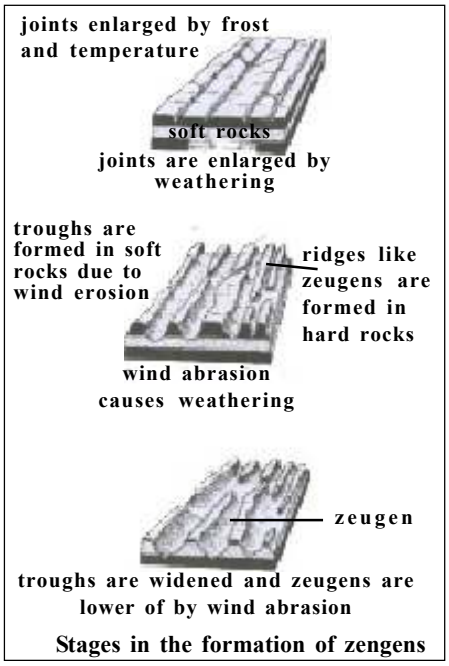
- In arid areas (in deserts) wind as an agent of erosion carves out topographical features.
- Apart from wind, topographical features are formed by the rainfall received for a short period in the arid regions.
- The formation of features in arid regions is the result of three processes
  1. Erosion 2. Transportation 3. Deposition

  Erosion is carried out in three ways
  1. deflection 2. abrasion 3. corrosion
- Parts of rocks which have been broken down on the land are carried by the wind and when rolled against the surface it is called deflection.
- The load that is being carried out will rub against the rocks. This is abrasion. Due to friction rock plane is scraped off which is called abrasion.
- Corrosion is the erosion that is caused by the clashing of the load with the rock masses on its path.
- Deposition means putting down the load carried out by the wind in various places.

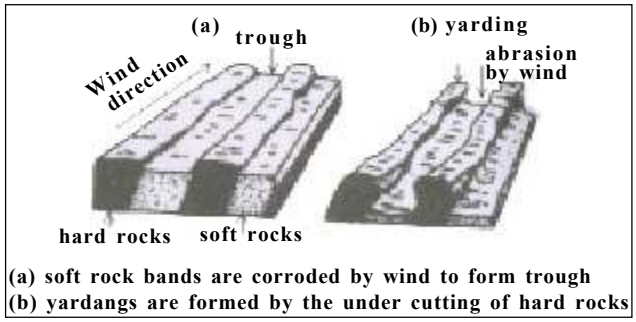
### - Landforms carved out by erosion in arid areas:-

- Inselberg
- yardang
- zeugens
- deflected basins
- ventifact
- dreikanter

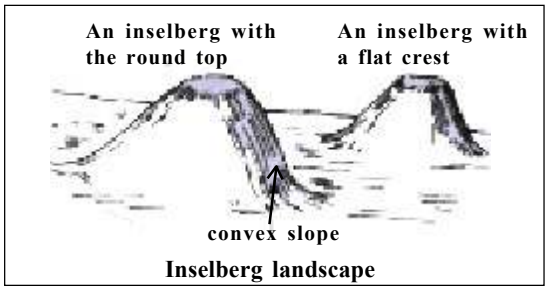
**Zeugens**




**Yardang**

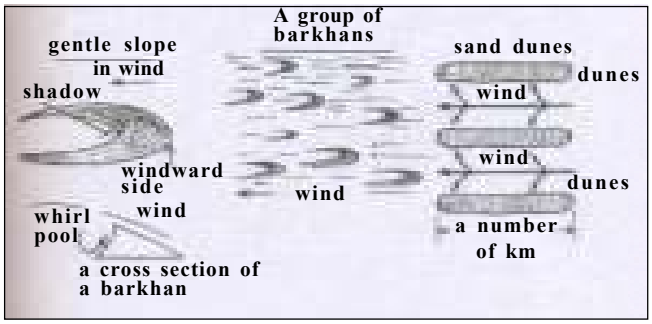



**Inselbergs**



- **Landforms of deposition in arid regions**
  - sanddunes
  - barkhan or crescent – shaped sanddunes
  - seif (longitudinal sand dunes)
  - loess deposits

**Formation of barkhans or crescent - shaped sand dunes**

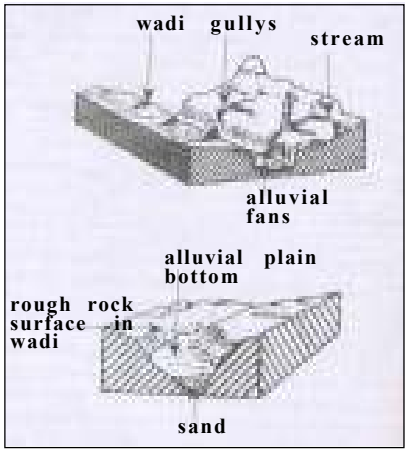



- The fine dust blown from the desert and deposited far away in neighbouring lands is called loess. It is a yellowish fertile dust. Since water is quickly absorbed, the surface is dry.

## Topographic features formed by water in deserts

Very seldom deserts get a quick downpour of rain which changes the whole landscape. Since soil is exposed, all the material on the surface soil is drained away by the rain water. The rock pieces, pebbles and sand that slide down from the top of hilly areas are brought down to lower land. Due to high evaporation water is quickly evaporated. Then the topographical features given below are formed.

- wadi
- gullys
- alluvial fans
- streams
- bahadas
- playa lakes
- pediments




**Landscape of wadi and gullys**

- There are 2 types of deserts based on climate
  cold deserts – Gobi, Atacama
  hot deserts – Sahara, Thar ,Arizona
- There are a few types of deserts based on nature of rocks
  - sandy deserts
  - stony deserts
  - rocky sheet deserts

## Coastal Features

Since the coastline is eternally subjected to the action of waves, tides and ocean currents, the features formed by these agents are called coastal topographical features.

Coast is the strip of land where the sea and the land meet. The coast can be divided into a few parts –

1. Back shore
2. Near shore
3. Fore shore
4. Off shore

### Coastal Erosion Process

Waves, currents and tides are the main agents of coastal erosion. Waves generated by wind travel from the deep sea area to the coast and strike it. It is called foreward strike. It strikes the shore and goes back in great speed. It is called back strike.

Waves are of two types – Creative waves and destructive waves.

**Wave action** consists of three functions.

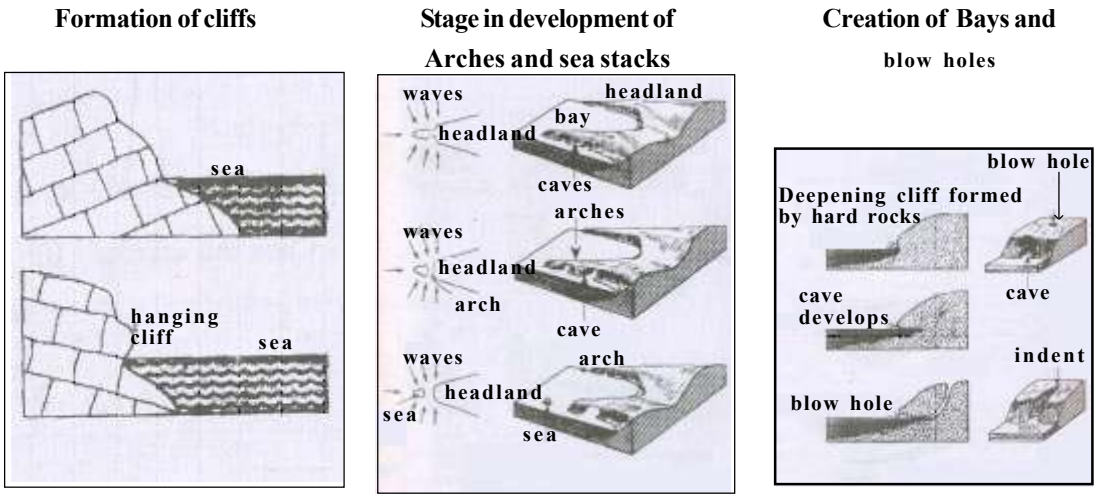
1. Erosion
2. Transportation
3. Deposition

**Wave erosion** also occurs under three processes

1. Solution
2. Friction
3. Abrasion

## The topographical features generated by wave erosion

- headland
- bay
- cliff
- wave – cut platform
- caves
- arches
- sea stacks
- hummana (spouting horn)




## Transportation by waves

The different types of materials carried by waves is called the load. This load consists of sand, mud and shingle.

Features produced by water

- beach
- sandbar
- headlands/spits
- mudsheets
- tombolo
- sandhill

## Coral Reefs as a Coastal feature

- A coral reef is a combination of a large number of living organisms.
- It is an eco-system with equilibrium based on the factors of plants and animals.
- The coral forming organism lives in water

- It takes animal plankton as food
- Coral reefs are mostly distributed in oceanic areas and seas in the tropics.
- Coral reef is a more fertile eco-system than the Tropical rain forest.
- Coral polyps (organisms) breed in two ways. One method is spawning (laying eggs) into the water. The other method is as in an orchid plant where from any part of its body a sprout may come up bearing life.

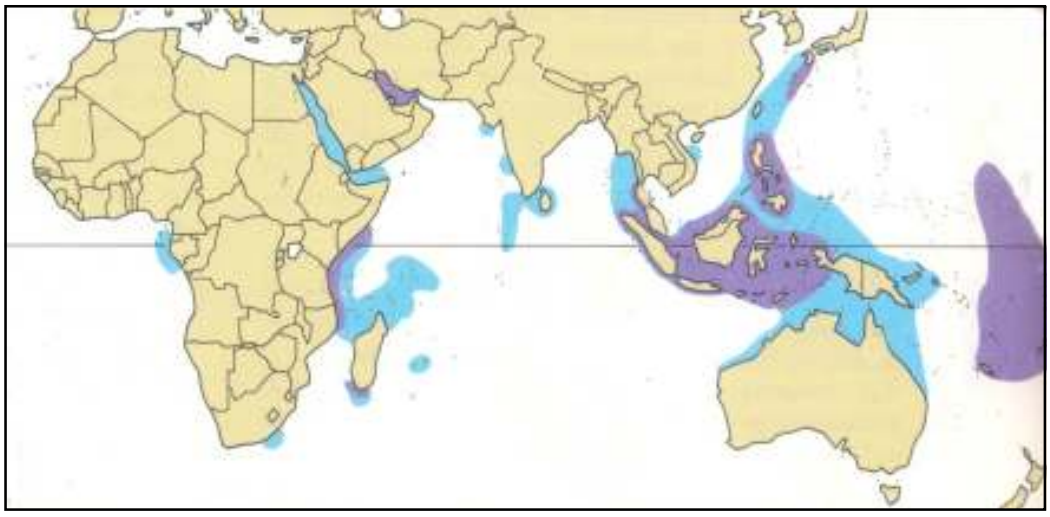
**The physical factors required for the formation of corals**

- The water should be at a temperature range of $20^0$C-$30^0$C. If there is a sudden change in the temperature for about $2^0$C to $3^0$C, the coral reef may be destroyed.
- The range of salinity should remain unchanged between 30%-35%.
- It is necessary that it should be stable.
- Sunlight should penetrate to the sea bottom and the water should be clear.
- A stable sea bottom is suitable for coral.

**The different types of coral reefs**

- If it is situated closer to the coastline it is a **fringing reef.**
- **The barrier reef** is situated parallel to the coast but a little far from the coast. A good example is the great Barrier Reef of Australia.
- When a volcanic island subsides a coral reef will remain around it in the form of a ring. Also when the volcanic island remain stable while the sea level goes down and the growing coral reef is uplifted. **Atolls** are formed by both these methods.

**Regions where coral reefs are abundant in the world.**



Source: Lean Geoffrey, Hinrihsen Don (1990), Atlas of the Environment

## Glacial Action and the landforms associated with it

### Formation of topographical features by the action of moving ice (glacier)

- A glacier is a large layer of ice. Topographical features associated with the erosion of the earth's crust by moving glaciers and also the features formed by deposition of eroded material are known as features associated with glaciers.

- In areas of low temperature (below $-32^0$C) snow forms in large masses. The crevices in these ice layers move slowly along diverse directions (a few centimetres per day)

- At present about 10% of the earth's crust is covered by glaciers.

- Glaciers are formed in 2 ways.
  1. Continental glaciers (sheet glaciation)
  2. Mountain glaciers (alpine glaciation)

- The ice masses formed near the poles in the earth are polar glaciers.

- Glaciers are largely distributed in the Arctic and Antarctic regions.

- The average thickness of these is about 2300 metres while in some parts the thickness is about 4 kilometres.

- The other areas where glaciers are distributed are Greenland, Iceland, Siberia, Alaska and Victoria Island in the Northern hemisphere.

- In the geological history of the earth 2 epochs are mentioned which are called Ice ages. They took place during the Carboniferous and Pleistocene epochs.

- During the Pleistocene period, out of the glaciers that formed, those formed a zone above $40^0$ north latitude, thawed in about 10,000 years ago. As a result topographical features associated with the Five great Lakes, Great Salt Lake, Manitoba Lake, Ladoga Lake, Baltic Sea and Bay of Finland were formed.

- In the formation of glacial features **glacial action** too is threefold.
  - erosion
  - transportation
  - deposition

  Erosion is done in 3 ways
  - plucking
  - sweeping
  - abrasion

In the mountain crests where ice sheets are abundant, water flows into the rock joints and crevices and turn into ice which thaws during summer. This process goes on and on for a long time resulting in disintegration of rocks which is called plucking.

When a glacier moves down the slope and erodes the rocks in the valleys, it is called scraping.

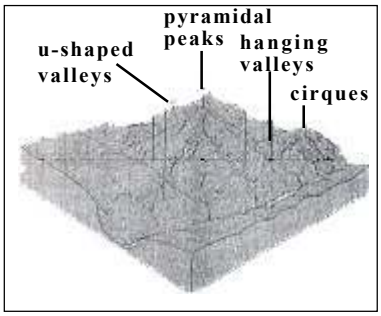
When a glacier moves over an area of hard rock, it cannot be eroded. Here the rock surface is scraped and polished which is called abrasion.

- Valley glaciers are ice sheets formed on high mountainous areas on the earth.
  These are formed in areas over 6000 metres in height in the earth.
  These glaciers move down the valleys in the mountains and through gravity come down to the lower slopes. Hence these are known as valley glaciers.

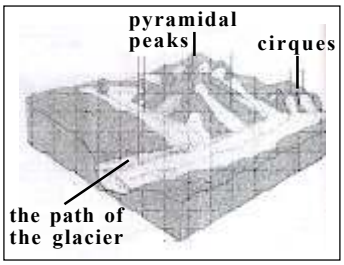
In mountainous areas on Alps, Atlas, Rockies, Andes, Himalayas, Pyranees and Kilimanjaro, glaciers are spread over a length of hundreds of metres thick.

**How glaciers move to lower valleys from upper mountainous areas.**

**Landscape after glaciation**




**An area under glaciation**



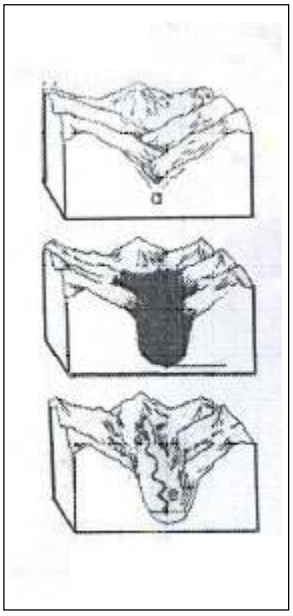
## Erosional Features of mountain glaciers

- Cirque/ ewms/ corries
- Tarn/ mountain lakes
- aretes
- pyramidal peaks
- horn snout
- U-shaped valleys
- Hanging valleys
- Rochemoutennees

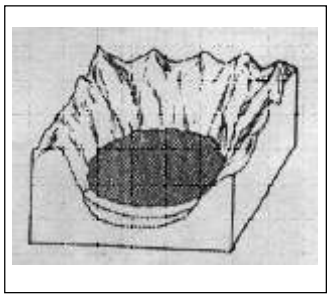
## Depositional features of mountain glaciers

- moraines
- lateral moraines
- medial moraines
- terminal moraines

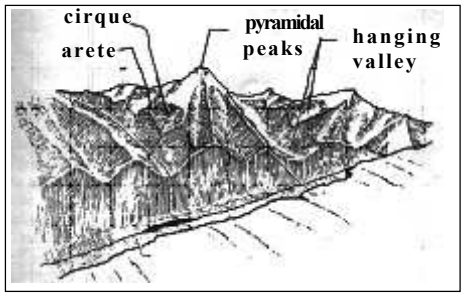
**Formation of U-shaped valleys**



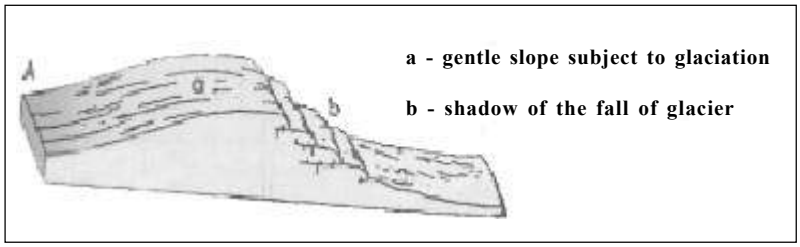
**A tarn**



**Landscape of an arete pyramidal peaks and horn snout**




**Formation of a Rockies mountennce**



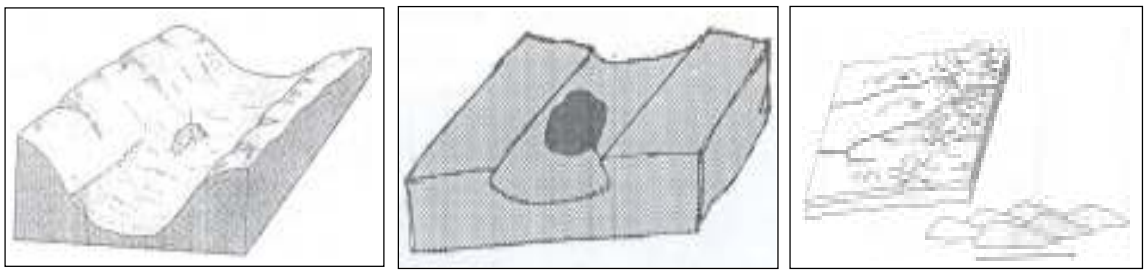

## Features of continental glacial erosion

- crag and tail
- nunatak
- fiord coast
- erratics

**Features of continental glacial deposition**

- drumlins
- eskers
- kames

**kames** **terminal moraine** **drumlin**



**The economic value of glacial landscape**

- Fertile lowlands of economic value are born out of glaciation
  Eg. 1. The fertile land in West Anglia in Great Britain
  2. The wheat, rye, barley, and oat cultivated lands of North and South Europe.

- Using glaciated regions for tourism. Water falls and U-shaped valleys are attractive places for tourists.

- Tourists arrive to enjoy the glaciated landscape as well as to do skiing.

- The water falls that cascade from the U-shaped valleys are utilized for hydro-power.
  Egs. Norway, Sweden, Canada, Switzerland have generated water power using waterfalls.

- The lakes and rivers formed by erosion due to movement of glaciers are utilized for transport.
  for eg. The five Great lakes of North America, St-Lawrence River in Canada.

- Shipbuilding associated with estuaries formed by glaciation.

## Landslides

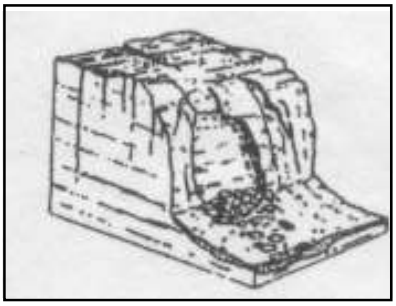
"Landslides" or mass movements is a flow of clay, silt, sand, pebbles and even big rocks from a higher elevation to a low land as a result of gravity.

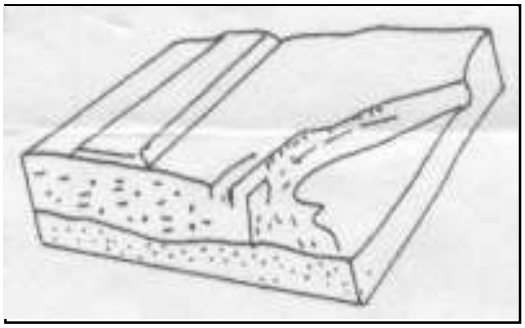
Geological, geomorphological features and climatic factors may influence the occurrence of landslides. In the same manner action of weathering that takes place along slopes over a long period of time may have an impact to activate a landslide. These mass movements are not uniform in every region. They may be small scale or large scale movements. Diverse factors cause landslides while human activities too have influenced. Landslides may be studied under several types due to the complexity of interrelationship among their agents and the diversity of the manner how they are formed

1. falling
2. rolling
3. sliding
4. flowing

### Falling

When a landslide is taking place, the fall of soil and rocks freely from an upper area to a lower area takes place due to gravity.



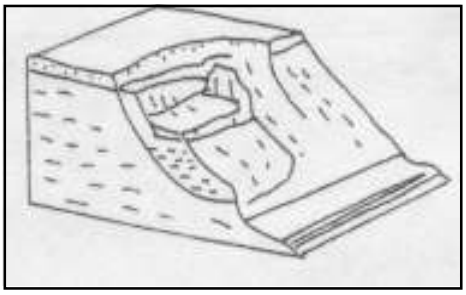


### Rolling

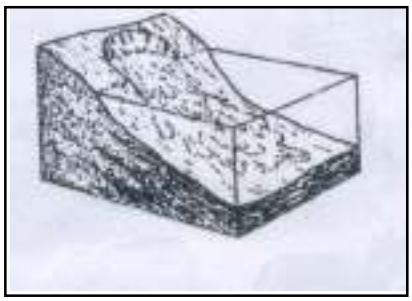
In a landslide, the soil mass/ rocks in the upper area is rolled along. This is similar to a fall or sliding.

### Sliding

This is called slipping. Such landslides may occur through a movement in a concave slope or a breaking down in an escarpment slope.



**Flow**



This takes place in the lower part of a landslide and is known as "drift". Materials with soft particles and pieces of rocks or rocks of large size like boulders and crushed rocks flow along with the drift.

**Factors that cause landslides**

Various reasons have caused landslides taking place in various regions and of various types. These causes can be divided into two as physical and human.

**Landslide**

| **Human factors** | **Physical factors** |
|---|---|
| 1. Destruction of forest | 1. Change in slope gradient |
| 2. Shocks caused by explosions | 2. Change in slope height |
| 3. Irregular land use | 3. Change in soil water |
| 4. Construction of reservoirs | 4. Underground water |
| 5. Construction on slopes | 5. Impact of snow |
| 6. Increase of weight on the slope due to filling up of banks or waste matter | 6. Weathering |
| | 7. Shock |
| | 8. Decay of parent rock |

**Reference**


1. Senevi Epitawatta (2006) Physical Geography–I, Geomorphology
2. Environmental Geography, Educational Publications Department
3. Cooray P.G., Rupasinha Mahinda, "The Earth around us"
4. Dhanapala A.H., The physical Features of the Earth
5. Physical Geography – Educational Publications Department
6. Upali Weerakkody, Environmental Geography – Part One
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## Teaching Learning Activities

**Activity -1** Numerous landforms are created as a result of exogenic forces. In each of the regions diverse landforms are carved out through various agents. Since Sri Lanka is a small country there are only a few agents that form topographical features. River erosion, coastal erosion and limestone erosion on a small scale are found here. From this activity what is expected is to study such topographical features by organizing a field trip and prepare a wall paper .

- Select any agent that forms topographical features close to your school.
- Organize a field trip to visit that place.
- Give instructions to pupils to obtain the required photographs, sketch maps, and notes.
- At the end of the field trip give instructions necessary to prepare the wall paper .
- Give all the instructions required for the field trip.
  Evaluate students based on learning outcomes.

**Activity - 2** It is difficult to find active examples to give experiences to students about the exogenic forces, their action and landforms associated with them. However the technological facilities in the present day world enable us to provide them such experiences. This activity is presented with the expectation of providing an understanding and a knowledge about such landform processes through the Internet or television programmes, magazines or newspapers.

- Arrange this as a single activity
- Give each of the students or groups one or more themes
- Collect information about the given themes from the Internet, television programmes, newspapers or magazines.
- For example
  1. Compression forces
  2. Tensional forces
  3. Intrusive volcanoes
  4. Extrusive volcanoes
- Instruct them to enter the information collected into CDs, transparencies or a report.
- Give them instructions to use the computer , overhead projector or any other technical tool.
- If any of the technical tools are not available present a detailed report.
- Make use of Quality inputs
- Observe the students from the time they start preparing the presentation.

* Evaluate the students on the basis of learning outcomes.

## Competency - 4

**While identifying the basic concepts and modes of weather and climate that enable the understanding of the physical and human landscape follows them accordingly.**

**Competency Levels :**

4.1 Explains the elements of weather (08 periods)

4.2 Describes with examples the factors that control climate (08 periods)

4.3 Explains the diversity of climates with reference to Koppens climatic classification (08 periods)

**Learning Outcomes :**

- Explains the difference between weather and climate.
- Describes the elements of weather
- Explains with reference to diagrams radiation, intensity of radiation, and the differences in radiation due to latitudes.
- States the importance of water and land distribution, and oceans and currents as factors of climatic controls.
- Describes the semi-permanent high pressure systems and low pressure systems and the action of wind patterns determined by them.
- Defines the criteria based on a climatic classification.
- Presents the Koppen climatic classification with the aid of a Table.
- Maps out the basic climatic types in the Koppen climatic classification.

## Introduction

The atmosphere acts as the medium for weather and climate. What we recognize as temperature, rainfall, pressure and wind pattern take place in the troposphere which is the lowest layer in the atmosphere.

Climate is the main environmental factor that influences directly or indirectly the continuation of life of the living beings as well as on human activities. Also, it is the climate that has influenced one of the major factors in determining human and economic activities of the particular regions of the world. The weather and climatic changes that exist day to day is also one of the environmental factors that makes an impact on man.

Hence, having an understanding about the atmospheric changing patterns will be of immense use when living with the physical environment. Also, it will be very essential at a time when we are confronted with diverse weather and climatic changes.

In studying this unit, it is expected to give an understanding about the climate and climatic classifications of the world.

## A guideline to clarify subject content

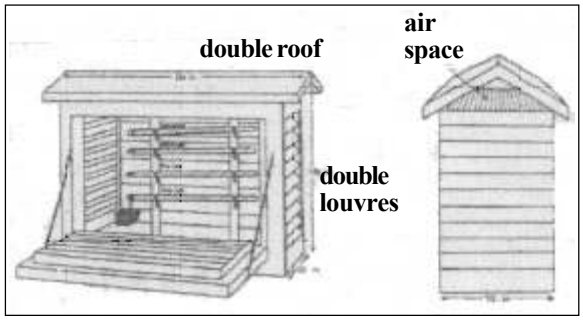
### Introduction to weather and climate

- Weather can be defined as the atmospheric condition that prevails at a definite time in a definite place. It means the weather that is existing. Weather changes according to time and place.
- At any time at any place there may be hazardous changes as a result of a change in weather.
- Climate is the average of atmospheric conditions that prevail over a long period at a certain place or a region.
- It is necessary to analyse the weather conditions for a minimum of 30 years to determine the climatic conditions.
- Hence, when coming to conclusions about climate, long-term observations and measurements of rainfall, temperature, humidity, pressure, winds, clouds and sunlight have to be taken into account.

## Elements of weather

### Temperature

- Temperature is considered as an important element of weather and climate.
- A thermometer associated with a glass tube filled with mercury is used to measure temperature. It is based on the principle of expansion of mercury when heated and contraction when cooled.
- Here Farenheit and Centigrade scales are used.
- It is air temperature that is mentioned in climate graphs and maps. For this purpose, temperature is measured with an instrument called the Stevenson Screen which is kept 1.3 meters above the ground.



- Inside this screen, dry and wet bulb thermometers are placed vertically while minimum and maximum thermometers are fixed horizontally.
- The maximum thermometer indicates the maximum temperature for the day. the minimum temperature for the day.
- The bulb of the dry bulb thermometer is covered with a white clean cotton piece of cloth to ensure that it is kept moist always.
- The air temperature is recorded in the dry bulb temperature while evaporation temperature is recorded in the wet bulb thermometer.

**Vertical Distribution of temperature**

- The vertical distribution of temperature in the atmosphere changes according to the different layers. The variations in the distribution of temperature has been the basis of dividing the atmosphere into various layers.
- In the troposphere which is the lowest layer in the atmosphere, the temperature decreases uniformly as you go upwards from sea-level. This is known as environmental lapse rate. The atmospheric lapse rate is $0.64^0$C to every 100 meters ($6.4^0$C to 100 m)

- Again the temperature increases gradually upwards from the stratosphere. The ozone layer is situated within the stratosphere. In this layer the reason for the increasing temperature may be due to the absorption of ultra violet rays in solar radiation by the ozone layer.
- Again, in the mesosphere which is the lower layer of Irnosphere, temperature decreases as you go up. At the bottom of the mesosphere the temperature is $0^0$C. When the upper limit of it is reached the temperature decreases up to $90^0$C
- From the upper limit of the thermosphere which is the uppermost layer of the atmosphere, temperature increases rapidly.
- Hence the lapse rate prevailing in the troposphere is not uniform throughout. Sometimes, due to unique conditions in the atmosphere, there may be more contradictory conditions in the atmosphere.
- Such a condition is called Temperature Inversion.
- There are two types of temperature inversion.
  - dynamic inversion
  - static inversion

- Due to radiation and conduction during a long winter season, the resulting cooling of the earth's surface lead to the formation of static inversion. For this to take place other atmospheric and earth surface conditions too have to be satisfied.

- A special feature related to static inversions of temperature is the formation of frost and fog.
- When air masses remain static, static inversions occur in the lowest layer of the atmosphere. On the otherhand, dynamic inversions are caused by traveling air masses and hence it is a special type of inversion that may occur in an upper layer.
- Dynamic inversions are caused by the subsidence of upper air masses then and there or by air masses coming from another region and subsiding there.

**Horizontal Distribution of temperature**

- Horizontal distribution of temperature means the inequalities of temperature seen in different parts of the earth's surface.
- The main factor that influences the differences in the horizontal distribution of temperature is the latitudinal location of regions. Accordingly, there is a gradual decrease in temperature from the equator to the poles.
- The other important fact which influences this is the nature of the distribution of land and water. This is due to the unequal heating and cooling of oceans and land.
- In land areas also, there are differences in distribution of temperature depending on relief and elevation of land.

**Humidity**

- Humidity means moisture in the air or the amount of water vapour present in the air in the atmosphere (composition of water vapour). The amount of water vapour that air can hold depends on the temperature of that air.
- Humidity can be stated as absolute humidity and relative humidity.
  **'Absolute humidity** is the amount of water vapour that a unit of air can hold under a given temperature condition. For example at a temperature of $22^0$C, if the water vapour content of 0.1 in a unit of air of 1 cubic centimetre is 2 grams the **absolute humidity** is 20 grams.

**Relative humidity**

It is the ratio between the actual amount of water vapour in a given volume of air and the amount which would be present if the air were saturated at the same temperature expressed as a percentage.

For e.g. at a temperature $22^0$C, the amount of water vapour held in 1 cubic centimetre is 20 gm and under that same temperature that particular unit of air can hold 40 grams of water vapur, the relative humidity is 100%. This fact shows a saturated condition.

- Saturation of a unit of air occurs in 2 ways.
  - The reduction of temperature in the air or the process of adiabatic lapse rate (by the air ascending)
  - Evaporation or addition of water vapour from outside (through evaporation)
- **Dew point** is the temperature at which the atmosphere being cooled become saturated with water vapour and the relative humidity 100%.
- Generally warm air can hold a greater amount of water vapour than cold air .
- In the equatorial regions, the average relative humidity in the air is 80%.
- There are two ways by which a saturated air mass gets cooled further (condensation)

$$\text{Relative humidity} = \frac{20}{40} \times 100 = 50\%$$

  - as formation of dew, . frost, mist and fog associated with the earth's surface.
  - as clouds in the upper atmosphere which cause rainfall.

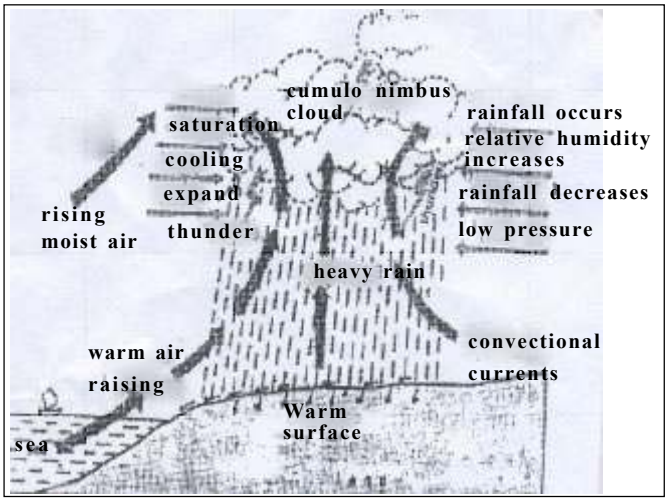
- The condensation process needs hygroscopic nucleii while dust particles, smoke, salt particles act as hygroscopic nucleii.

## Rainfall

- Rainfall is one effect of the inter-connection between the atmosphere and the earth.
- Here, the water that gathers in the atmosphere from the earth's surface as water vapour undergo a long process in the atmosphere and reaches the earth environment again as water .
- This process includes numerous atmospheric phenomena including temperature, air pressure, humidity and air movements.
- Rainfall is commonly known as rain. Snowfall, hail, fog and dew which are various forms of rainfall.
- It is rainfall that occurs as rain in tropical countries like Sri Lanka.
- Snowfall is the main form of rainfall in high latitudes and regions of high elevation where condensation occurs at a lower level than the dew point in air temperature.

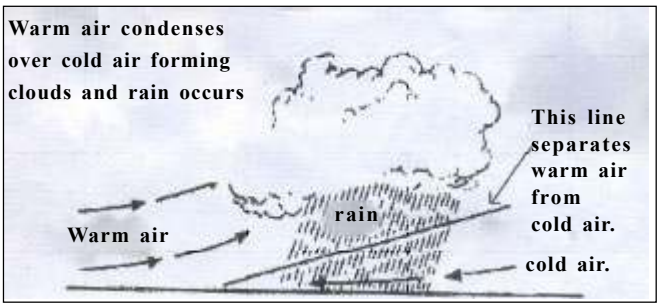
**Sources of rainfall in the world**

1. When air currents with heated water vapour rise up as a result of convectional process and cools due to condensation rain fall occurs. This is convectional process and cools due to condensation and rain fall occurs. This is **convectional rainfall .**




2. According to pressure changes on the earth the air circulation that takes place from areas of high pressure to areas of low pressure or the rainfall associated with surface winds (**monsoon rain**)
3. Frontal Activities associated with air masses of large scale (**Frontal rain**)

**Frontal Rain**




4. **Depressions/ cyclones** or air flow as a result of local pressure changes (cyclonic rain associated with depressions)

**Wind**

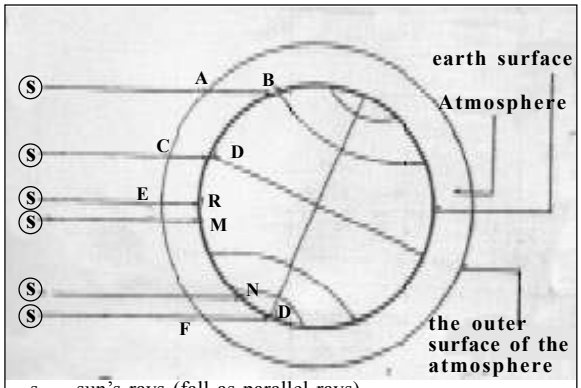
- Wind is movement of air and wind has a velocity and a direction.
- Air moves due to changes in pressure. Accordingly, air currents on the surface of the earth flow from areas of high pressure to areas of low pressure.
- With the changes that occur in pressure, the direction and wind velocity also change. This results in changes in temperature and rainfall.
- Hence wind is important as a basic factor in weather.
- The velocity of wind is generally measured by the anemometer.
- The wind wane is used to find the direction of wind.
- The velocity of wind is measured by the Beaufort scale.
- The see through distance or the general transparency in the atmosphere is called visibility.
- The visibility in the clear atmosphere may be 100% while this transparency may be less due to various reasons.
- The sources that affect visibility are haze, mist and fog.
- Haze is caused by the smog and dust particles emitted from industrial areas and also by the unusual reflection of light caused by the different density conditions in air in the lower atmosphere.
- Fog is a condition caused by the condensation of water vapour in air on land. This reduces visibility by about 1000 meters.
- Fog is formed by the condensation of water vapour associated with dust and other pollutant particles on land surface. Smog can be seen in the lower layer of the atmosphere as a cloud.
- When a smog is formed, the environment visibility is less by 1000 meters.

## Factors of Climatic Control

- The changes that occur according to solar radiation intensity and latitude.
  - The heat energy emanated from the sun situated at about 150 million kilometres from the earth reaches the earth at a velocity of 30,000 kilometres per second and it is estimated that it takes 8 minutes to reach the earth.
  - Thus the heat of the sun which is received by regions away from the atmosphere of the earth is called Insolation.
  - The value of a solar unit received by the earth is called the Intensity of insolation. The radiation energy that fall on an area of one square centimetre within one minute at an angle of $90^0$ is 1.94 calory grams. (1.9 Cal/ $cm^2$/ min)
  - The period when radiation falls on at a given place in day time is the intensity of insolation.

- This decreases gradually as you move from the equator to upper latitudes. Thus the intensity of insolation is low in polar latitudes than in tropical latitudes. This is because when the earth revolves round the sun in its orbit the earth's axis is $23\ 1/2^0$ tilted.
- Since the distance between the sun and the earth varies in July and January, then there is a difference in insolation received.
- Thus differences in the intensity of insolation is seen in Aphelion and Perihelion.

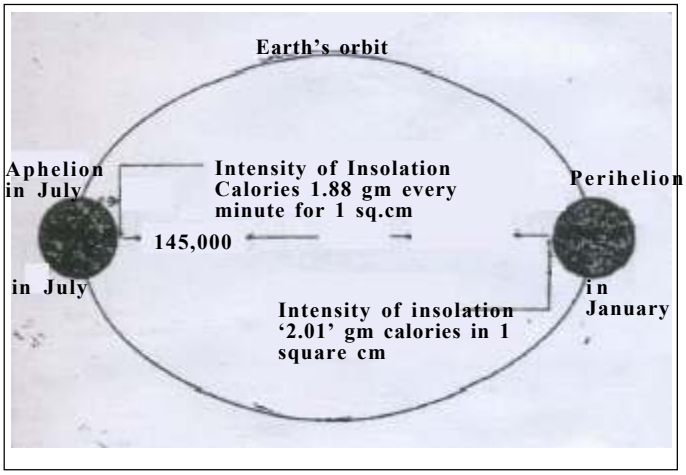
**The change in Insolation according to the angle of fall of radiation.**




s - sun's rays (fall as parallel rays)

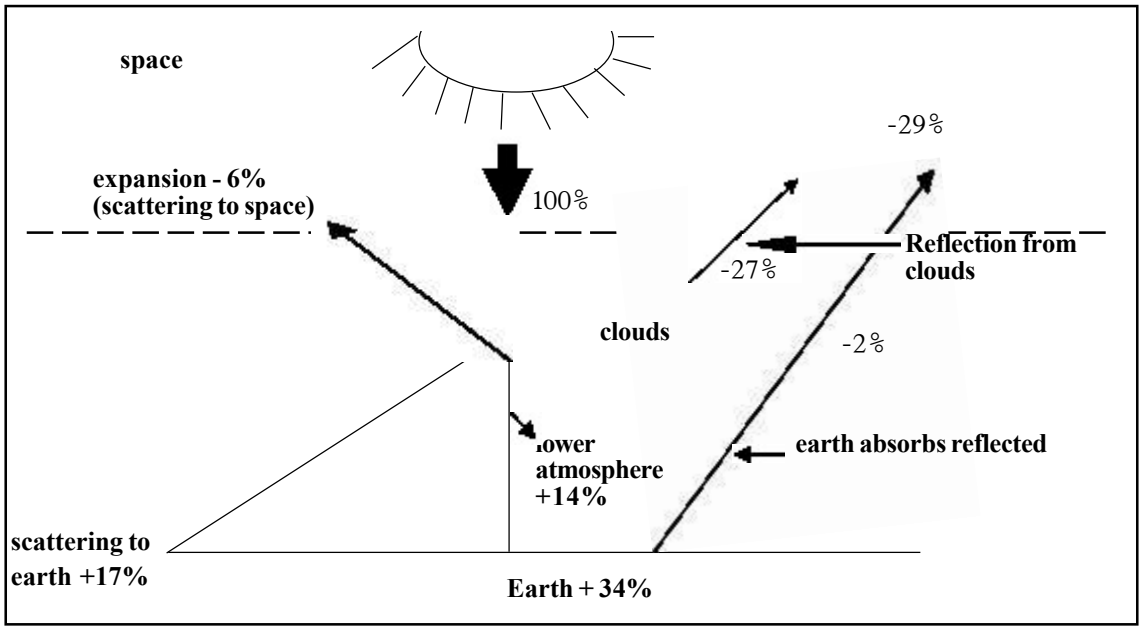
1. SAB rays have penetrated a longer distance than SCD rays
   AB atmospheric distance is greater than CD atmospheric distance.
   Hence when SAB rays reach the land surface has less heat than SCD rays.
2. SE rays fall perpendicularly to the earth surface
   SF rays fall at an inclination (tilted)
   Therefore the NP surface which gets SF rays is larger than the SM surface which gets SE rays Heat in NP is less. The heat in RM is great (Note that SE rays are equal to SF rays)
   Within the atmosphere, the sun's rays are subjected to the processes of absorption, reflection and expansion.

**Aphelion and Perihelion**




Source: Gunadasa J.M. - Climatology

- **Heat balance**
  - The heat balance indicates the amount of heat that reaches the earth from the solar radiation and the amount of radiation that is lost or lessened.

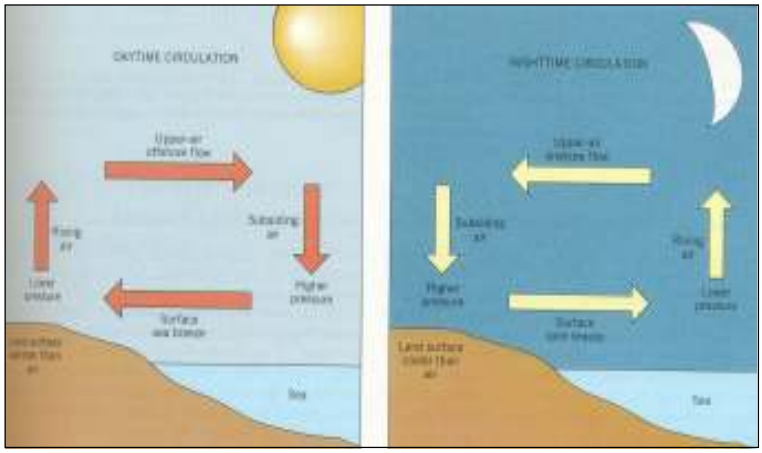



Source: Physical Geography, H.g. De Bliz, Peter & Muller

- Albedo is the amount of heat lost from the [redacted] radiation. This amount is 35% of the total radiation (6% of the radiation [redacted] the clouds and 29% is reflected from the earth). About 65% of the total radiation is spent in warming the earth and the associated atmosphere - 14% + 34% + 17%.
  The 34% directly received by the earth and 17% is scattered radiation to the earth while 34% is absorbed by the atmosphere.

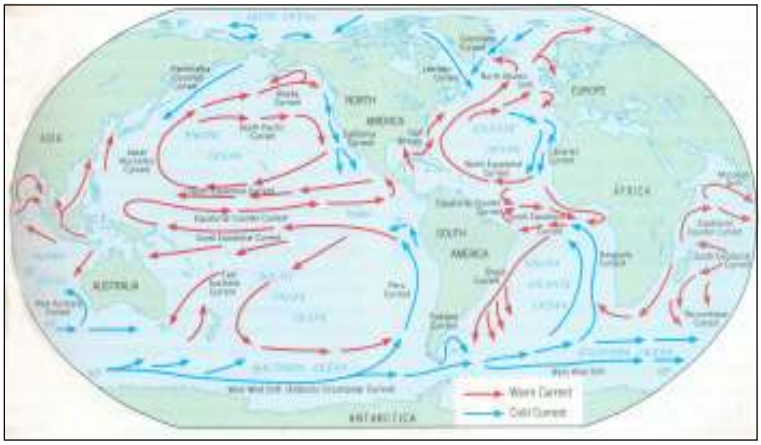
- **Distribution of land and oceans**
  - The nature of distribution of continents and oceans is a factor which influences the distribution of temperature and rainfall in the world.
  - A few variations in temperature in land and water is the result of heating and cooling.
  - In an expanse of water absorption of temperature is greater than the absorption power of land.
  - Land masses are warmed by conduction. Since water is not a solid substance its heat is distributed mainly by convectional currents or turbulence in water.
  - In relation to oceans, the diurnal range of temperature on land is greater because land gets heated quickly and water gets heated slowly and it takes a longer time for the water to get heated.

- The result of all these differences is that land gets heated and cooled more rapidly than an expanse of water .
- Hence due to the location of land and oceans, there are differences in climatic features in the interior of continents and coastal regions which have the oceanic influence.
- This influences not only the temperature but also the rainfall process.



Source: Physical Geography H.G. Blif and Muller.

- **The location of semi permanent Low pressure and High Pressure systems**
  - The prevailing wind patterns in the atmosphere is a basic element. The basic reason for the general circulation of the atmosphere is the differences in insolation latitudinally on the surface of the earth.
  - The main function of the surface wind pattern is to transfer the surplus heat received at the Tropics to the polar regions where the heat is less.
  - The warm tropical air is blown to the polar regions where it mixes up with the cold air in the polar regions.

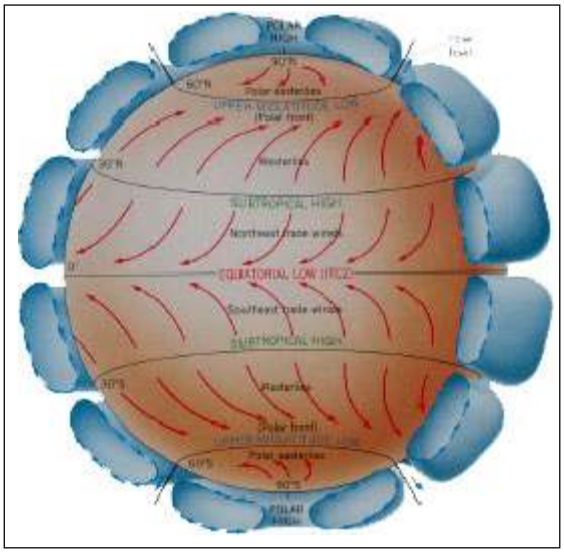


Source: Blij H.J. and Muller Physical Geography

- The location of pressure systems in the earth's surface is important with regard to the winds. In relation to the pressure belts, the general circulation of the atmosphere is Tri-Cellular.
- Monsoon winds, mountain winds, land breezes and sea breezes and all other wind circulation types are related to the general circulation pattern.

- **Distribution of atmospheric pressure in the World**
  - Air pressure in the world is not the same everywhere in the world and even in the same place pressure will not remain the same all the time.
  - Atmospheric pressure is dependent on the three factors of elevation, temperature and the earth's rotation.
  - The pressure distribution in the world can be considered from two angles as vertical distribution and horizontal distribution
  - The main feature in the vertical distribution of pressure is that it decreases gradually from sea level upwards
  - According to Boyles' law, at some definite temperature, the volume of an air mass and its pressure are inversely proportional. Thus if the temperature is decreased and volume too is decreased, pressure will increase while if temperature and volume both are increased, the pressure will be low.
  - Accordingly, the general condition on the earth is the prevalence of low pressure in areas of high temperature and high pressure in areas of low temperature. Yet there are situations when there will exist contradictory conditions to this fact.
  - There are two major types of pressure zones
    * low pressure zones, depressions and cyclones
    * high pressure zones and anti cyclones
  - Isobars are used to show the horizontal distribution of pressure. The general pressure belts or cells are distributed along latitudes in a west to east direction.
  - There are variations in the latitudinal distribution of pressure belts due to oceans, continents and relief. Hence in the Southern Hemisphere as there is no such diversity pressure belts are distributed without a break but it is not so in the Northern Hemisphere.

- 4 main pressure belts on a generalized globe can be recognized considering it as a general surface
  * Equatorial low pressure belt/ zone
  * Sub-tropical high pressure belts/ zones distributed centred along $30^0$ north and south
  * Temperate low pressure belt/ zones along $55^0$-$65^0$ north and south regions
  * Polar high pressure zones/ belts centred around north and south poles.

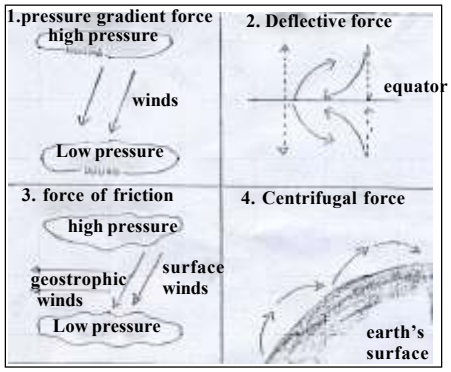


Source: Blij and Muller, Physical Geography

- **Pressure and Winds**
  - Generally the air that flows from areas of high pressure to low pressure is called wind.
  - Pressure gradient is shown by the change in direction and velocity of isobars. If the gap between isobars is great, it shows that the pressure gradient is gentle and if that gap is smaller the pressure gradient is high. When the pressure gradient is high, the wind velocity too is high.
  - According to the deflective force described by both Hadley and Ferrel, when the winds blow between the pressure belts on the globe, the winds are deflected to the opposite direction to the direction of rotation of the earth. This is also known as the Coriolis force. [In the Northern hemisphere the winds are deflected to the right of their path and in the southern hemisphere winds are deflected to the left (clockwise and anticlockwise respectively].

- **Theories about the General Circulation of the Atmosphere**
  - The basic cause for the general circulation of the atmosphere is the latitudinal difference in insolation over the earth.
  - In 1735 Hadley gave his theory about one-cellular hypothesis about the general circulation.
  - This theory stated that in an area which receives the greatest amount of insolation the surface air rises up and move towards the poles and subside at the polar regions while air from the polar regions flow towards the equator to fill the void in the equatorial areas, and that the direction of surface winds are deflected due to the rotation of the earth.
  - With the discovery of the sub-tropical high pressure belts and the sub-polar low pressure zones, in 1941 Professor Rosby presented the Tri-Cellular hypothesis.
  - The theory about the Jet stream is also important in the general circulation.

**The factors that determine general circulation**

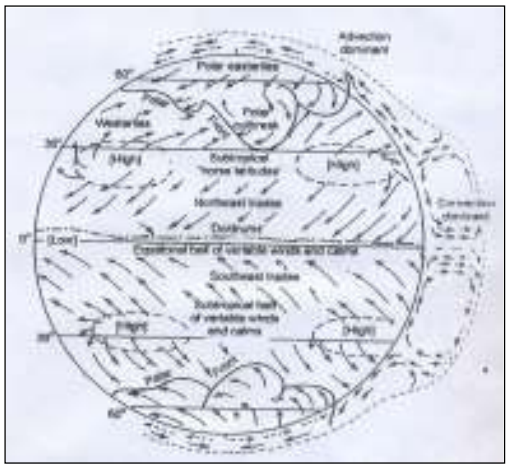



- **Atmospheric Circulation**

  - Atmospheric circulation can be divided into 3 major types
    * primary circulation (general circulation)
    * secondary circulation
    * tertiary circulation

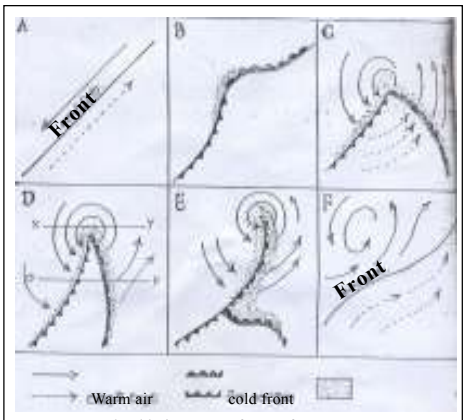
  - The wind pattern that operates in relation to the pressure belts of the world is called the general circulation. These winds blow from high pressure belts towards the low pressure areas of the world.
    * Trade winds
    * Westerlies
    * Polar winds

## Pressure belts and wind patterns



Source: Cooray P.G. 'The Earth Around us'

## The stages of formation of a temperate cyclone

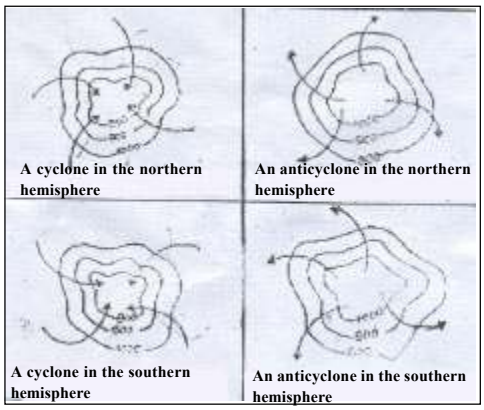



A Warm and cold air meet to form a front
B The beginning stage of a formation of a cyclone
C Stage of youth D mature stage E old stage
F The cyclone disappears and a new front is formed

Source: Gunadasa J.H. (1978) Climatology

- **Secondary Circulation**
  - The cyclones and anti cyclones that do not come under the atmospheric general circulation belong to the secondary circulation.
  - A cyclone is formed when wind blows in a circular pattern to the centre of a low pressure system. An anticyclone is formed when wind blows out in a circular pattern from a high pressure centre outwards.
  - In both these types, winds blow according to the coriolis force that is clockwise in the northern hemisphere and anti-clockwise in the southern hemisphere.

## The nature of cyclones and anti-cyclones




- Generally cyclones are of 2 types
  - * Tropical cyclones
  - * Temperate cyclones

- **Tropical cyclones** are formed in $8^0$ - $15^0$ north and south latitudes in areas of strong low pressure centres.

- When a cyclone is well-developed very strong stormy features are shown.

- Tropical cyclones are known by different regional names.
  - * As **Hurricanes** in the area round Bay of Mexico, West Indies and Caribbean sea.
  - * As **typhoons** in the western part of Pacific, (China, Japan)
  - * As **willy-willy** off the northern coast of Australia
  - * As **Bagio** – associated with Philippines
  - * As **cyclones** in Bay of Bengal and Arabian sea.

- Tropical cyclones are very destructive. The velocity of winds in about 120-320 km per hour. They bring heavy rainfall and stormy weather.

- The special feature about cyclones is heavy rainfall within a very short period.

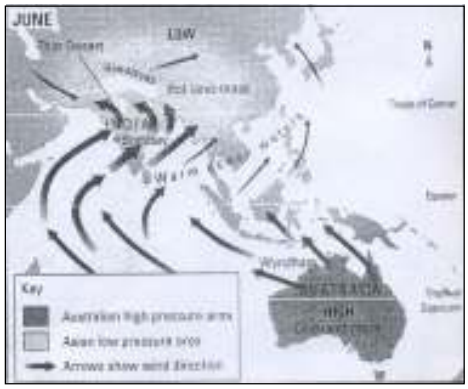
- There is also another stormy winds known as **Tornado** with a wind velocity of about 800 meters per hour. These are smaller in size when compared to cyclones. This type of weather has been reported mostly from U.S.A. and Australia.

- A tornado is a whirlpool storm which is seen at a distance as a funnel of about 1.5 kilometres in height with a diameter of about 150-160 meters.

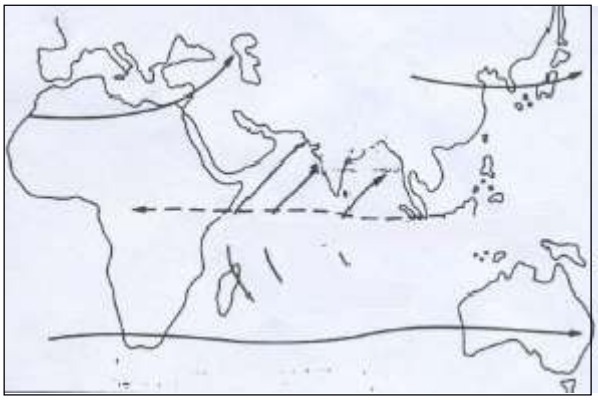
- **Temperate Depressions (cyclones)**
  - These are Cyclones caused by frontal activities when warm and cold air currents meet in regions of upper and mid latitudes.
  - A front is a place where the warm air currents blowing from the equatorial regions meet the cold polar air that blows towards the equator .
  - Here, at the front, the warm air mass flows up over the cold air mass. When the warm air is raised up from the surface, the water vapour in it is condensed to form rain.

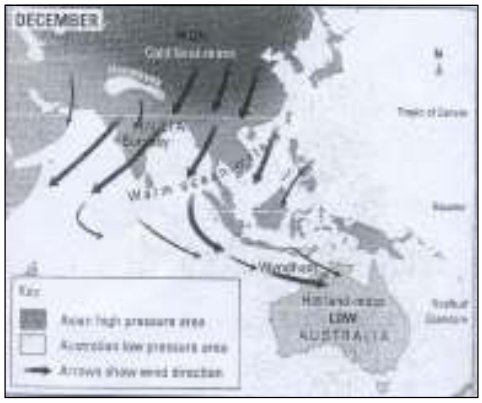
- **Tertiary Circulation**
  - Local winds and periodic winds which do not come under the primary and secondary circulation patterns belong to this type.
  - In a certain place during a definite period, if the prevailing winds blow from a particular direction more than from other directions, these winds are called periodic winds.
  - Among such wind systems, **monsoon winds** occupy a major place.
  - Monsoon winds are strongly active in South, South east and Eastern Asia.

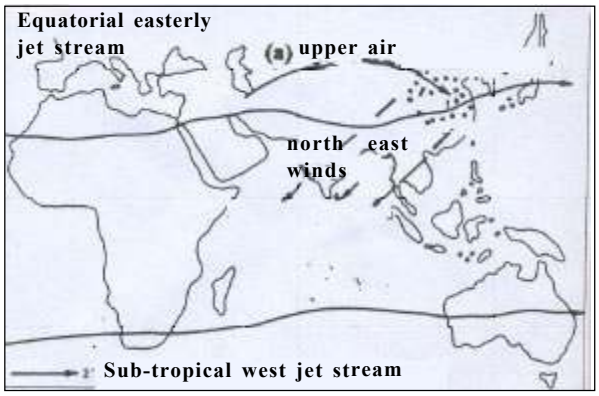
**Action of monsoon winds**



**Monsoon wind patterns of South Asia**






Source: Bandaranaike G.M. - Climate, Water and Environment

- The **land and sea breeze**s that prevail daily, the mountain winds associated with hills and valleys (Chinook in North America and Fohn in Europe) belong to the tertiary circulation pattern.

- **Climatic Classification**
  - The aim of a classification is separating a series of unequal conditions into equal and unequal types with the help of one common factor present in each type.
  - When a number of regional climatic types are condensed into major types and sub-types relatively according to any common criteria, it is what happens in a climatic classification.
  - The Greeks were the first people who presented a climatic classification. They divided the earth into three wide zones based only on temperature.
  - At a later date, out of the people who tried to present wide climatic classifications scientists such as Koppen, Thornhwaite in 1918, revised it in 1931 and presented a new classification in 1936.
  - For his new classification he utilized the plant classification of D. Kandol, and used the annual and mean monthly rainfall and temperature as the main criteria.
  - In order to identify the moist and dry climatic types he made use of a mathematical formula $r = 0.44t - 8.5$.
  - He substituted the mean temperature and rainfall data of a certain place to this formula. In the mathematical solution thus prepared, if the value in the side of r is less, it was classified as a dry climate and so if the value in the t side exceeded r it was classified as a moist climate.
  - Another special feature in this classification is the use of an English letter to identify every climatic group and sub-types. Every letter given is meaningful and they have been given a numerical value also.
  - For instance in the Af climate, A means hot forever and f means moist forever.

- **Koppens' Climatic Classification**

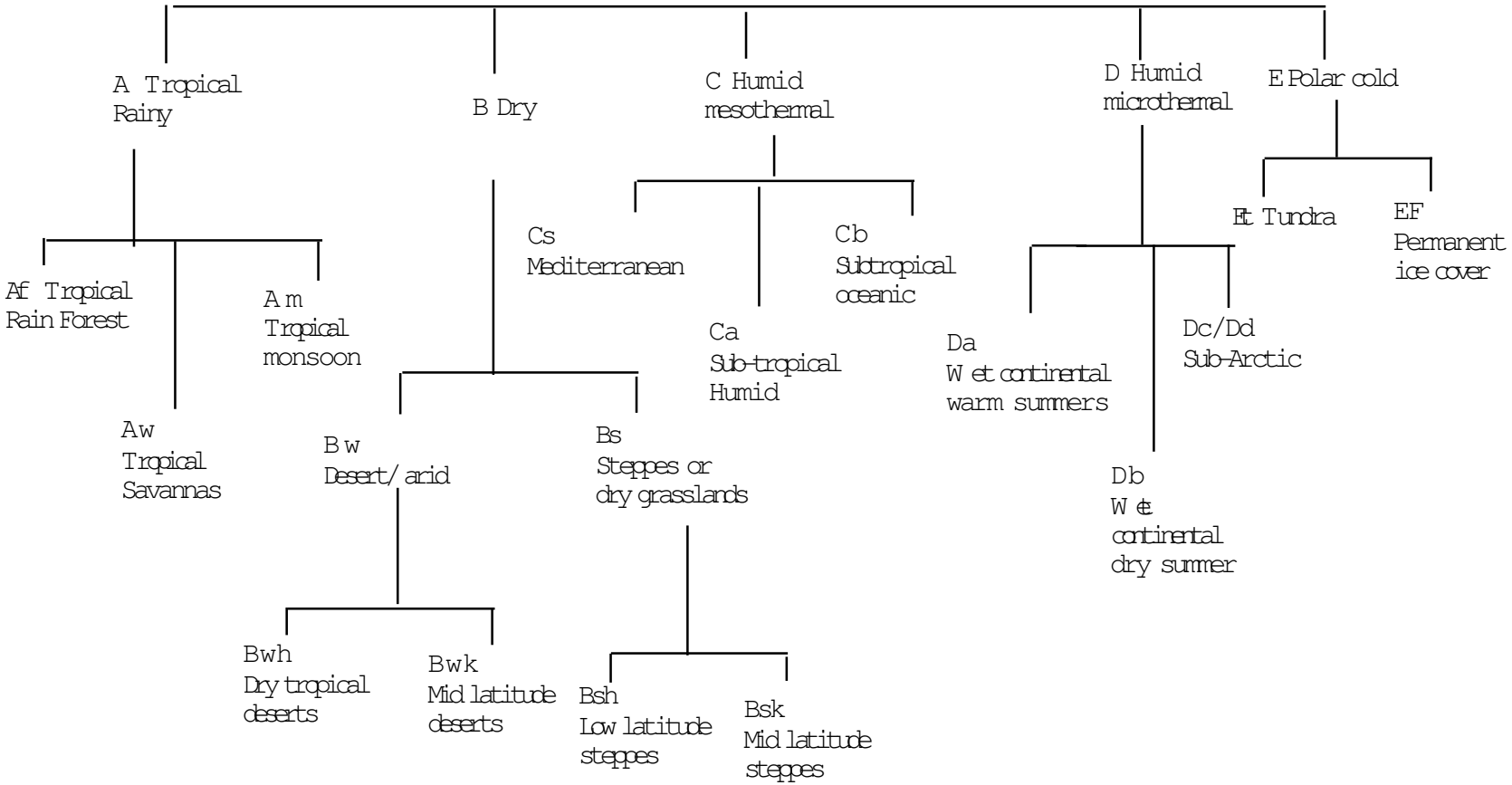
In the Koppens climatic classification, five main climatic types are seen. They are named A, B, C, D and E climates.

A – Tropical Rainy climates
B – Dry climates
C – Humid mesothermal
D – Humid Microthermal
E – Polar cold climates

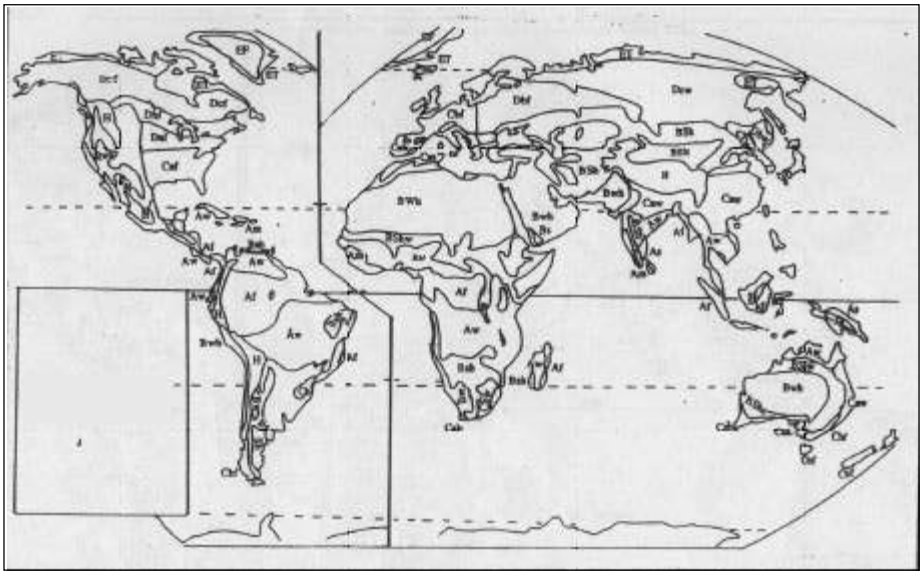
In addition to these classified Highlands/mountain climate denoted by letter H is also included.

- Pay attention to only A, B, C climates when utilizing this in the teaching-learning process.

**Koppen climatic classification**



**Koppen climatic classification**



Source: Environmental Geography, Educational Publications Department

## A Tropical Rainy climate

- This climate is distributed in regions near the equator in low latitudes. The temperature does not fall beyond $18^0$C. There is no cold season. The coldest month temperature is more than $18^0$C.

- There are 3 sub-types here
  Af - Tropical Rain forest climate
  Am - Tropical monsoon type
  Aw - Tropical savannah climate

## B Dry climate

- The main feature in these climates is excess of evaporation than rainfall.
  There are 4 sub-types. These 4 types are taken under 2 groups.

  Bw – Desert or arid climate
  Bs – Steppes or dry grassland climate
  Under these two are
  * Bwh – low latitude deserts with an annual temperature over $18^0$C
  * Bsh - low latitude semi-deserts with an annual temperature of over $18^0$C.
  * Bwk - mid latitude cold deserts with an annual temperature of less than $18^0$C.
  * Bsk - mid latitude semi-deserts with an annual temperature below $18^0$C.

**C - Humid Mesothermal climate**

- This is a type of warm temperate rainy climate. The coldest month temperature is below 18$^0$C-0$^0$C /(32$^0$F). There are 3 sub-types.

Cs - Mediterranean climate - summer is dry.

The rainfall of the driest month in summer is below 3 cm.

Ca - Moist sub-tropical climate

Warm summers, average temperature of the warmest month is over 22$^0$C.

Cb - Sub Tropical oceanic climate

Cool summers, average temperature of the warmest month is below 22$^0$C.

**D - Humid Microthermal climate**

This is limited to landmasses in the northern hemisphere. This is a climate with snowfall in winter. The coldest month temperature is 0$^0$C. It has a long cold season. There are 3 sub-types.

Da - Humid continental warm summer type

Db - Humid continental cool summer type

Dc or Dd - Sub-arctic type

**E - Polar climate**

- The temperature of any month does not go beyond 10$^0$C. Long cold season and a short summer. There are 2 sub-types

Et - Tundra

Ef - Ice-cover (permanent ice - cover)

**Reference** – Climatology by Trewartha

# Teaching-Learning Activities

## Activity - 1

The objective of this activity is as follows – study the elements of weather and climate and about weather and climate from the given information and from other information from books, magazines and any other media. With the information thus collected, students are expected to prepare a fact file, present them in class and discuss.

The elements of climate –

- Temperature
- Rainfall
- Winds
- Humidity
- Visibility

- This assignment can be done as a single activity or as group activities.
- Help students to find source material and articles required to obtain facts.
- It is possible to provide the required stationery from quality inputs.
- Give them a definite time for the assignment and do the needful for the students to present their creative work in class.
- Evaluate the presentations and give them feedback.

## Activity - 2

Today, Koppen's climatic classification is accepted widely out of the climatic classifications presented so far in the world. What is expected from this activity is to prepare a wall newspaper in relation to the climatic types in the Koppen Classification, the world distribution of those climatic types, the features of the main climatic types in the classification, their world distribution, the features of the main climatic types. In preparing this make use of the reports including this information.

- Provide the aids required out of the Quality Inputs.
- Direct students to collect information relevant using a suitable method (as a group activity)
- While supervising give the required guidance and instructions.

**Collect information under the following topics**

**Group 1**

- The criteria based on Koppen's climatic classification.
- The basic climatic types with the letters of Koppens' climatic classification.
- Showing the classification in a Table (the whole classification)

**Group 2**

- Presenting the distribution of Koppen's climatic types on a world map.

**Group 3**

- Preparing reports about details of Koppen'sA B C climates under the topics – Distribution, temperature, rainfall and special features, natural vegetation, human activities.
- Presenting the information reports prepared by all the groups in the wall newspaper .

## Competency - 5

## While appreciating the speciality in the climate of Sri Lanka contributes in conserving it.

**Competency Levels :**

**5**.1 Studies the nature of the climate in Sri Lanka.
(04 periods)

5.2 Enquires into the sources which bring rain to Sri Lanka.

5.3 Explains the variations in the climatic zones of Sri Lanka from information collected.
(04 periods)

**Learning Outcomes :**

- Maps out the distribution of rainfall in each of the seasons using outline maps of Sri Lanka.
- Describes how rainfall has influenced in forming the biotic systems, and determine human activities.
- Marks and names the climatic zones on an outline map of Sri Lanka.
- Analyses the factors that have influenced the regional diversity in the climates of Sri Lanka which is a small island near the equator .

## Introduction

Sri Lanka is a small island situated close to the equator with a latitudinal extent of four degrees and about two degrees of longitudinal extent. One of the prominent features in the climate of Sri Lanka is that average temperature is $27^0$C which is due to her small latitudinal extent and the location close to the equator.

The main sources of rainfall of Sri Lanka are convectional rain caused by the convectional process due to location near the equator and cyclonic rain and monsoon rain caused by the north south movement of the Inter-tropical convergence zone. Thus rainfall takes the prominent place out of climatic elements in determining human activities and in the formation of bio-systems in Sri Lana which has an equatorial monsoon climate. Hence it is expected from this unit to direct students to study information about the special features in the climate of Sri Lanka.

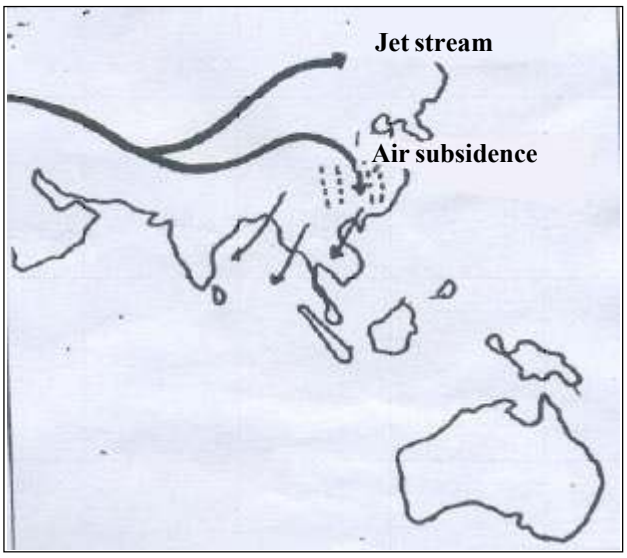
**A Guideline to clarify subject content**

**The factors that influence the climate of Sri Lanka**

**Global Factors**

- Sri Lanka lies on the path of the north and south movement of the Inter Tropical Convergence Zone (ITCZ)
- The ITCZ which is located about $5^0$-$10^0$ latitudes makes a movement over Sri Lanka to the Asian continent in June and in January moves to about $10^0$ south in the Indian Ocean.
- Due to the movement of the ITCZ there is a variation in the mean pressure in the Island (For eg when the ITCZ moves southward pressure decreases from north to south in Sri Lanka. In Jaffna it is 1012 milibars while in Galle it is 1011m)
- Location in the low pressure trough
  - There is an influence on the climate when winds blow from outside under low pressure condition in Sri Lanka.
  - The impact of the equatorial and sub-tropical Jet Stream.
  - That there are two air masses of high velocity which influence the South Asian Zone.

**The influence of the sub-tropical Jet stream**




- Ocean currents
  - The influence of the North Equatorial current which flows corresponding to the Trade winds from the Pacific Ocean to the Indian Ocean.

## Regional Factors

- The location of Sri Lanka in the Asiatic landmass including the Indian continent in the North.
- Coming under the influence of winds that blow from the high pressure centres that form periodically in the Indian Thar desert and Central Asia.
- Due to the relief features in India, the strength of the Trade winds that blow from north to south is reduced.

## The Influence of the Indian Ocean

- The influence of the moisture bearing winds
- Location of Sri Lanka relatively to Bay of Bengal
- Formation of low pressure centres very often on the surface of the Ocean.

## Local Factors

- Location as an Island
- Having relief features with the height of land increasing gradually from the coast to the central parts and the presence of a Central Hill Country.
  - Changes in temperature with increasing elevation
  - The location of the central hills influences rainfall
- Presence of local changes according to topographical features, water and soil conditions
  * The influence of soil types, topographical features and drainage on local temperature variations in Sri Lanka.

    For eg:

    Sandy soil absorb much heat and releases excess heat

    Forests absorb more heat and release less heat

    Lowering of temperature by the cooling of air through evaporation in areas with an expanse of water.

## Sources of Rainfall

There are 3 sources of rainfall in Sri Lanka

1. Convectional rain (Inter-monsoonal)
2. Monsoon rain
3. Cyclonic rain

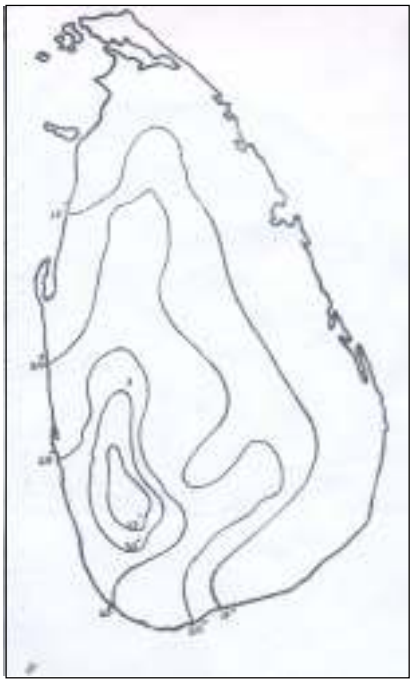
- Since Sri Lanka is located close to the equator due to high insolation, the convectional process is distributed throughout the year.
- The sea breezes which blow from the sea to the land to fill the void when air masses rise up help to induce convectional rain.
- Waning of the convectional process during the season of monsoon rains due to monsoonal winds blowing from outside the area.
- A sky laden with rain clouds seen in the evenings.
- Prevalence of heavy rain with thunder-storms in the evenings.
- The rain lasts for about 1 or 2 hours.
- After the rain a clear sky is seen at night.

**The period of convectional rain**

* March-April and October to November

- There are regional differences in the distribution of convectional rain due to
  * Southwestern region receives heavy rainfall due to the influence of relief (central hills)
  * Eastern coastal areas and northern regions get less rain

**The distribution of convectional rainfall**



## Monsoon Rain

- Monsoon winds are a type of strong winds which blow over the island during definite periods in the year . This is known as an outside wind which has burst in to the general planetary wind pattern.
- Three main phenomena influence the commencement of the monsoon
  * The northern oscillation of the southern trade wind belt
  * The changes that occur in the upper Jet stream
  * The pressure changes in the Indian Sub Continent

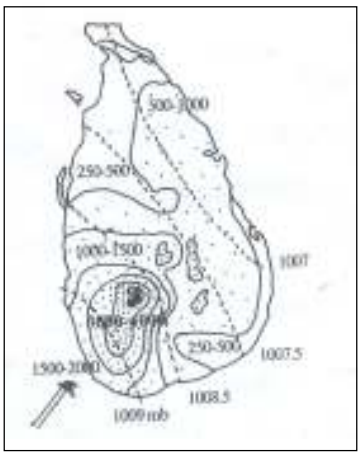
There are 2 types of monsoons which influence Sri Lanka

1. South west monsoon
2. North east monsoon

## South-west Monsoon

- From May to September
- Formation of low pressure centres due to the northern oscillation of the Inter Tropical Convergence zone
- Wind movement from the High pressure centres in the south towards low pressure centre in the north
- These winds which blow from the south west in a north-easterly direction are called south-west winds
- Since these winds cross over a large expanse of water and the central hills act as a barrier in their path, the south western region receives heavy rain.
- These winds bring little rain to the north and east.
- Since there are no mountain barriers at Mannar and Hambantota areas to cause rain these areas get less rain.

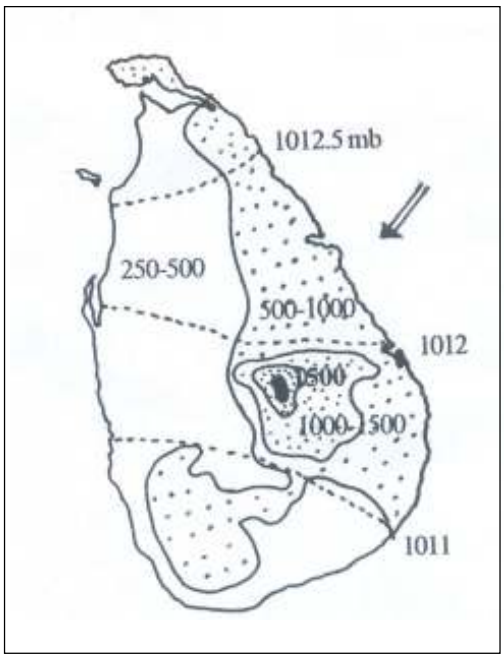
**Rainfall during the south-west monsoon in Sri Lanka**



**Northeast monsoon**

- From December to February
- With the shifting of the thermal equator and the Inter-Tropical Convergence Zone to the southern hemisphere a low pressure centre develops in the southern hemisphere. Winds from the high pressure centre in Central Asia blow towards this low pressure centre which form the north east monsoon winds.
- Since the north east monsoon winds have to pass through a large area of land and only a small area of the ocean on its way to Sri Lanka, these winds do not pick up a vast amount of water vapour. Hence the north east monsoon bring only a little rain.
- The northern and eastern regions of Sri Lanka get more rain while the south western areas get less rain.

**The Distribution of north-east monsoon rainfall and pressure gradient**




**Cyclonic Rain**

- October, November

**How cyclones are formed**

- Equinox caused by the sun being overhead at the equator
- At the time features of tropical cyclonic fronts may form over the island because of the location associated with the Northern Inter Tropical Convergence Zone.
- When tropical cyclones move towards the west passing across the Bay of Bengal they move from the eastern coast towards the northwest of the Island bringing heavy rain.
- Cyclones bring heavy rain to the northern and eastern areas of Sri Lanka.\

## Climatic Regions of Sri Lanka

Sri Lanka can be divided into five climatic regions based on the inter-action of the climatic elements such as temperature and rainfall

1. Low country wet zone
2. Low country dry zone
3. Hill country wet zone
4. Hill country dry zone
5. Semi arid zone

### 1. Low country wet zone

- Annual rainfall is more than 2000 mm
- Rainfall is distributed throughout the year
  * February and August are relatively dry months with low rainfall
  * Gets rainfall from the south west monsoon and convectional rainfall
- Bright sunlight prevails throughout the year
- Average annual temperature is $27^0$C
- Plants grow well due to heavy rain and high temperature.

### 2. Low Country Dry zone

- About ¾ of the land come under the dry zone.
- The annual rainfall is about 1250 – 2000 mm
- The rainy season is from October to end of January
- Rain received from cyclones and the north east monsoon
- There is a dry season from May to September
- Excess of evaporation over the rainfall received has resulted in dryness
- Even the amount of rainfall is not dependable

### 3. Hill Country Wet zone

- Rain is distributed throughout the year
- Rain is received from the south west monsoon and convectional rain
- Annual average rainfall is 3400mm but there are areas which have received over 5000 mm annually for eg. 5537 mm in Watawala.
- At present Maliboda is considered as the area which gets the most amount of rain in Sri Lanka.
- There is no dry season.
- Temperature decreases with elevation.
  For example the temperature of Kandy Plateau is more than $20^0$C
  Temperature of Hatton plateau is less than $20^0$C
  The temperature of Nuwara Eliya is less than that of both these places.

**4. Hill Country Dry zone**

- The land to the east of a line drawn connecting the towns Matale, Kandy, Nuwara eliya and Haputale and the high land within 300 meter contour line belong to this zone.
- Temperature is below that of the Low Country dry zone due to the influence of elevation.
- Most of the year subjected to the influence of dry winds because of the location in rain-shadow side of the Hill Country.

**5. Semi-Arid zone**

- Annual average rainfall is less than 1250 mm.
- Rainfall is limited to about 3 months.
- Less than 100 mm of rain is received in most of the months.
- There is a long drought of 6 months.
- Due to cloudless clear skies and high temperature evaporation is very high leading to aridity.

# Teaching Learning Activities

**Activity**

- Drawing climatic maps of Sri Lanka and preparation of a conceptual map.
- A group activity of preparing maps and information sheets about the factors that influence the climate of Sri Lanka, distribution of rainfall and climatic zones.
- Group the class and assign the topics below to each of the groups.
  - Group 1 – Distribution of South west monsoon rainfall and the isobars during the south west monsoon.
  - Group 2 – Distribution of northeast monsoon rainfall and the isobars during the north east monsoon.
  - Group 3 – Distribution of convectional rain
  - Group 4 – Climatic zones of Sri Lanka
- Give a chance to each group to present the information collected to the common group.
- Instruct groups 1, 2, 3 to complete the Table.
- Build up a conceptual map about the climatic zones of Sri Lanka making use of the information collected by Group 4.
- Be careful about identifying correct concepts and building up correct relationships.
- Complete the Table below making use of the facts collected by groups 1, 2, 3.

| Type of rainfall | Period | Factors that influence | Areas of distribution | Special features |
|---|---|---|---|---|
| Convectional | | | | |
| South west monsoonal | | | | |
| Cyclonic | | | | |
| North east monsoonal | | | | |

* Do the evaluation work based on learning outcomes.

## Competency - 6

## Examines the processes and causes that have influenced the global climatic changes

**Competency Levels :** 6.1 Shows comparatively the natural causes and influences that have led to climatic changes

(06 periods)

**Learning Outcomes :**

- Describes the processes that lead to climatic changes.
- Describes the physical and human processes that have caused climatic changes.
- Tabulates the causes and impacts of climatic changes.
- Contributes in preventing human activities that have led to climatic changes

### Introduction

From the origin of life up to the present day climate has influenced the continuation of life on earth. Plant and animal communities have adapted to the weather conditions prevailing in the environment. At the same time weather and climate especially influences human activities. Man's economic, social and cultural environment are also framed accordingly. Natural causes like the influence of sun spots and volcanoes and human activities like clearing of forest, use of resources in abundance, use of biotic energy and obstruction of water cycle have caused climatic changes.

Hence, the objective of teaching this unit is to direct the students to do a comparative study of the causes and impact of the changes in climatic conditions at present.

## A Guideline to clarify subject content

### Green House Effect

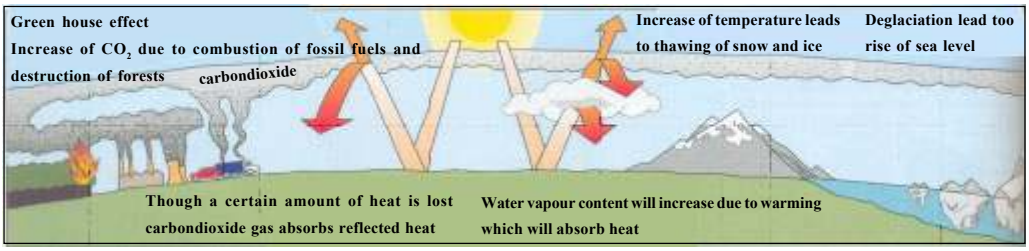
A hut which is covered by glass or plastic gets the heat from short waves of the sun. This heat gets reflected and travel as long waves. Since long waves cannot penetrate through glass or a plastic cover, the heat is retained inside the hut. This is called green house effect.

In cold countries such green houses are utilized to grow various plants. A similar process operates on the atmosphere of our earth.

This is because the required temperature levels are provided by the concentration of greenhouse gases naturally found in the atmosphere.

Yet, through human activities, this prevailing condition today has been changed. Today, due to human activities many greenhouse gases such as carbondioxide, methane, chlorofluorocarbon are accumulating in the atmosphere in an unlimited manner. Hence these greenhouse gases act as an obstruction to reflect the short ways of the suns rays received on the earth and the atmosphere around it by the long-waves of the rays. Hence as heat is retained green house effect is caused by the higher temperature.

**Process of the greenhouse effect**




Source: Gunasena New Philip Atlas (2003)

Greenhouse gases

- Carbondioxide
- Methane
- Nitrous oxide
- Chlorofluorocarbon (CFC)
- Water vapour and other gases

**The factors that have caused the Greenhouse effect**

- Combustion of fossil fuels
- Rapid destruction of forests
- Increase in regurgitating animal population
- Industrial sources
- Setting fire on cultivated areas
- Accumulation of methane due to paddy cultivation
- Garden waste and waste water
- Natural sources (volcanic eruptions, natural marshes etc)

### Results of Greenhouse effect and climatic influences

- Increase in temperature on earth due to the increase in the percentage greenhouse gases.
- With the increased warming of the earth the temperature in the ocean waters too is increased resulting in unsuitability for marine organisms.
- Rising of sea level as a result of thawing of polar ice sheets and glaciers due to increase in temperature.
- Changes in the modes of rainfall due to changes in wind patterns as a result of warming of the atmosphere.
- Changes in the margins of climatic zones and shifting of these zones.
- Changes occur in the bio system due to changes in climate
- Increase in wetlands
- Enlargement/ expansion of lagoons due to increase in sea level.
- Salinization of underground water
- Changes in fauna breeding zones
- Spread of diseases
- Changes in harvests

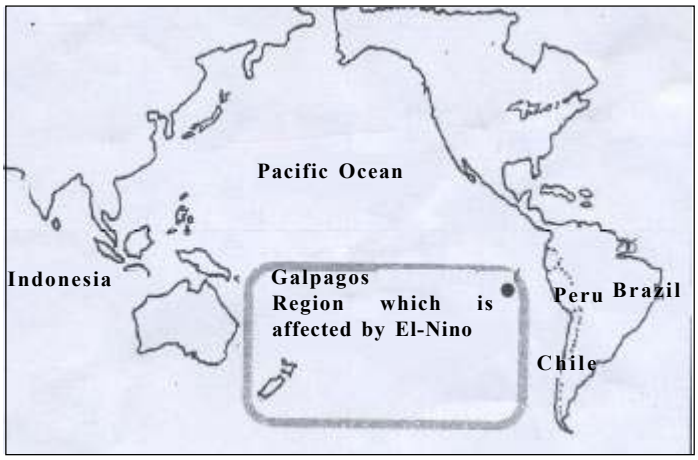
## Temperature changes on the ocean surface

- Oceans absorb the increased temperature in the atmosphere.
- When ocean water is heated its density is decreased and volume expands.
- Therefore sea level rises.
- Warming of the polar regions and the influence of heat circulation.
- Sea level rises by the thawing of glacial blocks and small ice stacks.
- Changes in the average temperature in the oceans horizontally also. As a result of the influences of warm and cold currents, the heat circulation in the atmosphere is changed and it affects the sea level in various regions.
- Changes in oceanic temperature influences the wind pattern over the surface of the oceans.
- The threat of formation of storms due to the increase in temperature over the oceans.
- Harm done to cultivated areas.
- Loss of settlements due to lowlands getting submerged.
- Destruction of natural vegetation like mangroves.
- Drinking water becomes impure when sea water inundates the land.

## El-Nino

- This happens when the temperature in the ocean surrounding the states Peru and Equator in the Pacific Ocean increases suddenly, resulting in a shifting movement which accompanies with the changes in pressure and wind pattern. This is called El-Nino.
- This is called "Chriss child" in Spanish term.

**Pacific Ocean**




## Effects of El-Nino

- A distortion in the wind pattern

  for eg instead of the upper air masses that moved from the western part of Indonesia in the Pacific Ocean to the eastern coast of Peru, there is an upper flow of air masses from the east towards the west

- Decrease in breeding of fish due to the flow of cold air containing nutrients to the surface of the oceans and the warming of the ocean surface making it unsuitable for fish to live.
- With the El-Nino condition, low pressure centres are formed and due to increased evaporation heavy rainfall occurs. For eg. Eastern Peru and Guatemala.
- The dry winds that blow from the east subside from the upper atmosphere obstructing the convectional process in countries like Sri Lanka. This results in drought conditions.
- Due to El-Nino one part of the world gets drought while another part gets heavy rainfall resulting in the threat of floods.
- Low harvests when cultivated areas are destroyed by the drought caused by El-Nino condition.
- Thawing of snow when the temperature is increased.
- There is a break in the intermonsoonal rain received in April in Sri Lanka due to El-Nino.

- The occurrence of bush fires due to El-Nino for eg. the bush fire that occurred in Indonesia during September to October in 1997.
- In 1997-1998, heavy rainfall was received in many parts of Sri Lanka due to the influence of El-Nino. In January 1998, heavy rainfall was received by a few regions in the wet zone which normally do not get rain from the North-east monsoon.

**La-Nina**

- With the ending of the El-Nino phenomena La-Nina occurred. In Spanish language La-Nina means "small girl".
- In the areas which showed a warm period by El-Nino, a cold condition was created by La-Nina.

  For example – In the month of June in 1998, the eastern surface of Pacific water had a sudden gust of coldness resulting in high pressure and a change in rotating velocity of ocean current.

**Sun Spot Cycles**

- Sun spots are caused by the convection taking place in the interior of the magnetic field lines which is found under the atmosphere of the sun. As a result of this, there is a bulge from it resulting in sunspots.
- At a time when maximum sun spot activities are taking place, about eight to nine eruptions occur on the surface of the sun.
- According to a study done by the German Astronomer S.M. Swabe, sun spots occur as a cycle once in 11 years continuously.
- There is an increase in temperature when the atmosphere absorbs the excess heat emitted by the action of sunspots.

  For eg: desertification in Sahel region of Africa
- There is a direct connection between sun spots and plant growth.

  For eg: the relationship between the sun spot cycle and the growth of vegetation cycle in Europe.

**Volcanoes**

- Global warming is increased due to expulsion of sulphurdioxide ($SO_2$) in volcanic eruptions.
- A major part of the sulphurdioxide accumulated in the atmosphere from volcanic eruptions is absorbed by the stratosphere.
- The aerosols released into the atmosphere remains there for a number of years and reflects solar radiation. As a result cold climatic conditions have accurred.
- As a result of volcanic activity, changes occur in the nature of prevailing winds blowing at that time and period. This results in changes in climate.
- It is clear to us that various human activities too have influenced inducing the climatic changes apart from the natural causes. In order to minimize such conditions it is important to identify clearly the human activities that affect such changes.

**The Human activities that contribute to climatic changes**

- Increased combustion of fossil fuels
- Clearing of forest
- Through the bacterial activity taking place in fields and marshes by the use of nitrogenic fertilizers, nitrous oxide is emitted to the atmosphere.
- In the production of plastics Chlorofluorocarbon (CFC) is accumulated in the atmosphere by the spraying plants.
- In air conditioning too, CFC is accumulated in the atmosphere by the use of refrigerators.
- CFC gases are emitted when computer circuits are cleaned.
- Greenhouse gases accumulate in the atmosphere due to the increase in the number of factories.

**Steps to be followed to minimize climatic changes caused by human activities**

- The contribution of Sri Lanka in increasing the composition of greenhouse gases emitted to the atmosphere by human activities is less than 1%. However, the global constitution of greenhouse gases in the South and Southeast Asian Regions is about 12%.
- Still there is a trend in the increase of greenhouse gases due to technological advancement related to industrial and agricultural development.
- It is important that Sri Lanka should draw her attention on the effects of warming on the earth and the atmosphere around it which is experienced in many regions as shown by modern research.
- Steps have been taken in this regard under various sectors to minimize the release of greenhouse gases to the atmosphere.

**Energy sector**

- Introducing energy sources which emit the least amount of greenhouse gases for industries, commerce, electricity production and domestic use.
- Encouraging reusable energy and technology.
- Encouraging the use of bio gas.

**Industrial sector**

- Concentrating the new industries inside Industrial Cities.
- Strictly implementing the standard limits related to emission of greenhouse gases.
- Carrying out efficient methods of utilizing energy in industrial enterprises
- Management of solid waste

**Transport sector**

- Prescribe the maximum level of emission of greenhouse gases for motor vehicles
- Encouraging train travel
- Increasing the contribution \by using common transport systems

**Agricultural and Forestry sector**

- Promoting forest plantations
- Developing multiple cropping in places where required
- Introducing agro-fertilizers which can minimize methane and nitrous oxide gases
- Introducing the importance of propagating crops which can absorb more carbondioxide
- Growing harmless trees which grow fast

# Teaching Learning Activities

## Activity

- Holding a discussion
- Presenting facts in a discussion with the information collected through group assignment
- Group the class into five and give the following topics to the groups

  Grop I – Green house effect

  Group II – Temperature changes on the surface of oceans

  Group III – El-Nino, La-Nina

  Group IV – Sun spot cycles

  Group V – Volcanoes
- Get students to collect facts under the given topic about the causes for climatic changes and their impact
- Give the chance to present information collected by each of the groups after finishing the assignment
- Direct students to present their ideas in the manner of a discussion about the natural causes and human activities which have influenced climatic changes
- Do the evaluation work based on learning outcomes.

# Competency - 7

## Contributes to Conservation of Water

**Competency Levels :**

7.1 Studies the global water balance in relation to data and maps.

(08 periods)

7.2 While studying the influences on the global water balance shows the importance of water conservation.

(04 periods)

**Learning Outcomes :**

- Identifies various modes in which water exists.
- Understands the inter-relationship between water and living beings.
- Explains the properties of water .
- Draws a diagram showing the water cycle.
- States how water is utilized in various ways for economic activities and continuation of life.
- Presents the factors that lead to water pollution.
- Explains the significance of water conservation.
- Collects information about sources of water in the area where one lives, how water is utilized and water conservation.

## Introduction

Water is essential for man's existence. Without water life will be limited only to a few days. since our earth is covered by 71% of water it is justifiable to describe earth we live in as a hydrosphere. The water on earth exists in various forms and they are distributed in various regions. Water exists in various forms as solid, liquid and gaseous.

Water is distributed as surface water , underground water and atmospheric water . Very often water is being polluted as a result of human activities that are expanding in the present day world. It has become such a serious problem. It is clear from this prediction "The Third World War will take place on finding a basis to share water". Hence in the present day world prevention of water pollution and conservation of water for the future world have become important tasks.

It is expected to study the distribution of water and conservation of water from this unit.

## A guideline to clarify subject content

### Global water balance

Hydrosphere

- As an eco-system
- Hydrosphere as a sub-system of the Geo-system

Water and various forms it exists

- The general nature of water
- Water is recognized as an inorganic substance essential for the continuation of life
- Chemical composition of water
  $H_2O$ - Water is formed by the combination of one atom of oxygen and 2 atoms of hydrogen
- Various sources of water (rain, snowfall, dew, mist)

### Various forms of water

Solid – Ice cover
Polar regions
High mountainous regions

Liquid – Water in oceans, lakes and tanks under ground water

Gaseous – As water vapour in the atmosphere

| Group | Volume | Precentage |
|---|---|---|
| Solid | $2.782 \times 10^7$ | 2.010 |
| Liquid | 1.356 x 10 | 97.989 |
| Gaseous | $1.3000 \times 10^4$ | 1.001 |

## Water and Living beings (inter-relationship)

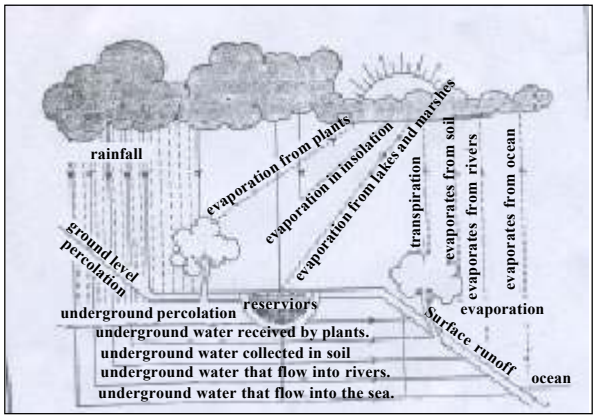
- The existence of man, animal and plants depend on water.
  Given below is the content of water in
  * Human body 60-80%
  * Terrestrial vertebrates 65%
  * Fish 80%
  * Aquatic plants 90-95%
  * Terrestrial plants 50-75%

## Properties of water

- Colour – There is no colour in pure water
  There are differences in colour due to the transparent nature or cloudy nature.
- Taste – There is no taste in pure water.
  Water in the earth has various tastes because of the various substances mixed with water (saline or bitter taste)
- Odour – There is no good or bad odour in pure water. There is the smell of sulphur in the water found in some areas.
- Salinity – There exist free radicals in any source of water. The amount of free radicals present in water determines the acidity or alkalinity. In some parts of the world the amount of fluoride radicals is very high. The composition of radicals in water is shown by pH value. If the pH value in water is over 8, it is alkaline and if it is below 8 it is acidic. If the acidic value is very high it is harmful for the body.

## Water Cycle

- Due to sun's heat water evaporates and mixes into the atmosphere
  - Evaporates from the ocean, expanses of water, rivers and lakes
  - Evaporates from plants
  - Transpiration
  - Evaporation from soil
- Condensation of evaporated water
- Rainfall




Source: Thambyahpillai George, Perera, M.P., Jayanthi Geography II

**Various forms in which water exists**

**Surface water**

- Oceans
- Seas
- Internal reservoirs
- Lakes
- Rivers
- Melted water (Ice cover)

**Underground water** (water deposited in the internal areas of the earth)

- Meteoric water (water that has penetrated into the water)
- Connate water (water deposited between sedimentary layers)
- Magmatic water (water present in hot water wells)

**Atmospheric water**

- Water vapour
- Water particles
- Ice particles, It is 0.001% of the total quantity of water.
  This is important in refilling the total store of water on the earth's surface.

**Water on the Earth**

| Group | Volume | Percentage |
|---|---|---|
| Solid | $2.782 \times 10^7$ | 2.010 |
| Liquid | $1.356 \times 10^4$ | 97.989 |
| Gas | $1.348 \times 10^9$ | 9.7390 |
| Interior of landmasses | $8.062 \times 10^6$ | 0.583 |
| Surface of land | $2.250 \times 10^5$ | 0.016 |
| Gaseous | $1.300 \times 10^4$ | 0.001 |
| Total (solid, liquid, gas) | | 100.000 |
| Saline water | $1.384 \times 10^9$ | 97.398 |
| Fresh water | $3.602 \times 10^7$ | 2.602 |

- Water exists mostly in liquid form (97.989%)

- As gases, it is 0.001%
- About 97.390% of water existing in liquid form is found in oceans
- Out of fresh water and saline water, about 97.398% is saline water.

**Surface Water**

- Very often, the earth is known as the Blue Planet. It is because about 71% of the earth is covered by water.
- A greater quantity of surface water is found in oceans. It is 97.2%.
- Another 2.15% is in the form of melted snow as continental and vallecy glaciers.
- The fresh water in rivers, channels and streams is very little (0.03%) However its influence on life activities is great.
- The earth gets its surface water from rainfall. A part of it penetrates into the interior and forms under ground water. The remaining flows on the surface and it is called the run off. Since ocean basins are at a lower level a large quantity of water flows into the ocean as surface run-off.
- The annual runoff quantity differs according to the distribution of continents, their magnitude and climatic type.

**Water - Balance of Continents per year (cm)**

| Continent | Rainfall | Evaporation | Run off |
|---|---|---|---|
| Africa | 67 | 51 | 16 |
| Asia | 61 | 39 | 22 |
| Australia | 47 | 41 | 06 |
| Europe | 60 | 36 | 24 |
| North America | 67 | 40 | 27 |
| South America | 135 | 86 | 49 |

Source: Weerakkody Upali, Environmental Geography.

**Surface Utilization of Water**

- Surface water is used for existence of life and human economic activities
- Ocean water and sea water
  - Obtaining fish
  - Other sea food
  - Salt production
  - Transport activities
  - Naval activities
  - Industrial work
  - Drinking water supplies

- Internal Natural reservoirs
  - Drinking water
  - Domestic uses
  - Transport activities
  - Industries
  - Food production
  - Tourist activities
  - Leisure activities

- Internal artificial reservoirs
  - Drinking water
  - Domestic needs
  - Agricultural irrigation work
  - Generation of hydro power
  - Fishing activities

- Rivers and streams
  - Drinking water
  - Domestic work
  - Transport
  - Agricultural activities
  - Generation of power
  - Fishing activities

**Surface Water in Sri Lanka**

- There are 108 rivers flowing from the Central Hill Country
- About 64% of the water received from rainfall are carried by these rivers
- The quantity of flowing water differs according to rivers
- The quantity of flowing water differs according to factors such as amount of rain received, nature of land, magnitude and nature of soil
- The rivers in the wet zone carry surplus water. Most of the rivers in the dry zone are periodical rivers.
- It is clear from the old tanks and modern reservoirs constructed in connection with rivers in Sri Lanka how far surface water could be utilized for human needs.

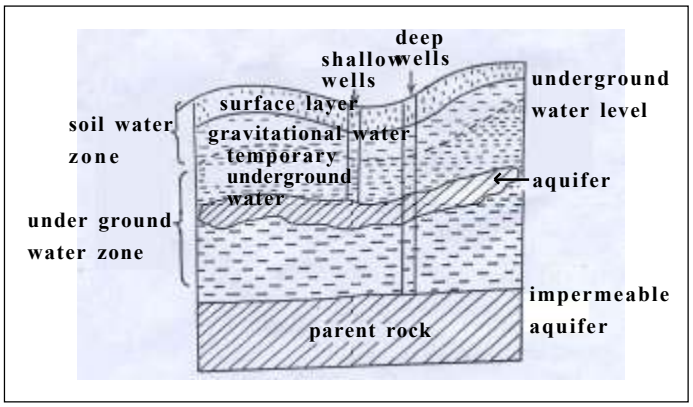
## Saline water and Fresh water

- Saline water is largely distributed in oceans
- Saline water is found in internal seas such as the Caspian Sea, Dead Sea.
- The average salinity in ocean water is 35 (35 gm of salt for 1000 gm water)
- The main mineral found in ocean water is sodium chloride. Apart from this, it constitutes magnesium chloride, magnesium sulphate, and chlorine.
- Fresh water exists in melted form in the polar and high mountainous regions and are distributed in liquid form in streams, channels and springs.

## Underground water

- The water found in the lower region of the earth's surface is called underground water.
- The quantity of underground water that will be deposited is determined by factors as the porosity and the slope of the land.
- Underground water flow through rocks very often.
- Underground water is collected from rain and rivers.

**Location of underground water**




Source: Environmental Geography, Educational Publications Department.

- In many parts of the world, underground water is used for human activities. It is used mostly for drinking water and it is used in some regions for agricultural activities too.
- Temporary underground water is obtained from shallow wells while water is taken from the permanent underground aquifer through Artesian wells.
- The main problem that arises in areas which obtain water from shallow wells is the drying of wells during the dry season when the underground water level goes down. In drawing water from deep wells the expenses are very high.
- In some areas, the quality of water is poor due to high salinity in underground water, and the presence of various chemical substances.

### Atmospheric water

- The water in the atmosphere exist in various forms such as water vapour , water particles, ice particles.
- Atmospheric water is 0.001% of global water .
- The water in the atmosphere is an important factor that determines the amount of rainfall in a certain region.
- In hot regions rainfall is high because the amount of water vapour that the atmosphere can hold is very high.
- Atmospheric water is very useful in renewing the water content on the earth though it is very little in quantity .

## Water conservation

### Water needs and water pollution

- The main problem concerning water is that the supply does not meet the demand for it and the existing water is being polluted.
- In about the year 2025, it is expected that about 2/3 of the world population will suffer through scarcity of water . The United Nations Organization says that in the 21st century, there is the fear that there will be wars and clashes inside the states and between states about sharing water resources.

### There are many factors that lead to water pollution

- Water needs become higher due to the population distribution and urbanization while water is polluted through activities related to refuse, waste, and disposal of sewage.
- Water is polluted by the use of fertilizers for agricultural work, use of agro chemicals and the accumulation of waste given out by animals.
- Chemicals and waste matter are released into water through industrial activities.
- Through the production and transport of petroleum waste matter is released into water .

### Conservation of Water Resources

- In any project about conservation of water there should be two basic objectives
  - Supplying the quantity of water required for various tasks
  - Improving the qualitative value of the water supplied.

- There are a few courses of action that could be taken in conservation of water resources
  - Taking action to prevent large scale wasting of water that is supplied for agricultural, industrial and domestic needs. In this task, attention should be given to the harmful chemical substances included in underground water.
  - Increased use of consumption of underground water
  - Taking action to prevent floods
  - Construction of tanks and large reservoirs
  - Protection of catchment areas in rivers
  - Conserving the quality of water (removing impurities, purifying water, preventing the mixing of chemical substances)
  - Recycling and purifying water for reuse (such water is used for agriculture and industrial purposes)
  - Making use of sea water that is desalinized

# Teaching-Learning Activities

## Activity 1

- Creation of a poster showing the importance of water resources. This could be a single or group activity.

## Activity 2

- Study the water balance in the area where one lives and prepare a detailed report on the factors that affect it.
- There is a strong relationship between water and living beings. Hence the dwellings of people are connected to water always. In areas where human settlements are being built up, various steps are taken regarding supply of water resources and utilization. These actions are natural as well as those improved by man. When water is being utilized, it becomes impure. Hence various steps have to be followed in preventing it.
- Through this Activity the students will get the opportunity of identifying the water balance in one's region and the influences directed against it.
- This could be organized as a single/group activity.
- Instruct students to collect information relevant to the topics given below regarding water in the region where they live. Start collecting facts 2 weeks before preparing Information sheets.
  1. Various methods of obtaining water
  2. How water is utilized
  3. Various ways by which water is made impure
  4. Steps to be take in preventing pollution
- Give instructions about writing the report.
- Evaluate it according to criteria given.

# Geography II
# Human Geography

## Competency - 1

## Examines the foundations of Human Geography and makes use of those concepts for meaningful human activities.

**Competency Levels :**

1.1 Enquires into the spatial patterns and processes in the phenomena that come under Human Geography.
(05 periods)

1.2 Shows comparatively the interaction and inter relationship between human and physical phenomena
(05 periods)

**Learning Outcomes :**

- Describes the foundations of Human Geography
- Analyses the interaction and interrelationship between human and physical phenomena.

### Introduction

The foundations of Human Geography is the study of the spatial diversity in human activities created by the relationship between man and environment. This human landscape includes population and all activities of man such as economic, social, cultural and political. The foundations of Human Geography the study of the human landscape that is created and is still being both as a result of the influence of the physical environment and also the decisions taken on the basis of human needs and the activities carried out.

The objective of learning this unit is the study of the patterns and processes of human activities on a local, regional and global scale from a spatial and temporal perspective and also the study of interaction and inter-relationship of the human and physical phenomena.

### A Guideline to clarify subject content

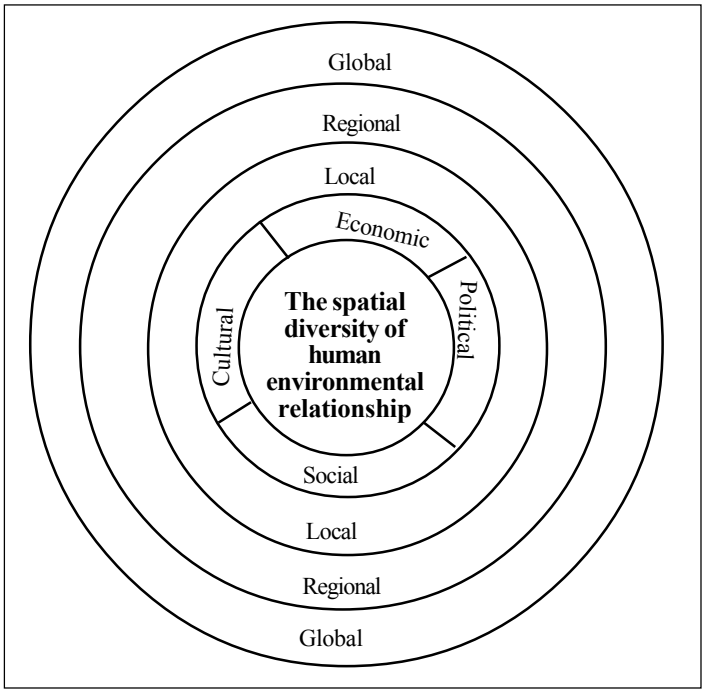
- Human geography is called the geographical study of human activities.
- As described by the Geographers Karl Richter and Alexander Von Humboldt, in order to study the nature of Geography, "Study of the inter-relationship between man and environment" is basically important.
- In the above definition are included – how does the environment influence man? how does man change the environment" what are the results of inter-action of man and environment.
- According to the definition presented by the Geographer Richard Hartshorne, the nature of Geography is "the study of the spatial diversity of the earth".

- Within this definition, are included – what are the geographical patterns that come out through this spatial diversity? What are the causes that have influenced the formation of these patterns, how are these patterns distributed on the earth's surface and what are the impacts of these patterns?
- When the above two definitions are integrated, Human Geography is "the study of spatial diversity of human activities created by the human – environment relationship"
- The human landscape can be called the sum total of the changes made on the earth's surface through diverse human activities.
- Human landscape includes man's economics, social, cultural and political activities including population. For example construction of houses, roads and reservoirs.
- It is seen how the human landscape differs spatially that is from place to place.
- The spatial diversity of human activities depends not only on the decisions of man and the results of his activities but also on the physical environment and the diversity in the physical environment.
- Accordingly the core of Human Geography is the study of the human landscape created and is being created as a result of both the influence of the physical environment, the decisions taken on the basis of human needs and also the activities that are being carried out.

## Spatial Patterns and Processes of Human Phenomena

- Human landscape is the result of the relationship between man and environment. Since the nature of that relationship differs from place to place and from region to region a spatial diversity is seen.
- The subject limit of Human Geography is determined according to the spatial distribution of human activities created by the relationship between man and environment.
- When we compare the other disciplines as Sociology and Anthropology, Human Geography has a different and special subject content. Its subject limit is open. Hence it is a subject fed by the above subject fields as well as other disciplines (branches) of Geography in studying wide and complex spatial relationships.

## The spatial nature of Human Geography




- Thus the subject area of Human Geography is an integrated subject content with an inter-disciplinary subject constitution.

- When studying the human landscape in Human Geography special attention is drawn on the distribution of human activities and their processes including man.

- **The distributions identified in Human Geography can be shown as follows.**

| | | |
|---|---|---|
| Points | – | for eg. urban centres |
| Flows | – | for eg. migrations |
| Focus | – | for eg. industrial zones |
| Linear | – | for eg. linear settlements |
| Clusters | – | for eg. cluster settlements |
| Zones | – | for eg. urban zones |
| Inter-zones | – | for eg. rurban settlements |

Examples

Organization of settlements

- Dispersed
- Linear
- Clusters
- Metropolis (urban)

- In Human Geography, identifying the diverse human activities, studies the processes that affect them. Two main processes which influence human activities are given below
  - Physical processes
  - Social processes

These processes could be studied under the fields given below

- mobility
- cycle processes
- system processes
- Interprocesses
- Processes different from each other
- Processes that prevail periodically
- Random processes

- In the organization of human activities have to face **physical processes** directly or indirectly.

For eg. Mobility – Entering a certain area, the time taken/ to travel the distance between two places and the distance

Cyclical processes – Water cycle

Systems processes – Biosphere

Interactions – Distribution of rainfall

Inter-relationship – Temperature and rainfall

Processes different from each other – Drought and floods

Processes prevailing periodically – Large floods, cyclones

- In organizing human activities have to face the influence of **social processes** either directly or indirectly.

| | | |
|---|---|---|
| Cyclical processes | – | Facing the vicious circle of poverty |
| Systems processes | – | Transport network and distribution of settlements |
| Inter processes | – | Determining and utilization according to time and distance |
| Inter-relationship | – | Water, distance, agricultural harvests |
| Processes different from one another | – | Urbanization and growth of shanties |
| Periodical processes | – | Natural hazards (epidemics) |

- The major sector studied under Human Geography is the economic activities of man. Agricultural, industrial and service activities are foremost here.

- Apart from these, political, social and cultural activities and the patterns associated with them are also studied.

- At present, attention is drawn on environmental management and sustainable development too because emphasiz is laid on influences directed to the environment from human activities.

## Interaction and interrelationship of human and physical phenomena

It is important to look at the nature and action of the physical and human environment from a holistic approach

- Through the study of the spatial diversity of the human activities on the earth from a geographical vision, the interaction and inter-relationship between physical and human phenomena can be considered.

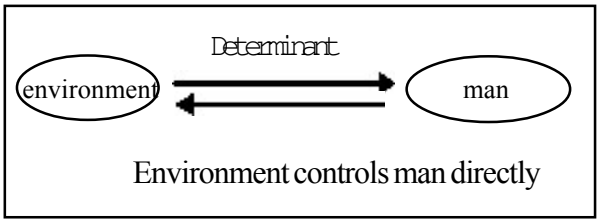
- Inter-action means the relationship between man and environmental activities.

**The period when man was submissive to the environment**

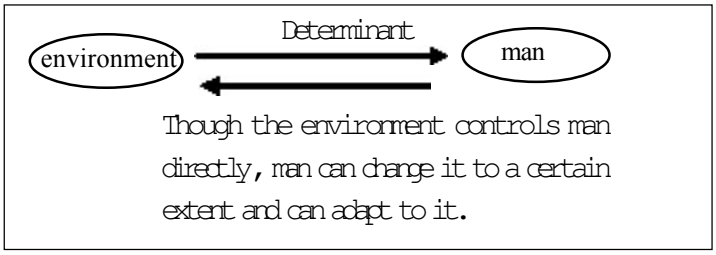
- At the end of the 19th century the idea of Geographers was that human activities were directly controlled by the environment. It was called Environmental Determinism.

- Yet some scholars state that though the environment can influence human activities man is not totally controlled by the environment.

**Determinism**




**Possibilism**



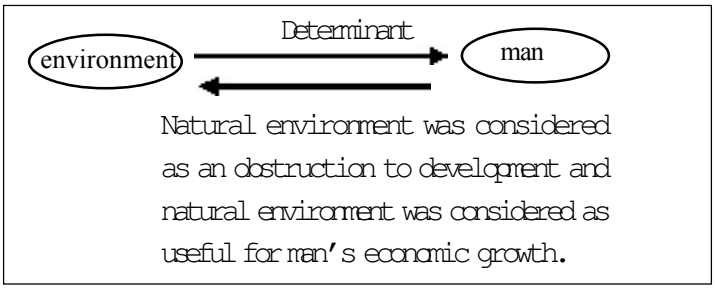

**Living in harmony with the environment**

- What is meant by living in harmony with the environment is not living with submission to the environment but the understanding of the processes in the environment and raising the standard of living while minimizing the harm done to the environment.

## Controlling the environment

- Man conquering the environment can be shown through two periods
  - The period when man's main economic activity was traditional agriculture
  - The period after the Industrial Revolution when industrialization was given priority among man's economic activities.
- During the primary agricultural period, the influence of agricultural activities on the environment was restricted regionally while the influence directed at the environment from agricultural activities with the growth of population, began to increase gradually.
- With the growth of population, they were motivated to change the earth environment to fulfill man's increasing needs. Then an agricultural landscape was distributed on the earth.
- Accordingly the origin of economic, political and social patterns came into being.
- With the beginning of a new civilization natural environment was changed on a large scale by the human landscape.
- During the period when industrialization was given the foremost place among man's economic activities there was a revolution in transport as a result which enabled the inter connection of human relationships which were in isolation so far new economic patters came about as result of this revolution.
- This gave birth to a new consumer society based on the expansion and complexity of demand for resources which were not utilized by that time. Hence environmental resources had to be utilized on a large scale to maintain such a complex society.
- In meeting the needs of the industrial society it was not possible to be submissive to the environment or to maintain a harmonious relationship with the environment.
- A prominent feature was the arising of a series of environmental problems as a result of making the earth environment to undergo very complex changes.

## Conquering the Environment

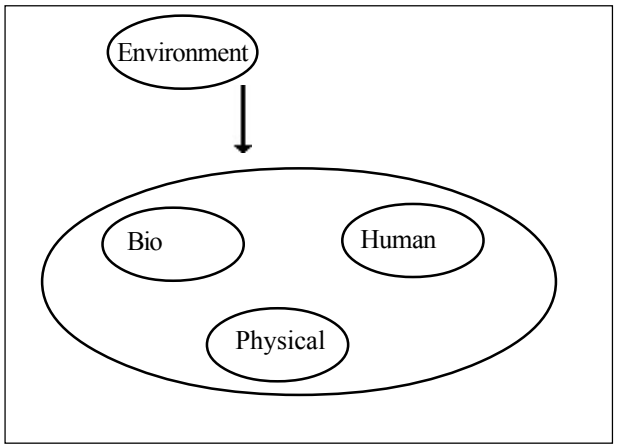



## Man considered as an internal element of the environment

- As a result of the changes made on the environment by man, the environment that was friendly became harmful due to utilizing it improperly.
- Creation of unsound environmental conditions as accumulation of poisonous gases, impure water, industrial and urban waste, soil erosion, destruction of forests etc.

  for eg. warming of the atmosphere, increase in carbondioxide in the atmosphere, depletion of the ozone layer, rising of the sea level, and climatic changes.
- Confronted by such problems, the Environmental Scientists were motivated to think back about the man – environment relationship.
- They emphasized that man is included in the environmental system as an internal element. Hence man was considered as one element in the total environmental system.
- One of the basic principles of an eco system is that any impact on any part of the system will have its effect on every other part of the system.
- Hence it is not possible to prevent any environmental reactions to man as influences from the environment in return for his impacts on the environment.
- It has the ability to minimize to a certain extent the influences directed at the environment.
- However when the intensity of man's influence is increased, the environment changes unprecedentally and transforms itself into a harmful environment.
- Due to this, in the present day there is the opinion that man's development activities should be carried out in accordance with the environment and it should be done harmoniously and not against the environment.

**Consider man as an internal element in the environment**




- In this manner, according to the way that man maintains the inter-action and interrelationship between the physical and human environments, it is possible to identify positive and negative features in the nature of those relationships.

- The above mentioned approaches give an understanding about the manner how man acted during these interactions.

- It is possible to study through the inter-relationship the action of man in relation to the phenomena in the environment.

- Thus human activities are determined by the physical environment.
- In the same way, in geography, examining places and relative places, and building up inter-connections based on the factor of distance is seen.

- As shown by Peter Haggot (1977) any system operates or exists due to energy. Energy does not exist in one place. It is always flowing. Within these systems due to movements, 'channels' are created. When these channels are interconnected "junctions" are formed.

- In the junctions thus born, some are more powerful and in some others force is less relatively. Accordingly hierarchies are formed from more powerful junctions to junctions with less power.

- Thus within systems spatial differences exist which enable inter-relationships to grow within them.

- When people settle on the earth, it happens according to some patterns and these patterns do not show any similarity. Though similar features are built up artificially it differs with time.

- Hence action depends on the inter-relationship of any phenomena.

- Likewise, the inter-relationship of physical and human phenomena could be identified locally, regionally, zonally and globally.

- When studying the interaction and inter-relationship of physical and human phenomena from a holistic approach, the geographer is motivated to find answers to questions as What? Where? Why?

- In Human Geography, in finding the answer to the question 'Where', the map gives the relevant answer to it.

- Through the map, analytical facts can be presented. How to solve the origin and nature, causative factors, and results of human activities etc. comparative information can be presented.

# Teaching-Learning Activities

## Activity 1

Select an example from your region about (origin of settlements, birth of towns transport network, market, infrastructure facilities) any one of these areas to study the spatial patterns and processes of human phenomena and do an assignment.

## Activity 2

Prepare an article to a wall newspaper on the Nature and evolution of Human Geography.
* Give marks to these for activities based on criteria.

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## Competency - 2

## While enquiring into the main characteristics of population works to minimize the problems that arise in population.

**Competency Levels :**

2.1 Shows the main characteristics of world population in association with a few areas
(08 periods)

2.2 Emphasizes the importance of population as a resource
(02 periods)

**Learning Outcomes :**

- Describes the main characteristics of the world population
- States the importance of human resources

### Introduction

The total number of people who live in every country in the world is called world population. The world population is growing day by day. About 71% of the surface of the earth is covered by water and only 29% of the land remains for human habitation. Even out of this percentage only a small amount of land is suitable for human habitation. 80% of the world population are distributed in a land area of less than 20% of land.

When studying about the world population it can be considered under various fields. Among them, the size, growth, distribution, density and composition are important.

When we consider the population with the present development process, the relationship between population and development has become an important topic.

Population is a human resource. If the population grows rapidly or decreases rapidly problem situations will be created. Hence various countries in the world follow diverse policies and strategies to make population a resource. If the human resource in any country becomes a problem, the people living in those countries will have to face the consequences which are harmful.

By studying this unit it is expected to identify the main characteristics of population, analyse them and recognize population as a resource.

# A guideline to clarify subject content

## 2.1 World Population

Introduce the characteristics of population

- size, growth, distribution, density and composition

### Size

- 6555 million (data in 2006 www.whdesomewords.org)
- 6783.03 million in 2009 (www.wikipedia.org)

### Growth of population

- Annual growth of population means the growth of population within one year.
- In the growth of population periods are prominent
- Historical period (the period when population growth was slow)
- The period from the beginning of life to1650 A.C. can be shown as the period of slow growth

| Time | Population |
|---|---|
| Earliest period | Less than a million |
| 8000 B.C. | Between 5-10 million |
| 1 A.C. | 300 million |
| 1650 A.C. | 500 million |

Source: Advanced level Human Geography - Part I

### Recent Period

- After 1650 A.C. the population increase in the world was rapid. Within a period of 200 years population was increased to 1000 million. The time taken for population to double gradually decreased.

| Year | Population in million | Time taken to double (years) |
|---|---|---|
| 1650 | 500 | 1650 |
| 1850 | 100 | 200 |
| 1930 | 2000 | 80 |
| 1975 | 4000 | 45 |

- According to the growth rate of population in a country, the time taken for it to double can be calculated.

$$\text{Time taken for the population to double} = \frac{70}{\text{percentage of rate of growth}}$$

- According to the United Nations Population Enquiries, the growth rate will reach a stable state by 2025-2030 A.C.
- From the point of view of population growth it will be the developing countries zone that will make a great impact by the year 2020 A.C.

**Population Distribution and Density**

- Population distribution of a country means how the people in that country are distributed.
- Population density means the number of people in a country who live within a square kilometre.
- On the earth's surface there is only a small quantity of lands suitable for people to live. Hence a large number of people are distributed in a small area of land. In the same way, in some other areas only a few people live and these are areas of sparse population.

**The most densely populated 15 countries in 2009 (estimated)**

| Country | Population | Percentage |
|---|---|---|
| China | 1338,156,900 | 19.87 |
| India | 1163,900,000 | 17.16 |
| United states of America | 306,527,000 | 4.52 |
| Indonesia | 230,330,000 | 3.42 |
| Brazil | 191,353,288 | 2.81 |
| Pakistan | 166,460,500 | 2.47 |
| Bangladesh | 166,221,000 | 2.41 |
| Nigeria | 154,729,000 | 2.73 |
| Russia | 141,825,000 | 2.7 |
| Japan | 127,630,000 | 1.9 |
| Mexico | 109,610,000 | 1.13 |
| Philippines | 92,226,000 | 1.37 |
| Vietnam | 88,033,000 | 1.31 |
| Germany | 82,032,200 | 1.22 |
| Ethiopia | 79,221,000 | 1.18 |

Source: Population Reference Bureau, World Population Data Sheet 2008.

- There are four main areas of the world which are densely populated
  - South and South East Asia
  - Eastern Asia
  - North east United States of America
  - North western Europe
- Only 10% of the land area of the earth is occupied by dense population.
- Densely populated areas are distributed in every continent in the world.
- Sparsely populated regions
  - The northern parts of North America, Europe and Asia
  - High mountains and high plateaus of the world
  - Desert areas
  - Tropical Rain forests
- 64% of the total land area of the earth corre under sparsely populated areas.

**Moderate population**

- The regions in between densely populated areas and sparsely populated areas belong to this. This occupies 26% of the total land area.

**The Uneven distribution of Population**

- Various factors have caused the uneven distribution of population
- Since a number of factors influence together in determining population distribution it is difficult to identify the influence of each of the factors separately.
- The influence of these factors differs according to time and space.
  for eg. though the Prairies Grassland region was a sparsely populated area in the past, at present it has become an area with a moderate population.
- At present it is seen that in determining population distribution, technological advance surpasses all other factors.

The factors that influence the uneven distribution of population

- Physical factors
- Human factors
- Demographic factors

## Physical factors

- **Climate**

  Tunder regions, arid regions and areas which receive heaviest rainfall are sparsely populated areas.

- **Relief**

  In high mountainous and steep slopes population is sparse.

- **Water facilities**
  Most of the densely populated areas are seen associated with rivers

- **Soil**
  Soil and water have been strong factors in originating the earliest settlements. In areas of fertile soil a dense population has been living for centuries.

- **Natural resources**
  The uneven distribution of natural resources too has influenced population distribution. In areas where natural resources are found in abundance a dense distribution and a minimum distribution of population in areas where natural resources are scanty is seen. However at present with the application of technology the influence of this factor has been minimized relative to the past. For eg. Japan
- In areas of dense forests population is sparse.
  For eg. Amazon Congo river basins, Sinharaja forest

## Human factors

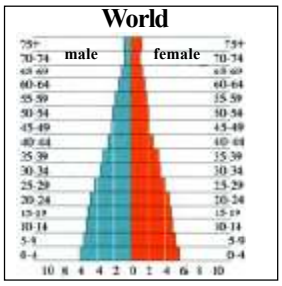
- With the improvement of transport systems, population distribution is taking place in sparsely populated areas.
  Eg. Middle east and countries near the poles.
- Trade and urbanization, new trade centres and birth of new towns has caused a change in population distribution for example Kobe in Japan, New Delhi in India.
- Mobility of labour
  Daily movements or short term movements for daily needs.
- Development in communication media
  The development in modern communication media has influenced population distribution.
- Political reasons
  There are occasions when changes occur in population distribution due to political reasons and various conflicts for instance Afghanistan, Iraq,
- Development schemes.
- Demographic factors
  - Births
  - Deaths
  - Migrations

## Composition of Population

- Population composition means the sum total of factors obtained at birth such as age, sex, religion and nationality and those derived from the environment such as education, economy and culture.

## Population Pyramid

– The age groups and male female composition of the population in any country can be shown through a population pyramid. The nature of the age groups and growth of population can be shown by a population pyramid. The population pyramid of the countries of the world shows various shapes.

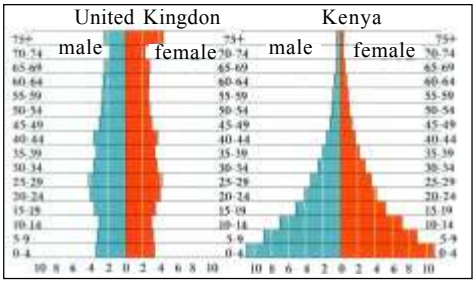


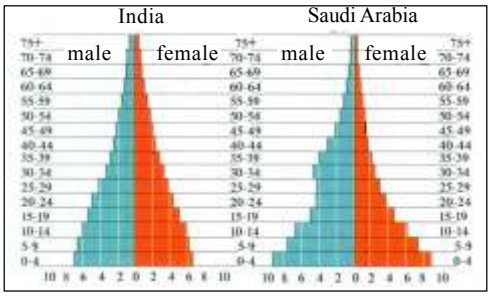

Source: Gunasena New Philip world Atlas (2003)

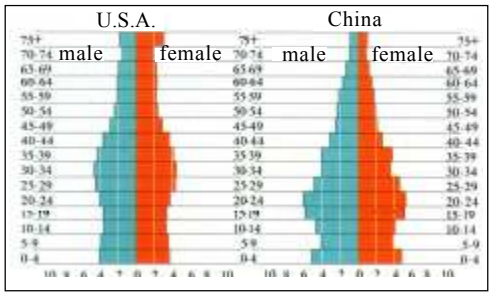
- According to the above pyramid population of younger age groups is high and that of old age groups is low.
- In developed countries the age structure and male female ratio show a balanced nature.

  Eg. United Kingdom and United States of America
- In Developing Countries, a bottom-heavy pyramid is seen.

  for instance Kenya, Saudi Arabia, India
- However, the increase in aged-population relative to the younger population is a global trend that is seen now. Hence in future, narrow-bottomed and top-broad population pyramids could be seen in future.
- The age structure and the sex ratio of any country directly affects the development process in that country. This is because the age structure determines the number in the labour force.
- The increase in younger generation and old age people in the population of a country affects unfavourably in the development of that country.




## Population as a Resource

- Physical resources are transformed into economic resources by the mediation of man.
- Man becomes a resource since he discovers resources making use of his technological knowledge and also because he is motivated to make use of them as needed.
- The present human resources is important for the continuation of the future world.
- The young age group dependents can be considered as a potential resource.
- The population of any country can be decided as a resource by proper manipulation only.
- Various countries in the world follow various course of action to transform their population as resources.
- There are situations when the action of the present day man has become a threat to future human resources.

# Teaching Learning Activities

## Activity

From the distant past up to the present day world population has been growing regularly. This could be divided into a few historical periods. Hence according to the nature of growth it is divided into a few periods. Even at present there are inequalities in the distribution of population.

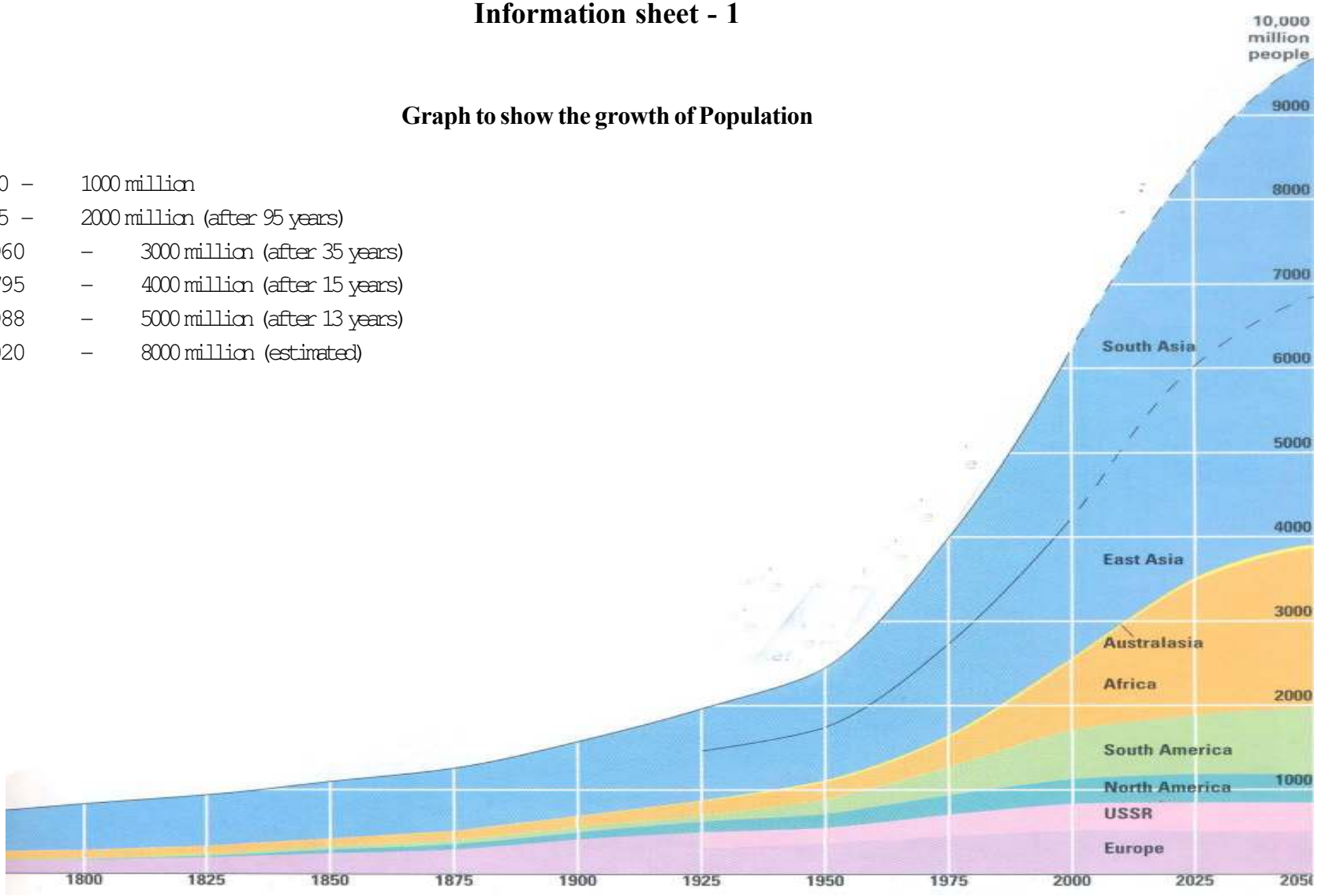
By doing this activity preparation of a short fact file including the historical growth of world population and the historical growth of world population and the distribution of world population is expected from this activity.

- Organize this as a single activity.
- Study the graph showing the growth of world population mentioned in Information Sheet –I.
- Draw your attention on the following
  - The growth from early period up to the year 1650.
  - Growth from 1650–1950.
  - The nature of growth after 1950.
  - The effect of growth regionally.
  - The time taken for the world population to reach 8000 million by 2020 which was 1000 million in year 1830 (estimated)
  - Study Information Sheet – 2
  - Mark and name on a map of the world the 18 countries where 75% of the world population live.
  - According to the Information sheet above, prepare a short fact file including your conclusions about the growth of world population and distribution.
  - Give statistical data and examples where needed.
  - Pay attention to the finish or the final product of the fact file.

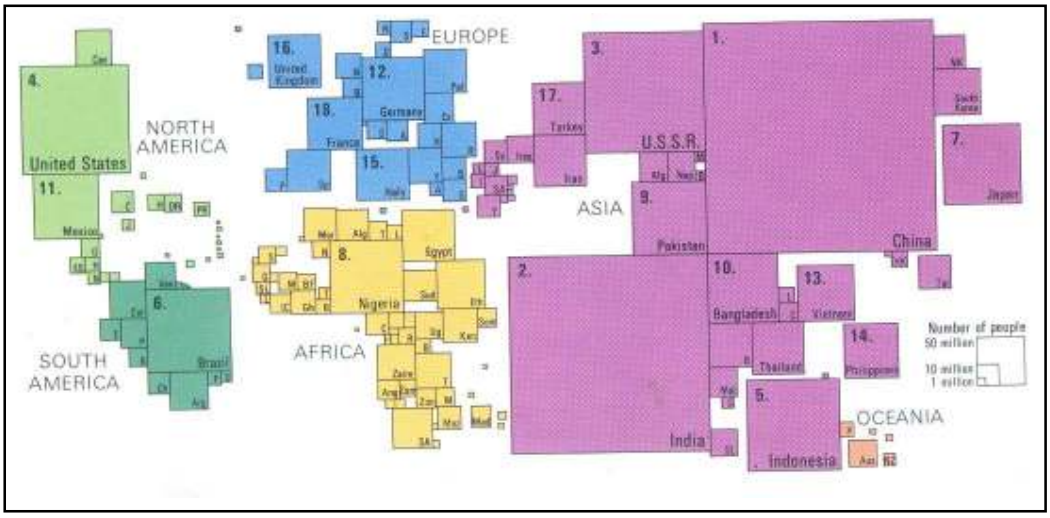
# Information sheet - 1

## Graph to show the growth of Population

In 1830 – 1000 million
1925 – 2000 million (after 95 years)
1960 – 3000 million (after 35 years)
1795 – 4000 million (after 15 years)
1988 – 5000 million (after 13 years)
2020 – 8000 million (estimated)



# Information sheet - 2




The above figure shows a special diagram about the size of population according to countries. Here large squares show the most densely populated countries while the smaller squares show moderate to lower population in countries.

**Competency Levels :** **2** 3 Explains the main characteristics of the population of Sri Lanka (08 periods)

2.4 Explains the modern trends of the population of Sri Lanka. (02 periods)

**Learning Outcomes :**

- Shows the main characteristics of the population of Sri Lanka.
- Explains the reasons for the uneven distribution of population
- Presents the differences in the composition of population through various criteria.
- Explains the special features of the population pyramid of Sri Lanka.
- Presents the composition of population according to ethnicity and religion by graphs
- Explains the recent trends in the population of Sri Lanka.

## Introduction

The existence of any country depends on the economy of that country. A country needs a population to develop its economy. The population of any country is a resource. In order to understand correctly the real nature of such a resource it is very essential to find out about the population of that country. By teaching this unit it is expected to give a correct understanding about the size, growth, distribution, composition and new trends of the population of Sri Lanka.

# A guideline to clarify the subject content

### The size of the population

20,010 million (2007& mid year estimation – 2001)

Source: Department of Population and statistics

### Population growth

- From 1871–2007 the population of Sri Lanka has increased from 2.5 million to 20 million.
- A few stages in the rate of population growth during that period can be seen.
  - The period of slow growth of population from 1871–1946
  - The period of rapid growth of population from 1946–2000.
  - By 2001, the average rate of population increase in Sri Lanka was 1:1%. By 2007, the estimated rate of growth was 0.6%.
  - The highest rate of population growth was recorded in Ampara, Mulative and Vavuniya Districts.

- The lowest rate of growth is seen in the Districts of Jaffna, Nuwara Eliya, Kegalle, Galle, Kandy, Matara and Badulla.
- The growth of population is determined by the number of births, deaths and migrations.

**Distribution and Density**

- Uneven distribution
- In Sri Lanka 65% of the land belongs to the Dry Zone and 35% of the land belongs to the Wet Zone. it is proved by the statistical figures.
- There are inequalities is distribution of population according to Districts.
- Colombo is the District which has the highest density of population. It is 3305 to a square km. The lowest density is Mulativu which is 50 to 159 per km.
- The average population density of Sri Lanka is 299 for 1 sq km.

**The reasons for the uneven distribution**

- Relief
- Climate
- Facilities of water
- Soil
- Forests
- Natural resources
- Infrastructure facilities
- Urbanization
- Conflicts

**Composition of Population**

**Composition**

- Sex/gender
- Age structure
- According to religion
- Ethnicity
- Economic structure (employment)

**Sex ratio**

- The number of females has increased. In 2006 it was 98.4%.
- In any country the male-female structure reflects the social status.
- The great difference in the sex ratio leads to social problems.

## Age Structure

- The nature of the age structure in a country directly affects the development in that country.
  The population of Sri Lanka can be grouped as follows according to age
  0-14 children
  15-65 work force
  over 65 elderly population

- According to population statistics in 2007 the work force was 69.1%.
  Children 23.3%
  Elderly 7.6%

- Annually the age group of 0-14 has gradually decreased while the group over 64 has increased.

The population of Sri Lanka on sex ratio (1992-2006) (in thousands)

| Year | Female | Male | Total | % difference |
|---|---|---|---|---|
| 1992 | 8340 | 8291 | 16631 | 1.1 |
| 1993 | 8438 | 8412 | 16850 | 1.3 |
| 1994 | 8544 | 8545 | 17089 | 1.4 |
| 1995 | 8627 | 8653 | 17280 | 1.1 |
| 1996 | 8719 | 8771 | 17490 | 1.2 |
| 1997 | 8811 | 8891 | 17702 | 1.2 |
| 1998 | 8913 | 9022 | 17935 | 1.3 |
| 1999 | 9035 | 9173 | 18208 | 1.5 |
| 2000 | 9150 | 9317 | 18467 | 1.4 |
| 2001 | 9267 | 9465 | 18732 | 1.2 |
| 2002 | 9392 | 9615 | 19007 | 1.3 |
| 2003 | 9510 | 9742 | 19252 | 1.2 |
| 2004 | 9615 | 9847 | 19462 | 1.2 |
| 2005 | 9718 | 9950 | 19668 | 1.1 |
| 2006 | 9718 | 10060 | 19886 | 1.1 |
| 2007 | 9888 | 10122 | 20010 | 0.6 |

Source: Department of Population and Statistics

**Sex Ratio according to Districts**

| District | Total | Male | Female |
|---|---|---|---|
| Sri Lanka | 19886 | 9826 | 10060 |
| Colombo | 2421 | 1229 | 1192 |
| Gampaha | 2125 | 1033 | 1092 |
| Kalutara | 1120 | 541 | 561 |
| Kandy | 1361 | 660 | 701 |
| Matale | 471 | 234 | 237 |
| Nuwara Eliya | 735 | 362 | 373 |
| Galle | 1040 | 503 | 537 |
| Matara | 804 | 888 | 416 |
| Hambantota | 547 | 272 | 275 |
| Jaffna | 595 | 283 | 312 |
| Mannar | 142 | 72 | 70 |
| Vavuniya | 100 | 52 | 48 |
| Mulativu | 164 | 80 | 84 |
| Kilinochchi | 145 | 70 | 75 |
| Batticaloa | 556 | 271 | 285 |
| Ampara | 627 | 314 | 313 |
| Trincomalee | 395 | 197 | 198 |
| Kurunegala | 1511 | 742 | 469 |
| Puttalam | 745 | 168 | 377 |
| Anuradhapura | 791 | 401 | 390 |
| Badulla | 382 | 199 | 180 |
| Ratnapura | 837 | 414 | 423 |
| Moneragala | 420 | 212 | 208 |
| Ratnapura | 1073 | 541 | 532 |
| Kegalle | 797 | 388 | 409 |

Source: Department of Registration of Persons

*** Ethnic groups**

- There are 4 ethnic groups
  - Sinhala
  - Sri Lankan Tamils
  - Indian Tamils
  - Moors

- Apart from the main ethnic groups there are a few other groups.
  Burghers, Malays, Chinese and Europeans
- All the ethnic groups live in every part of the country.

**According to ethnicity, composition of population of Sri Lanka as a percentage**

| Ethnic groups | 1981 | 1994 | 2001 |
|---|---|---|---|
| Sinhalese | 73.95 | 83.86 | 81.9 |
| Sri Lankan Tamil | 12.70 | 5.39 | 4.3 |
| Indian Tamil | 5.52 | 3.62 | 5.1 |
| Moors | 7.05 | 6.35 | 8.0 |

* The Census was held only in 18 districts

Source: Department of Population and Statistics (1998-2001)

## Religions

- The people follow a few religions
  - Buddhism
  - Hinduism
  - Islam
  - Catholicism

**Composition of population according to Religion as a percentage**

| Religion | 1981 | 1994 | 2001 |
|---|---|---|---|
| Buddhist | 69.30 | 78.24 | 76.7 |
| Hindu | 15.48 | 7.51 | 7.9 |
| Islam | 7.55 | 6.71 | 8.5 |
| Catholic | 7.63 | 7.50 | 6.9 |
| Others | 0.06 | 0.04 | 0.1 |

Source: Statistical Handbook (1998-2001) Dept. of Population and Statistics

## Economic Structure (Employment)

- Though majority of the population in the economic structure of Sri Lanka are involved in agricultural activities, a periodical decrease is shown.
- In 1990, 56.8% of the total population were engaged in services in agricultural sector while in 2001, it has decreased to 32.6%.
- Those employed in production, construction, commerce, transport and communication services have shown an increased percentage from 1990–2001.
- The foremost place enjoyed by agriculture is gradually decreasing while an increase is seen in the industrial and services sectors.

**Modern Trends in Population**

- Gradual decrease in the rate of population growth.
- The rate of growth of populations in 1999 was 1.5% while it has decreased to 1.1% in 2005. In 2007, it had come down to 0.6%.
- A decrease in the children age group (0-14)
- A trend of ageing in population is seen
- The occurrence of various social and environmental problems due to migration of people to the towns.
- Growth of population centres in the neighborhood of main towns.
- The number of people going abroad for education and employment has increased.

## Teaching Learning Activities

### Activity 1

Just as in the world, in Sri Lanka also there is an uneven population distribution. Population distribution is clearly reflected from a dot map. There are a number of factors that cause an unequal distribution of population. The most important out of these is the physical factor . Relief, climate and drainage are the main physical factors. The human factors that cause unequal distribution are economic, political and social. Make a small booklet to study these facts.

- Study the map showing the population distribution of Sri Lanka in Annex I.

- According to that distribution, observe;
  i. the most densely populated urban areas
  ii. the densely populated regions
  iii. the sparsely populated regions

- Identify examples for each of these regions

- Build up a short report with details about the particular regions according to the plan mentioned in Annex 2. Give the reasons for the uneven distribution of population and give examples of such places/ regions.

### Activity 2

- Build up a conceptual map for the study of subject areas as causes for uneven distribution of population, special features in the population pyramid, ethnic groups, and modern trends in population.

- Evaluate the conceptual maps

## Annex I


Palk strait
Bay of Bengal
Population
Key
Distribution in other areas dot represents 73000 based on 1981 census
Densely populated towns and urban areas more than 2500 persons per km.
Provincial bounding
District bounding
Bay of Mannar
Indian Ocean
Indian Ocean
Indian Ocean
Scale: 1 : 1500 000

**Annex II**

| Factors | Regions of dense Population | Regions of sparse Population |
|---|---|---|
| Relief | | |
| Climate | | |
| Water facilities | | |
| Natural resources | | |
| Distribution of forests | | |
| Growth of transport | | |
| Trade | | |
| Urbanization | | |
| Communication network | | |
| Political reasons | | |
| Conflicts | | |

**Competency Level :** **2.5** Analyses the factors that influence the dynamism of the population of the world

**(10 periods)**

**Learning Outcomes :**

- Examines the causes that influence the dynamism of world population
- Explains the dynamism with examples
- Calculates the rate of population growth giving with an example

## Introduction

With the rapid growth of world population, population education has become an important topic. Population dynamism means the diverse changes that occur in a population.

The main factor that influences the dynamism of world population is the natural increase in population. The causes for the historical growth of population was the increase in births and low death rate. Another factor that shows population dynamism is migrations. But it does not make a difference in the numbers in world population. It only results in a change in the pattern of population distribution.

The objective of teaching this unit is to give an understanding about the dynamism of world population and the factors that influence it.

### A guideline to clarify subject content

- The dynamism of world population
- The factors that influence dynamism
  - Rate of natural increase
  - Migration
- Rate of natural increase
  - Gross birth rate
  - Sex ratio
  - Average fertility rate
  - Gross death rate
  - Infant mortality rate
  - Maternal mortality rate

**Gross birth rate**

- The number of live births for every thousand of the population at mid year during a precise year

**Sex Ratio**

- It is the number of males for every 100 females in a population. If it is over 100, it denotes that there are more males than females and if it is less than 100, the number of females is more than males.

**Average Fertility rate**

- It is the number of births for every 1000 females of the age group 15-49 during a precise year. The maximum fertility rate is shown by the 25-29 age group. This limit may differ from country to country.

**Gross death rate**

- It is the number of deaths per thousand mid-year population in a precise year in a particular country.

**Infant mortality rate**

- It is the number of deaths below the age group of 1 year for every live thousand births that occur during a precise year.
- This reflects the socio-economic status of a country.

**Maternal death rate**

- The number of mothers who die in a precise year from the time of pregnancy up to 6 weeks after the cofinement calculated relatively for live thousand births in that year.

**Rate of Natural increase**

- This is calculated by subtracting the number of deaths from the number of births within that precise year and dividing that by the mid year population and shown as a percentage.
- The rate of natural increase reflects the rate of increase or rate of decrease in a population.
- In the calculation of this rate only deaths and births are taken into consideration. It is called the rate of natural increase.

## Migrations

- The geographical or spatial movement of a population is broadly known as a migration.
- There are a number of definitions for migration. The United Nations Organizations defined it as "spatial movements between clear inter-geographical units which results in a change of living place of man".
  - Causes for migrations (employment, education, security)
  - Migration groups (single, groups, sharing, nations)
  - Distance of migrations (short, long) may be under various basis
  - Migrations take place within a country too just as between countries.
  - Migrations may be forced or voluntary.

## Internal Migrations

This is an important medium that can be utilized to minimize the regional development inequalities found in countries. In regional migrations the emphasiz is on undeveloped areas to developed areas. An example is migration from rural areas to urban areas.

Employment, industrialization, location of industries, infrastructure facilities, relocation schemes, natural hazards are the major causes for internal migrations, local migration or migrations within the country.

## International Migrations

These can be grouped under the nature of migrations.

1. Permanent residence
   Such migrations occur from developing countries to developed countries. Very often such migrations are seen in Canada, Australia, U.S.A., United Kingdom and Germany.

2. Temporary Employment
   Migrations from developing countries to developed countries and Middle Eastern countries for skilled jobs and unskilled jobs.

3. Political asylum
   Migrations to European and American countries from Asian, African countries for permanent residence claiming political asylum due to political victimization.

4. Migrations to other countries as refugees due to displacement in one's own country as a result of various forms of conflicts.

- When we take world migrations as a whole, though it does not make any impact on the world population as such migrations influence in making changes in the population of each country affected.

- Within the last few decades, people from other countries migrated to Canada, Australia, U.S.A. for permanent residence

- Rate of population growth
  It is the total of the three factors births, deaths and migrations. It can be calculated according to the formula below.

$$\frac{\text{Gross birth rate} - \text{gross death rate} - \text{net migrations}}{\text{Mid year population}} \times 100$$

## Population Pyramid

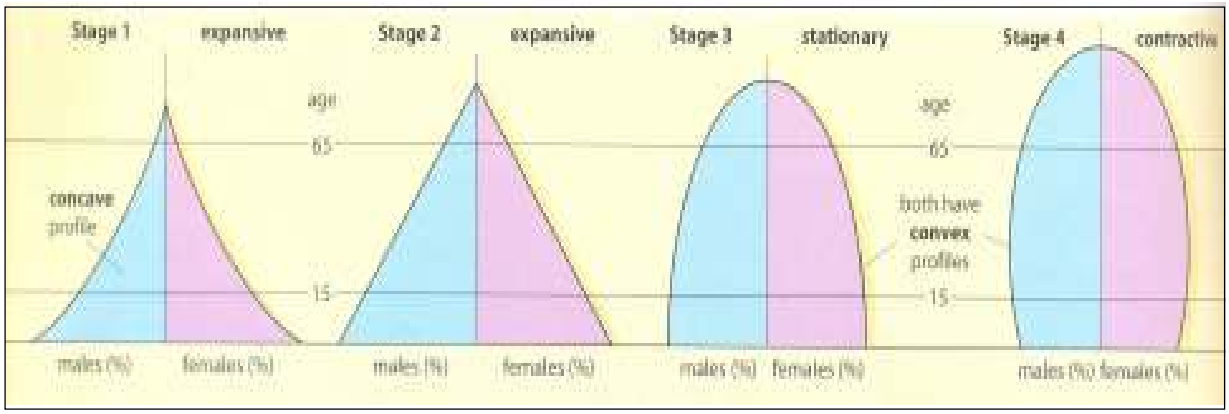
- The dynamism of a population in any country can be represented by a pyramid. Age–structure and gender is included in it.

- We can come to conclusions about the nature of a population of a country by looking at a population pyramid.

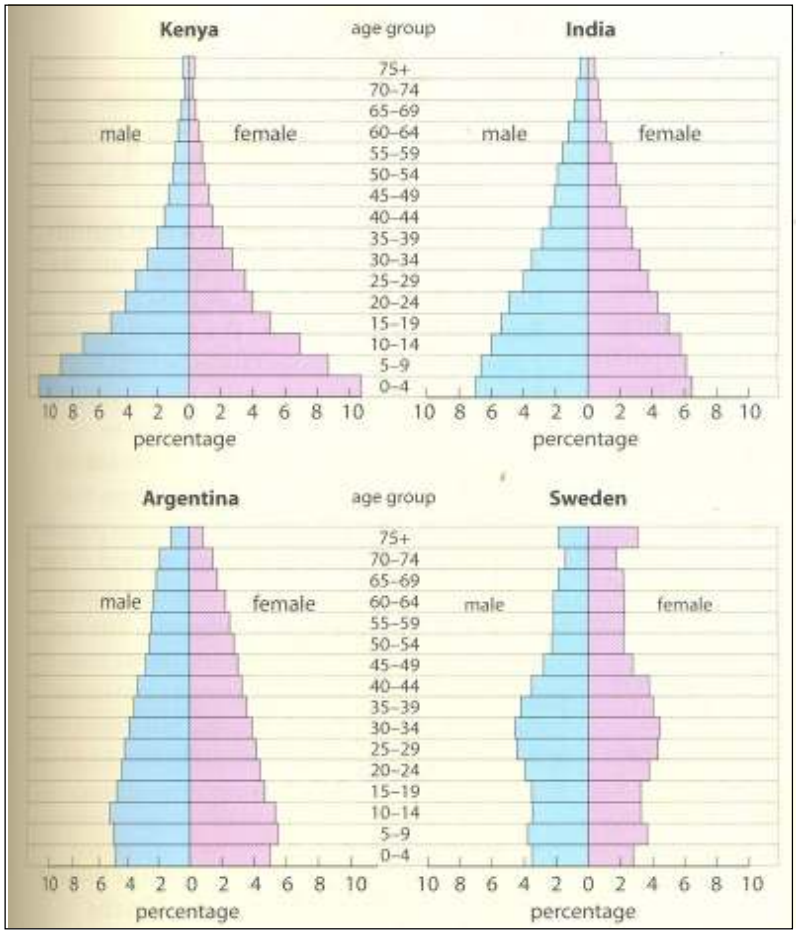
- In the present day, 4 types of pyramids which show population of countries can be identified. It is seen from the diagrams below.

  1. Expansive stage
  2. Expansive stage
  3. Stationary stage
  4. Contractive stage

## The form of Population Pyramid




## Examples for population/ pyramids from Kenya, India, Argentina and Sweden




Source: Waugh Dand Geography an Integrated Approach

**1. Kenya**

Is a country in the expansive stage. Both rates shows a high value. 51% of the total population are below 15 years. A rapid lowering of upper age groups is seen due to the low life expectancy at birth. Only 2% of the total population live over 65 years.

**2. India**

There is an expansion in every age-group. Though number of births is high, life expectancy is fairly high, 39% of the population is below 15 years and only 3% of the population is over 65 years.

**3. Argentina**

Argentina has reached the stationary stage. Birth rate has come to a stabilized level is seen from the fact that groups under 15 years have almost equal population. (0–4, 5–9, 10–14) Since death ratio had decreased life expectancy is high. 26% of the population is below 15 years. 8% are over 65 years.

**4. Sweden**

22% of the total population are below 15 years. 16% are elderly. Life expectancy is high. Both birth rate and death rate show low values.

# Teaching Learning Activities

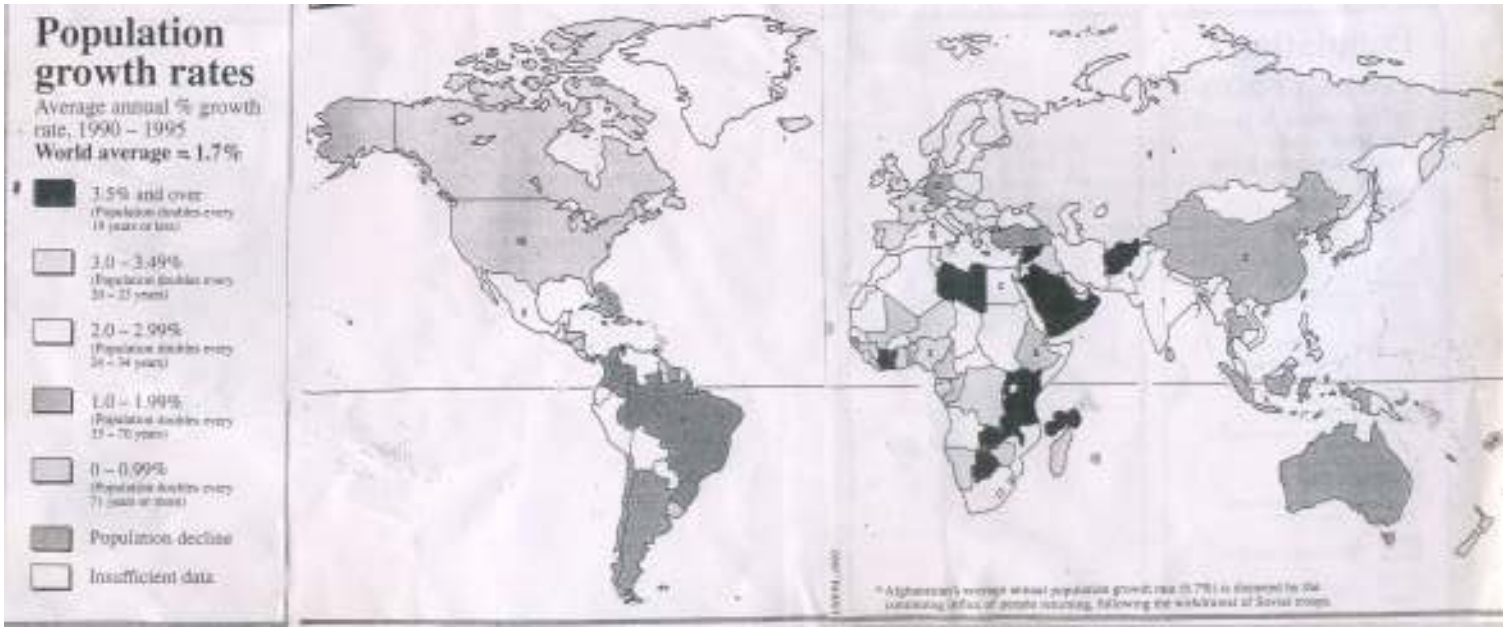
## Activity

Rate of population growth in the world by 2007 was 1.7%. But when we take country by country, this value is not the same. Make use of the activity given below to list the countries with low death rates and high birth rates.

- Organize this as a group activity. Study annex I and the world map showing rate of population growth in the world.
- Identify the rates of population growth of each of the countries.
- Identify those countries in an Atlas and list them.
- The countries with rate of growth showing a negative value is shown by the colour green in the map reference. The countries shown in grey colour are those where sufficient information is not available.
- Separate as shown below the other population growth rates shown by the remaining five colours in the reference.
  - i. Low rate of growth (<0.99%)
  - ii. Moderate rate of growth (1.00%–2.99%)
  - iii. High rate of growth (>3.00%)
- Display in class the lists prepared by the groups. Give them time to make short notes of information studied.
- Evaluate based on learning outcomes

**Annex I**

## Population Growth Rate



**Competency Levels :**

2.6 Examines the dynamism of population of Sri Lanka
(05 periods)

2.7 Enquires into the trends that affect the dynamism of population of Sri Lanka
(05 periods)

**Learning Outcomes :**

- Explains the factors that influence the dynamism of population of Sri Lanka
- Shows recent trends in the population of Sri Lanka

## Introduction

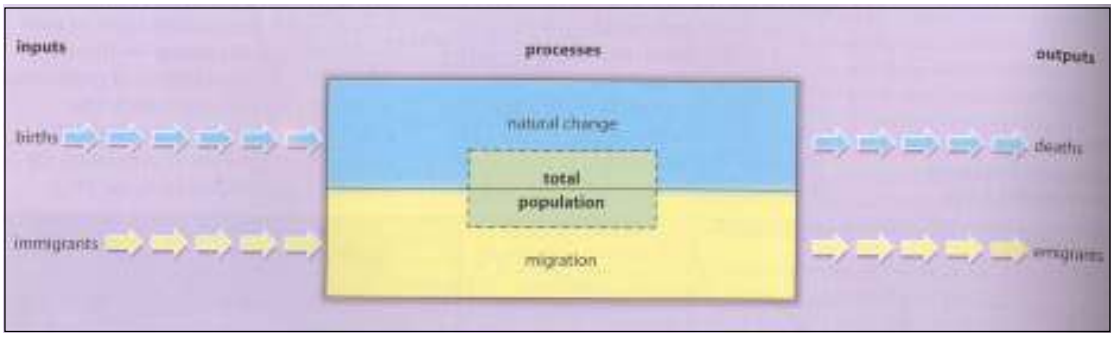
Population is a resource for a country. However when a country has a dense population it becomes a problem when that country has to face various complexities. With sound management it is possible to resolve such problems.

The population of Sri Lanka has undergone several changes often. Two main factors have influenced such changes. They are natural increase and migrations. The rate of natural increase depends on the number of birth and deaths. Migration depends on immigration and emigration. International migrations influence changes in a population. Internal migrations make changes in the nature of distribution of population of a country. It is expected to study the changes in population in Sri Lanka by teaching this unit.

### A Guideline to clarify subject content

- The pattern of population distribution in Sri Lanka is determined by the dynamic variables of births, deaths and migrations.
- Patterns of population distribution which are based on dynamic variables are changing often.
- There are 2 important facts which influence the population of a country. They are natural increase and migrations.
- Natural increase is the difference between birth rate and death rate.
- Migration is the difference between emigrants and immigrants.

**A diagrammatic representation of natural increase in population**




Source: Waugh David (1995) Geography an Integrated Approach

Changes in population, its distribution, composition and migration according to time and space and the process of those changes are shown by the above diagram.

**Natural Increase**

- Natural increase mainly contributes to the dynamism of population of Sri Lanka.

**Rate of natural increase in the population of Sri Lanka**

| Year | Population in million | Rate of natural increase |
|---|---|---|
| 1997 | 17.7 | 1.2 |
| 1998 | 17.9 | 1.3 |
| 1999 | 18.2 | 1.5 |
| 2000 | 18.4 | 1.4 |
| 2001 | 18.7 | 1.2 |
| 2002 | 19.0 | 1.3 |
| 2003 | 19.2 | 1.2 |
| 2004 | 19.4 | 1.2 |
| 2005 | 19.6 | 1.1 |
| 2006 | 19.8 | 1.1 |
| 2007 | 20.1 | 0.6 |

Source: Department of population and statistics (2007)

- The population of Sri Lanka has increased gradually.
- Within a period of ten years it has increased by 2 million
- After 2002 rate of natural increase has been gradually decreasing
- According to the mid year census of 2007, the rate of natural increase has been 0.6%.

## The factors that influence dynamism

- When population pyramids are compared, it is clear that the total population in the younger age group of 0–14 is gradually decreasing. This is because the number of births are decreasing gradually.
- It is seen that the number of people in age groups over 60 years is gradually increasing. This is because life expectancy at birth is very high. The improvement in health facilities and expansion in education too has influenced it.

## Migrations

There are 2 main types

- International migrations
- Internal migrations

## International migrations

- The movement of people among countries or near political frontiers is called international migrations. A few international migrations connected with Sri Lanka can be identified.
- During the period 1871 – 1881 British administrators brought down South Indian labourers to work in the tea plantations of Sri Lanka.
- During that decade, they contributed about 67% of the total population growth in that year.
- In the decade 1971–1981 under the brain-drain from Sri Lanka to other countries, the migrants contributed 26.5% of the total population growth.
- After 1970, the people who migrated to Middle East and other countries for employment increased.

  In 1979, 2,89,000 migrated
  2001, 1,84,000

## Internal migrations

- There are three major parts
  - From rural areas to urban areas
  - From rural areas to other rural areas
  - From urban areas to rural areas

  There is no change in the population of Sri Lanka due to internal migrations. However through changing permanent residence or semi-permanent residence, a change in the population distribution pattern occurs.

- The internal movements for daily activities and for employment and other personal needs are called internal migrations.
- During the last few decades, under internal migrations, the movements from rural areas to urban areas was seen very often.

  In 1994, the net migration ratio to Colombo city was +11.2%
  to Gampaha town +12.1%
  In 1994, the net migration ratio in Matara town was –20.2%
  from Kandy town –12.7%

- Out of the migrations from rural areas to other rural areas, the migrations to agricultural settlement schemes takes an important place.
  In 1974 the net migration to Anuradhapura from various regions of the Island was +15.4%
  From various regions to Polonnaruwa +35.0

## Recent Trends

- There is migration from rural areas to urban areas always.
- Though migration to agricultural settlement schemes has stopped still there is migration to Mahaweli settlement schemes.
- Internal migration take place due to natural hazards also. Owing to the tsunami disaster in 2004, there is migration from coastal areas to the interior .
- The temporary displacements due to conflicts also lead to migrations
- Development schemes also induce migrations for example construction of Expressways and harbours.

## Teaching Learning Activities

### Activity 1

- Preparation of an information sheet with reference to population statistics giving the reasons for the dynamism of the population of Sri Lanka.
- Evaluate with reference to learning outcomes.

### Activity 2

The structure of the population of any country can be shown by a population pyramid. Generally every layer in a pyramid is divided to groups of five years and the vertical axis shows population percentage according to sex.

Various countries in the world are passing through various stages of the population pyramid. In the developing countries, a pyramid with a concave shape shows the expansive stage. When the rate of growth is low, the population pyramid reaches the contractive stage after passing expansive and stationary stages. The features seen during this stage are low birth rate, low death rate, high proportion of dependents and high life expectancy.

This activity is assigned to prepare a report on the nature of population pyramids of a few selected countries.

- In Annex I, there are four population pyramids of Ethiopia, Bangladesh, Sri Lanka and Australia.
- Study those pyramids
- Compare the population of each of the age groups. Draw attention to the age groups shown below.
  1. 0–14 age group (young dependents)
  2. 15–59 age group (work force)
  3. 60–79 age group (old dependants)
  4. over 80 age group (old dependents)
- Study how sex ratio and its changes and the various stages in development of the country are reflected by the pyramids.
- Prepare a report including your conclusions of the population structure of each of the countries and comparative conclusions that can be arrived at about the four countries.
- This is a single activity
  - While discussing with students, give them instructions required about preparation of reports
  - Give them time to present their reports
  - Evaluate based on learning outcomes

# Competency - 3

## Appreciates the values of the main cultural dimensions of population

**Competency Level :** 3.1 Examines the cultural dimensions of world population
**(05 periods)**

**Learning Outcomes :**

- Describes the cultural groups of world population
- States the diversity in the cultural dimensions of world population
- Describes how the cultural dimensions of the world are built up based on religion and language

## Introduction

Religion and language can be introduced as the main factors which help to maintain the bondage in human culture.

People who live in two regions of the world make use of language to develop mutual relationships. In the same manner they build up connections with the surrounding environment based on language. People who lived in various environments during early times made use of diverse sounds and symbols to exchange their ideas. That was the origin of language which in later times letters were used to build up written languages.

Religions can be introduced as a factor which binds together groups of people who have got together based on beliefs and faith. At the beginning, religions were born based on natural objects found in the environment.

In the present day world, various religious beliefs are seen. Most of the religions are based on the faith of gods. Apart from these, other religions without any belief in a god which had an origin from a philosophical basis spread throughout the world.

A few people who live in the world still live as tribal people.

By teaching this unit it is expected to give an understanding about such cultural groups.

## A guideline to clarify subject content

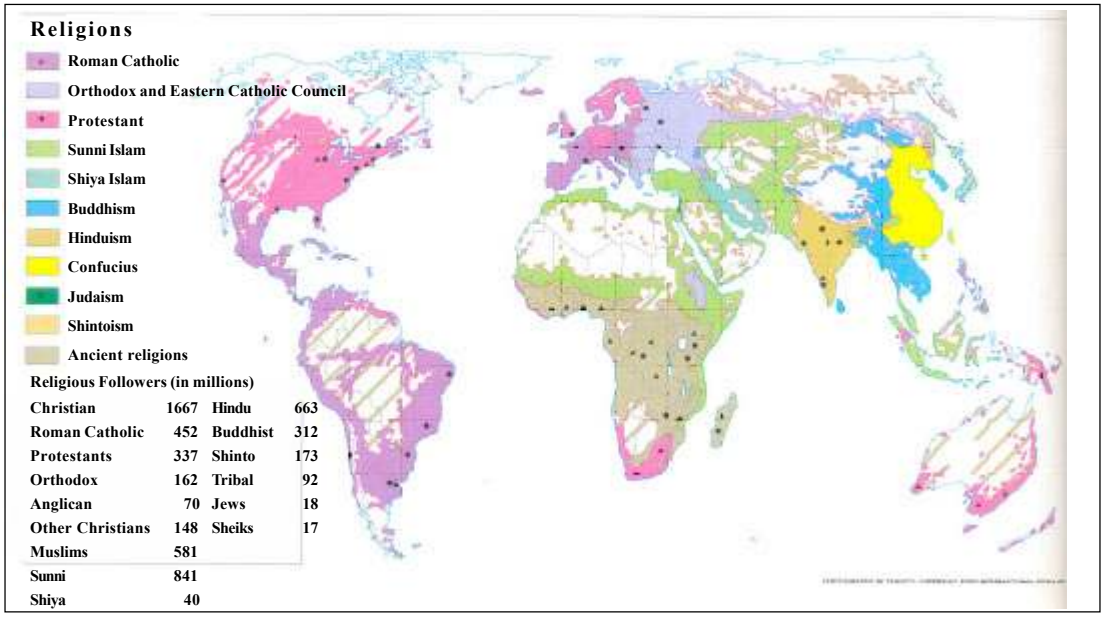
### Cultural groups

- religious groups
- language groups
- other groups (tribes, indigenous)

### Religious groups

- A number of religious groups are seen in the world
- Christian
  - Roman catholic
  - Protestants
  - Anglican
  - Christians
  - Orthodox
  - Others
- Islam
  - Sunni muslim
  - Shiya muslim
- Buddhist
- Hindu
- Confucius
- Judaism
- Shinto
- Tribal religions

**Map showing the Distribution of Religions in the world**




Source: Gunasena new Philip Atlas (2003)

- Out of the religious groups, the largest group is the Christian group. They include 1667 million out of the world population.
- Christian followers are divided into a few sects (see map)
- Christian followers are mostly distributed in the continents of Europe, North America and Australia.
- There are about 881 million Islam followers. They are mostly distributed in the Middle East and North African countries.
- Hindu, Buddhist, Confucius and Sheik religious groups are mostly distributed in Asia.
- About 92 million people who follow tribal religions are distributed in every continent in the world but mostly in the African continent.
- Shintoism is distributed in Japan.
- Judaism is mostly distributed in Israel and surrounding regions.

**Language Groups**

- Though there are more than 3000 languages in the world, about 60% of the world population use only 12 major languages.
- About 907 million of the world population speak mandarin (language of Chinese)
- In India the main language spoken is Hindi. In the middle East, Arab language is spoken by about 208 million.
- In most of the countries in the world a few languages are spoken.
- People who speak tribal languages are distributed in every continent. In Africa such tribal languages are often spoken.
- During recent times learned men have made an effort to create a world language. For example Esperanto.
- Though a large number of language groups are found in the world, due to recent technological advancement and communication media, the frontiers which separate human groups have been loosened.

| Language | Population in million |
|---|---|
| Mandarin | 907 |
| Hindi | 383 |
| Spanish | 362 |
| English | 456 |
| Bengali | 189 |
| Arabian | 208 |
| Russian | 293 |
| Portuguese | 177 |
| Japanese | 126 |
| German | 119 |
| French | 123 |
| Malay | 148 |

**Tribal and Indigenous Groups**

- A group of people who speak the same language and have common habits living in a small area is called a tribe.
- Anthropologists have recognized a few common features seen in these tribal groups. They are religious belief, language, culture and lineage.
- A tribe is a smaller unit. Other connections with the rest of the groups are decreasing for e.g.

West Africa

Fulani
Azande
Bantu
Hutu
Bushman

North America – A pawe

- With globalization, the cultural identify found in tribal groups is gradually decreasing.

- Indigenous people were the earliest groups who inhabited diverse regions in the world from distant past.

  For eg. Australia – Aborigines
  Japan – Inoos
  North America – Red Indians
  Sri Lanka – Veddas
  Africa – Pigmies
  North Polar area – Eskimos

## Teaching Learning Activities

### Activity

- Preparation of a small booklet that shows the cultural dimensions of world population.
- Evaluate based on learning outcomes.

**Competency Level :** 2.3 Examines the cultural dimensions of the population of Sri Lanka

**(08 periods)**

**Learning Outcomes :**

- Appreciates the values of cultural dimensions in the population of Sri Lanka.
- Names the cultural groups that originated based on ethnicity.
- Shows the cultural groups that diversified based on language and religion.

## Introduction

The composition of population of Sri Lanka is diverse. They are ethnicity, religion and language. These can be called cultural groups.

These cultural groups have mixed up into various patterns resulting in sub-cultural groups. When we consider the distribution of the various cultural groups, it is seen that some cultural groups are distributed in some specific areas in the Island while some other groups are mixed up and distributed throughout the Island. The distribution pattern of cultural groups is often undergoing changes due to natural hazards, internal conflicts and other cultural reasons.

The aim of this unit is to give an understanding about the cultural groups their distribution and new trends.

### A guideline to clarify subject content

**Cultural groups**

- ethnic
- religious
- language

**The cultural group based on ethnicity are**

| | |
|---|---|
| Sinhalese | 81.9% |
| Sri Lanka Tamil | 4.3% |
| Indian Tamil | 5.1% |
| Sri Lanka Moor | 8.0% |
| Others | 0.7 (Burgher 0.3%, Malay 0.3%, other 0.1%) |

**An even distribution is not seen in ethnic groups.**

The composition of people of Sri Lanka according to Ethnicity as a percentage (includes only the 18 Districts where the census was held)

| Ethnic type | 1981 | 1994 | 2001 |
|---|---|---|---|
| Sinhala | 73.95 | 83.86 | 81.9 |
| Sri Lanka Tamil | 12.70 | 5.39 | 4.3 |
| Indian Tamil | 5.52 | 3.62 | 5.1 |
| Moor | 7.05 | 6.35 | 8.0 |
| Others | 0.78 | 0.78 | 0.7 |

Source: Statistical Hand Book (1998-2001) Dept. of population and Statistic

Population of Sri Lanka according to ethnicity (2001)

| Ethnic type | Number in thousands |
|---|---|
| Sri Lanka | 13,876.2 |
| Sri Lanka Tamil | 732.1 |
| Indian Tamil | 855.0 |
| Muslim | 1,339.3 |
| Burger | 35.3 |
| Malay | 54.8 |
| Others | 36.9 |

Source: Department of Population and Statistics

* Data is not available for 7 Districts in Census held in 2001.

**Religious**

- Cultural groups have emerged based on religions. Accordingly
  - Buddhists – 76.7%
  - Hindu – 7.9%
  - Islam – 8.5%
  - Catholics – 6.9%
  - Others – 0.1%

- Religious groups are distributed throughout the Island more than ethnic groups.

- Cultural groups based on the language spoken are seen. Cultural groups based mainly on Sinhala and Tamil Languages are distributed in various regions.

- Every ethnic group learns English Language and cultural groups associated with them are seen.

- Cultural groups based on Malay and Arabic languages are also found in small numbers.

**Composition of people according to religions as a percentage**

| Religion | 1981 | 1994 | 2001 |
|---|---|---|---|
| Buddhist | 69.30 | 78.24 | 76.7 |
| Hindu | 15.48 | 7.51 | 7.9 |
| Islam | 7.55 | 6.71 | 8.5 |
| Catholic | 7.61 | 7.50 | 6.9 |
| Others | 0.06 | 0.04 | 0.1 |

Source: Statistical Handbook (1998-2001), Department of Population and Statistics

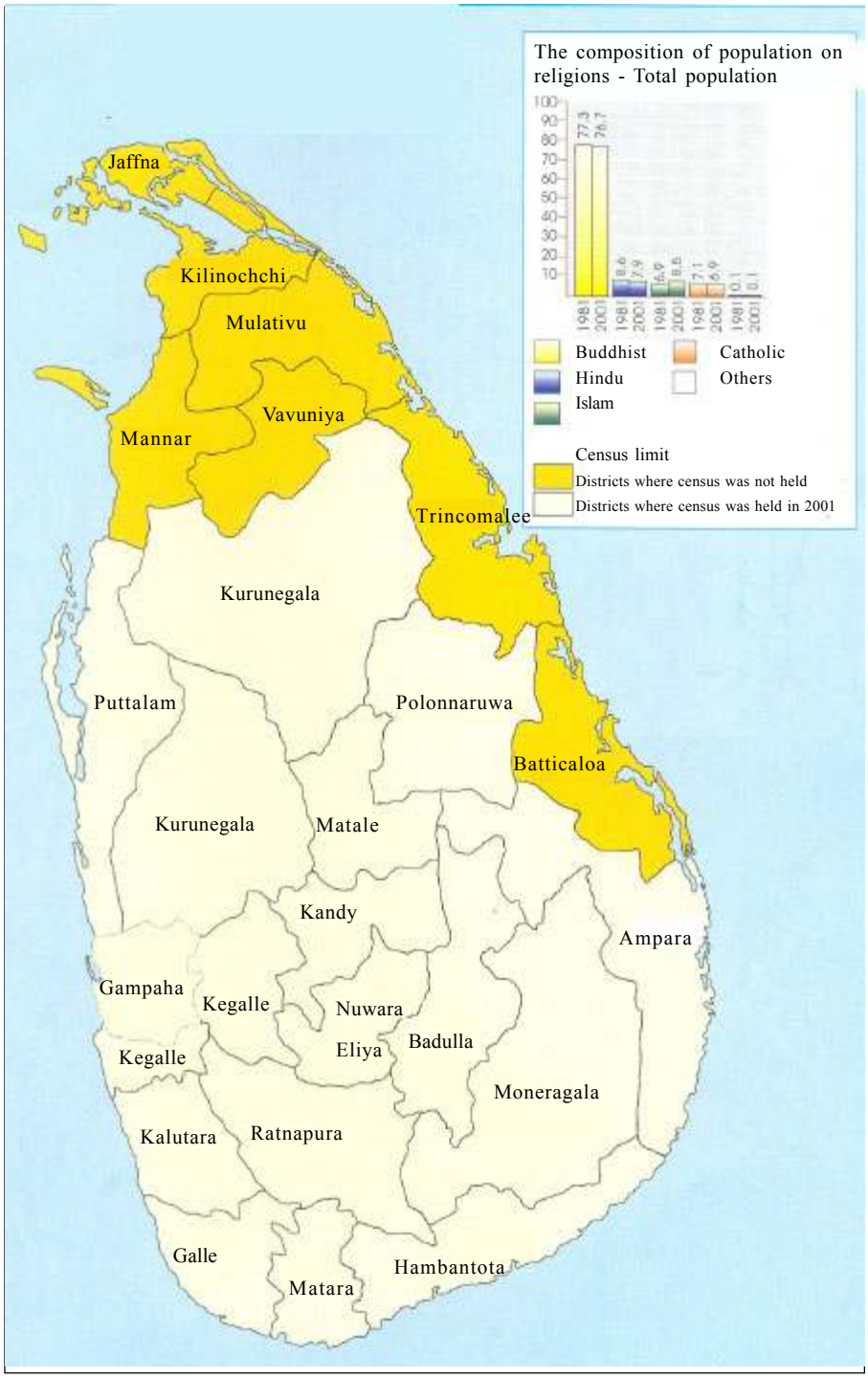
**Population of Sri Lanka according to religions (2001)**

| **Religion** | **Number (in thousands)** |
|---|---|
| Buddhist | 12,983.6 |
| Hindu | 1,312.9 |
| Islam | 1,435.9 |
| Roman Catholic | 1,035.7 |
| Other Christians | 150.2 |
| Others | 8.4 |

Source: Department of Population and Statistics

Since the 2001 census was not completed, data of 7 Districts are not included.

**Population distribution i n Districts according to religions 1981-2001**




Source: Gunasena Modern Philip World Atlas (2003)

## Trends

- A series of sub-cultural groups have emerged in Sri Lanka due to the division into religions and language group based on ethnicity.

- Sub-cultural groups live in various regions throughout the Island. As such there are regional differences in religions and language within those cultures.

- The indigenous population of Sri Lanka is considered as a special cultural group. These specialties could be seen in ethnic, religious and language aspects.

- Since the indigenous population has mixed up with other cultural groups problems have arisen with regard to conservation of their identity. Small tribal cultural groups distributed in a few areas are found in Sri Lanka for eg. gypsies

# Teaching Learning Activities

## Activity 1

- Make situations to collect information, report writing, presentation and reviewing as a group activity about cultural groups in the population of Sri Lanka, their distribution and new trends.
- Evaluate based on learning outcomes.

## Activity - 2

- Preparation of a survey report
  People who live around the school are diverse. One analytical task which can be followed in this survey will be to find out information about this diversity. Data could be collected from several angles about composition of population.
  according to ethnicity – (Sinhala, Tamil, Moor, others)
  according to language – Sinhala, Tamil, English, others)
  according to sex – (male, female)
  according to employment – (agricultural, industrial and services)
- Presentation of the data collected according to some order is also significant here. In this regard use Tables, graphs, diagrams, pictures and drawings.
- The most important task in the preparation of a report is giving conclusions. Present the conclusions you can arrive at about the composition of population according to each topic.

It will be useful to form a correct picture about the composition of people living around your school.

- Direct the students to do a survey about the composition of population living around your school and get them to prepare a report about it.
- It will be very effective if it is organized as a group activity. When you select this area, limit it according to the congested nature.
- If it is an area with few people, you may be able to select limits as a village/ grama seva division, if it is a congested area, you can select a street or a few streets.
- Collect information about ethnicity, religion, language, male-female numbers, employment about the selected area.
- Prepare reporting documents as suited to note down information. Collect data. Tabulate the data.
- Prepare a detailed report on the composition of population living around your school.
- Include any conclusions about the composition of population in your area.
- Pay attention to the final finish when presenting the report.
- Observe the reports presented by the other groups also.

## Competency - 4

## While enquiring into the basic settlement types, examines its geographical relationship

**Competency Level :** 4.1 Classifies the basic settlement types in the world according to their location and functions.

(10 periods)

**Learning Outcomes :**

- Explains the nature of various settlements in the world.
- Describes the various stages of the growth of settlements.
- Shows the factors of location of settlements
- Explains the hierarchy in the distribution of settlements
- Mentions the differences between the rural and urban settlements
- Classifies the criteria of classifying settlements
- Describes the various stages of the growth of towns

### Introduction

Man lives in dwellings in whatever form. Man makes use of dwellings to protect himself from environmental conditions as sun, rain, snowfall, heat and cold and also to protect himself from wild animals, and burglars. Hence man has made use of natural caves or hollows of trees as a dwelling from very ancient times and later on tents, shanties and diverse permanent houses for his dwellings.

Settlements are not limited to human dwellings alone. Sometimes an isolated housing unit even may be a settlement. The broad meaning of a settlement is that it is a broad system consisting of various buildings such as houses, factories, offices, shops, religious places and land areas such as home gardens, fields, parks, play-grounds and also other elements which connect them such as roads, water pipes, electricity lines and fences etc.

According to the parts shown above, there is diversity in settlements in the world. According to this diversity, the following types of settlements are identified and classified within the settlements continuum –

→ Farmstead or isolated house
→ Hamlet
→ Village
→ Town
→ City
→ Metropoly
→ Conurbation
→ Megalopolis

By teaching this unit it is expected to give an understanding about the diversity of settlements, settlement patterns, their basic features, functions and trends.

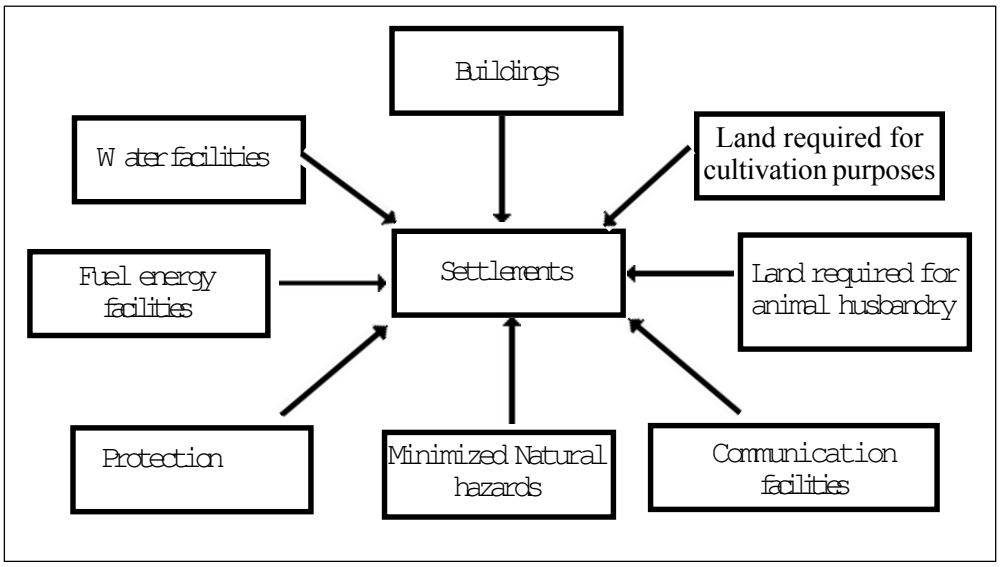
## A Guideline to clarify subject content

### Various stages in the growth of settlements

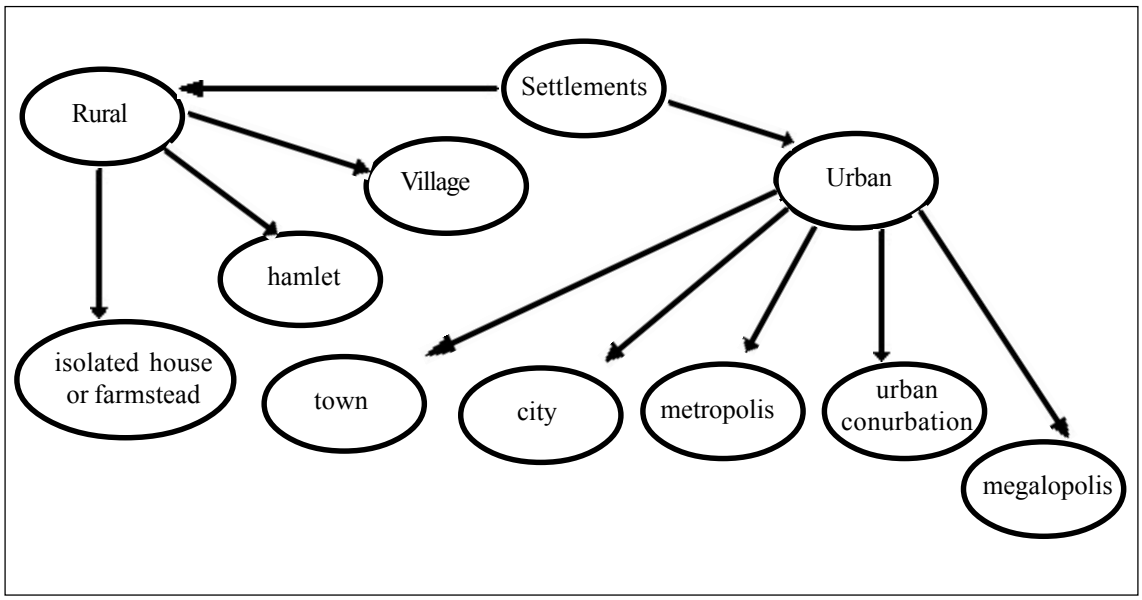
- During the old stone age, use of temporary settlements in hollows of trees and caves by hunters and fruit gatherers.
- Construction of semi – permanent settlements with the beginning of nomadic herding and cultivation.
- Origin of permanent houses and hamlets with the beginning of agriculture and animal rearing (agricultural revolution)
- While getting used to an urban life style from a rural life style (urban revolution), birth of urban settlements.
- After the 17th century, during the period 1750–1850 with the dawn of the Industrial Revolution, rapid growth of urban population and towns (period of urban revolution)
- 20th century – after 1940

  With the increase in urban population in developing countries, during the period of dynamic urban settlements towns developed throughout the world and later expanded as cities, metropolis, urban conurbations and megalopolis.

## Factors of Location of Settlements




### Hierarchy of Settlements



## The differences between urban and rural settlements

- **Population**

  The population in an urban settlement is relatively more than in a rural settlement. Population is used as a criteria in separating the rural and urban settlements, but there is a difference in the number of population used by different countries.

- **Economy**

  In rural settlements primary economic activities are carried out while in urban settlements secondary and tertiary economic activities are in abundance.

- **Services**

  In urban settlements diversity of services as education, financial, and commercial sectors are centralized. This type of services are very few in rural settlements.

- **Land utilization**

  In rural settlements open spaces are abundant, the percentage of land utilization in agriculture is high. Most of the lands are occupied and sometimes only small scale industries are seen.

  In urban settlements, industries and services take most of the space in land utilization. Built-up areas are abundant among land resources.

- **Society**

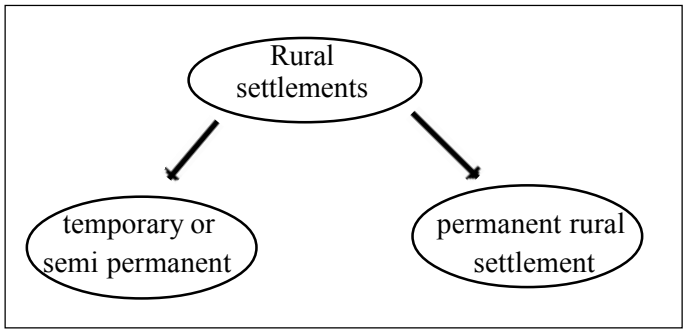
  When considering social and cultural relationships, in rural settlements though the physical distance is greater , the social distance is very small. In urban settlements the social distance is greater while the physical distance is smaller .

**Prominent differences between rural and urban settlements**

| Criteria | Rural (Settlements) | Urban Settlements |
|---|---|---|
| Population<br>Population density<br>Economic activities<br><br><br>functions/<br>service | relatively low<br>low<br>Primary economic activities are abundant<br><br>Primary functions<br>Resident functions | relatively more<br>high<br>Secondary, tertiary and quaternary economic activities are abundant.<br>Various functions such as administrative, industrial, financial health and education are concentrated |
| Land utilization | associated with agriculture | Built-up areas |
| Physical distance between housing units | is more | is less |
| Social distance between housing units (social relationships) | is less | is more |
| Daily movements into the area | less | more |

## Rural Settlements

- Rural settlements are defined as areas where a large number of people who are dependent on primary economic activities such as agriculture, rearing of animals, fishing, hunting and gathering fruits are living. But in some rural settlements, individuals who are engaged in secondary or tertiary employment are also living.
- Basically rural settlements can be defined as settlements with primary economic patterns.
- In many rural settlements two sections can be seen as built-up area and economic area.
- Rural settlements can be divided again into two types on the basis of their stability.




- Man lived in temporary or semi-permanent settlements before he started to live in permanent settlements.
- Even today, in some areas of the world, semi-permanent and temporary settlements connected to many economic activities can be seen.
- Semi-permanent and temporary settlement patterns have come about due to reasons such as difficulties in finding food and hence periodical migrations in search of food, transhumance, fishing industry, shifting cultivation, seasonal climatic changes.

**Permanent Rural Settlement**

- Settlements that existed continuously at the same place for a long time are called permanent rural settlements.
- These settlements can be classified on criteria such as origin, location, economic activities, land use, population, form of settlement patterns.
- Diversity in distribution of permanent rural settlements
  Settlements in areas of paddy cultivation in Asian countries
  Examples – Wet zone villages in Sri Lanka
  Villages along valleys in Central hill country
  The ancient villages which cultivate paddy with water from the tanks in the Dry zone
  (permanent settlements with paddy cultivation as the main crop)
- In the areas where crops like tea, rubber, cane are grown under plantation agriculture, the workers quarters, estate superintendent's bungalow and other buildings in the settlement are put up according to a formal plan.
- In North western Europe permanent rural settlements are associated with crop farming and animal husbandry farms carried out under mixed farming.
- Isolated farms where crop farming and animal rearing are done.
- Small fishing villages.

**Rural Settlement Patterns**

- The pattern in which houses and buildings are distributed in any region is called settlement pattern.

**Isolated settlement**

- Single housing unit in isolation located in a large area of land for example settlements in the Amazon forest which depend on natural resources. Houses distributed in large farms in the Prairies.

**Nucleated settlement**

- Settlement where buildings are concentrated.
- Mostly seen in South and South East Asian countries.

**Linear or ribbon settlement**

- When houses and other buildings are distributed along roads, channels and narrow valleys there is a linear pattern in the villages.

**Ring settlement/ focal villages**

- Settlements built in a circular pattern concentrated around a specific place.

**Planned settlement**

- The new settlements built up at present come under planned settlements. In most of the urban areas as a solution to the urban congestion, such planned settlements are built in the interior of the main town.

## Urban settlements

- Urban settlements are settlements with a high population density due to the concentration of a large population in a limited area of land and where various functions such as minerals, industrial, financial, educational, health, administrative and residential purposes are concentrated.

**The main features**

- Since buildings meant for various functions are concentrated within the town, the area under built-up area is much more than the land utilized for agriculture and forests.
- Individuals belonging to various ethnic groups engaged in various jobs as secondary, tertiary and quaternary though they belong to various religions and castes live in towns.
- Population is more than in a rural settlement while density of population is also relatively higher in a town.

- Criteria of identifying towns and rural settlements.
  - Diversity of functions
  - Population and density
  - Economic activities
  - Road network
  - Services facilities

- However, according to the socio-economic conditions in countries and the features of settlements, the criteria of identifying towns and villages are diverse.

## Population

- Most countries in the world, use population as a criteria in identifying towns from villages. Here in keeping with the socio-economic characteristics inherent in particular countries, they have determined the minimum level of population in an urban settlement.

| In the agglomeration or the smallest administrative unit, the minimum population | Country |
|---|---|
| 200 | Greenland, Iceland, Norway, Spain |
| 400 | Albania |
| 1,000 | Venezuela |
| 1,500 | Ireland |
| 2,000 | Bolivia, Cuba, Vietnam, Liberia |
| 2,500 | Netherlands, France |
| 10,000 | Bahrain, Zimbabwe, Portugal, Senegal |

## Administrative function

- All the areas that come under the administration of urban Local Government Institutions are considered as towns.

**The countries which use administrative criteria**

| Criteria | Country |
|---|---|
| Only administrative | Sri Lanka, Libya, Pakistan, Haiti, United Kingdom, El Salvador, Dominican Republic, Costa Rica |
| Administrative and other criteria | Sudan – administrative centres and population over 5000 |
| | Comoros – administrative centres and population over 5000 in settlements |
| | Nicaragua – administrative centres in Municipio and population over 1000 and settlements with electricity and road network |

- According to the population in the largest settlement located in an administrative unit, that administrative unit is identified as a town or a village.

**The countries which use several criteria in separating urban settlements from rural**

| Criteria | Countries |
|---|---|
| Population, urban features and percentage of non-agricultural jobs | Tajikistan, Turkmenistan, Usbekistan, Latvia, Belaroos, Estonia, Lithuania, Ukraine, Russia, Kazakastan, Khirghistan, Armenia |

Source: Demographic Year Book (1995)

**Minimum Population and other criteria**

| | | |
|---|---|---|
| Australia | over 1000 | over 250 houses and atleast permanent dwellers in 100% of the houses in the settlement |
| Panama | over 1500 | Road network, water and waste pipeline system, electricity |
| Honduras | over 2000 | Urban features |
| Israel | over 2000 | 75% of the population engaged in non-agricultural employment |
| Zaire | over 2000 | Prominence given to non-agricultural economic activities |
| United States | over 2500 | Urbanized areas |
| Zambia | over 5000 | Majority of the settlements depend on non-agricultural economic activities |
| Botswana | over 5000 | 75% of the people engaged in non-agricultural jobs |
| India | over 5000 | Population density over 1000 per square mile, clear cut urban features, 75% of the adult males in the nucleated settlement engaged in non-agricultural jobs. |
| Japan | over 50,000 | Over 60% of the houses in the town centralized in the built-up area of the settlement, over 60% of the labour force engaged in industries, trade or any other urban jobs. In some settlements urban facilities and urban features are found. |

Source: Demographic Year Book (1995)

- There are situations when a city is classified into 2 main types. That is legal city and geographical city.
- The town limits accepted officially by a country is the legal city. Yet the geographical city sometimes extends out of the legal city or extends into the legal city.

## Classifying towns according to population

- The population in urban settlements which are identified or classified using various criteria comes under a large range.
- Urban settlements have been classified based on population as shown below

  Below 20,000 – small towns

  20,000 – 100,000 – medium or intermediate cities

  100,000 – 1 million – cities

  1 million – 10 million – million cities

  over 10 million – mega cities
- The increase in cities is a recent trend in the world.

  The number of million cities or cities with more than a million

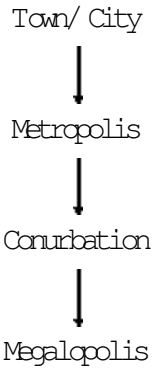
  1920 – 24

  1940 – 41

  1960 – 113

  1980 – 198
- A significant feature in the development of urban settlement is the creation of mega-cities where over 10 million population live.

### Various Stages in the growth of cities




## Metropolis

- Around cities which are growing rapidly sub-town and rurban zones which are born due to the city itself and which have close connections with it are grown.
- Such a large urban zone consisting of the above parts is called the metropolis.

## The world urban Agglomerations of more than 1 million people

**1950**

| Urban Agglomerations | Population in million |
|---|---|
| 1. New York | 12.3 |
| 2. Tokyo | 11.3 |

**1975**

| Urban Agglomeration | Population in million |
|---|---|
| 1. Tokyo | 26.6 |
| 2. New York | 15.9 |
| 3. Mexico city | 10.7 |

**2007**

| Urban Agglomerations | Population in million |
|---|---|
| 1. Tokyo | 35.7 |
| 2. New York | 19.0 |
| 3. Mexico City | 19.0 |
| 4. Mumbai | 19.0 |
| 5. Sao Paulo | 18.8 |
| 6. New Delhi | 15.9 |
| 7. Shanghai | 15.0 |
| 8. Culcutta | 14.8 |
| 9. Dacca | 13.5 |
| 10. Bucnos Ayres | 12.8 |
| 11. Los Angeles | 12.5 |
| 12. Karachchi | 12.1 |
| 13. Cairo | 11.9 |
| 14. Riode Janeiro | 11.7 |
| 15. Kobe-Osaka | 11.3 |
| 16. Beijing | 11.1 |
| 17. Manila | 11.1 |
| 18. Moscow | 10.5 |
| 19. Istanbul | 10.1 |

**2025**

| Urban Agglomeration | Population in million |
|---|---|
| 1. Tokyo | 36.4 |
| 2. Mumbai | 26.4 |
| 3. New Delhi | 22.5 |
| 4. Dacca | 22.0 |
| 5. Sao Paulo | 21.4 |
| 6. Mexico city | 21.0 |
| 7. Newyork | 20.0 |
| 8. Calcutta | 20.6 |
| 9. Shanghai | 19.4 |
| 10. Karachchi | 19.1 |
| 11. Kinshasa | 16.8 |
| 12. Lagos | 15.8 |
| 13. Cairo | 15.6 |
| 14. Manila | 14.8 |
| 15. Beijing | 14.5 |
| 16. Buenos Ayres | 13.8 |
| 17. Los Angeles | 13.4 |
| 18. Rio de Janeiro | 13.4 |
| 19. Jakarta | 12.1 |
| 20. Istanbul | 12.1 |
| 21.Gavenshu | 11.8 |
| 22. Kobe -Osaka | 11.4 |
| 23. Moscow | 10.5 |
| 24. Lahore | 10.5 |
| 25. Shenshen | 10.2 |
| 26. Paris | 10.0 |

Source: Demographic Year Book (1995)

## Conurbations

- Metropolis is a dynamic settlement type. With the rapid growth of population in a metropolis, sub towns grow rapidly more than the main city due to insufficient space.
- When metropolis expand, two of the metropolis join together and create large areas which spread continuously and show urban features. In this manner, the zone which is created by the joining of metropolis is called a conurbation.

  For example: Great London Conurbation, Western Yorkshire, Ruhr

## Megalopolis

- A megalopolis is created when a few conurbations are joint together by a network of roads.
- The formation of the megalopolis is considered as the maximum stage of the growth of urban settlements.

  For example:
  - The megalopolis which extends from Boston to Washington (Boshwash) which is formed by joining New York conurbation of U.S.A.
  - Chicago-Pittsburg megalopolis (Chipits)
  - Tokyo and Hokkaido megalopolis of Japan

## Teaching-Learning Activities

### Activity-1

- Group the class into three.
- Distribute the assignment in the Annex and give instructions to prepare a detailed report on the relevant topic after exploring facts.
- Supervise the student activities while giving the guidance needed.
- Give them a chance to present the detailed report prepared in class.
- While pointing out shortcomings and weaknesses give the necessary guidance to rectify them.
- Give marks for the student creative work based on criteria.

**Source Material**

- Geography–3 Human Geography, Department of Educational Publications.
- G.C.E. A/L Geography – Instructional Manual for Teachers.
- Other supplementary reading books.

**Annex 4.1**

Collect the relevant facts assigned to your theme/ heading and prepare a detailed report. Make use of rough sketches and maps where relevant.

| |
|---|
| **Group I**<br>– What are Settlements/ Introduce/ Define<br>– Evolution of settlements (stages in the growth) |
| **Group II**<br>– The differences between rural and urban settlements<br>– The basic features of rural settlements |
| **Group III**<br>– Rural settlement patterns |

### Activity-2

- Prepare a fact file including pictures which show the nature of diverse settlements in the world.

### Activity-3

- Prepare for an assignment which includes the factors of the location of settlements in the world.

### Activity-4

- Present the differences in rural and urban settlements by a group activity.

### Activity-5

- Prepare a short report explaining the criteria of classifying settlements.

### Activity-6

- Prepare a creative Information file discussing with examples various stages in the growth of towns.

- Evaluate all the above activities based on learning outcomes.

**Competency Levels :** 4.2 Classifies the main types of settlements in Sri Lanka according to location and functions.

**(**10 periods)

**Learning Outcomes :**

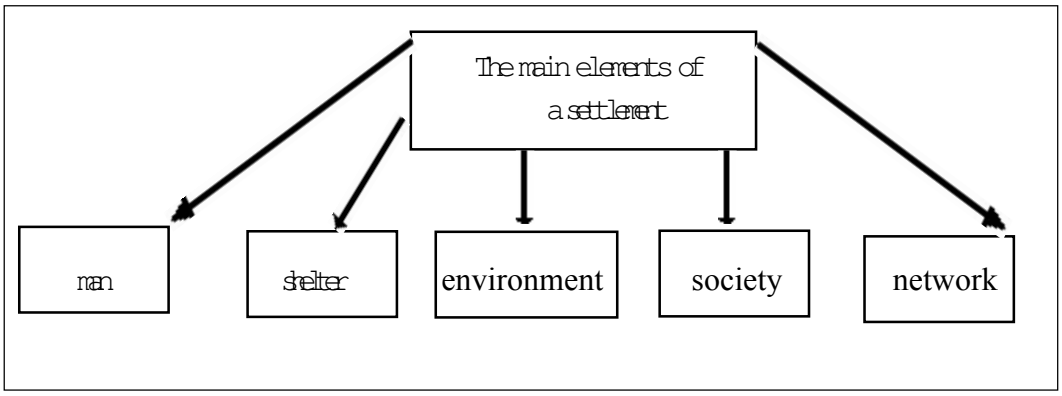
- Names the types of settlements in Sri Lanka.
- Explains the functions of settlements in Sri Lanka.
- Describes the trends in settlements of Sri Lanka.

## Introduction

A settlement is a unit built up to escape from the rigours of the environment and to get protection from wild animals and enemies. It is made up of houses as well as the environmental phenomena. The network of roads, channels and streams and electricity wires also belong to a settlement.

- The rock caves where fruit gatherers and hunters spend a night, the tents of herdsmen and the permanent houses of farmers are considered as settlements.

- The houses which people put up to live for a short period temporarily, the hamlets, villages, small towns up to the megalopolis are all settlements.




- The objective of teaching this unit is to classify the basic settlements according to location and functions.

## A Guideline to clarify subject content

### The types of settlements in Sri Lanka

1. Urban settlements
2. Rural settlements
3. Plantation settlements
4. Planned settlements

### Urban Settlements

- An urban settlement is a settlement where various functions such as minerals, industries, education, health, administrative, residential etc are centralized.
- It is a settlement where a dense population has concentrated in a limited area of land but with a high density and also where functions such as commercial, industrial, administrative and education are concentrated.
- An urban settlement is a land area where a number of people are organized in non agricultural activities are concentrated.

### The main features of an urban settlement

- Non agricultural
- Different from the pattern of life of rural people
- Greater space occupied by various buildings and built-up areas
- A crowd belonging to various ethnic groups, religions and castes live.
- Daily movement is greater .

### The diversity of functions in an urban settlement in Sri Lanka

1. Administrative towns
   Various administrative functions are located in these towns for eg. Sri Jayawardenapura.
2. Cultural towns
   Towns which are associated with diverse cultural affairs for eg. Kandy,Anuradhapura
3. Towns which are famous for leisure activities – Holiday homes, tourist towns which attract tourists for eg. Hikkaduwa
4. Residential towns
   Special towns created due to urbanization recently

### Towns can be classified according to the population

1. Large towns – the population is over 50000
   eg Colombo
2. Medium towns – population is 10000–50000
   eg. Kalutara
3. Small towns – population is below 10000
   eg. Kegalle

## Recent Trends in urban settlements in Sri Lanka

1. Development of Colombo as a metropolis
2. Growth of population in towns close to the colonization schemes in the Dry Zone
3. Slow rate of urban growth

## Shanties and slums

In the areas where urbanization has taken place shanties and slums have sprung up. Two types of slums associated with them can be identified

1. Line-houses
2. Slum-estates

- Houses have been constructed for the workers in factories and commercial activities. The area of each of these houses is 150-275 square feet.
- Line houses, slum estates can be seen in Kochchikade, Keselwatta and Panchikawatta within the city of Colombo.

The steps taken by the Government of Sri Lanka with regard to the problems of slums and shanties

1. Raising the standards of areas where slums are found
2. Relocation of people in the area
3. Relocation out of the towns
4. Providing financial facilities to build houses
5. Supplying sanitation facilities

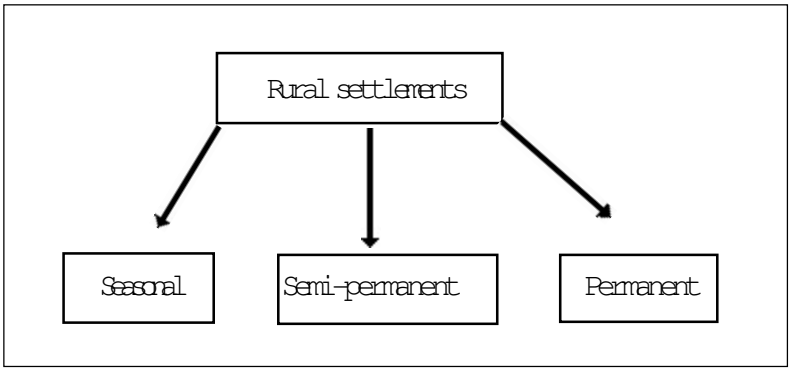
## The Growth of urban settlements in Sri Lanka

- After the advent of the Western Nations to Sri Lanka there was a rapid urbanization in Sri Lanka. The foundation for the urbanization in coastal areas was especially seen during the British administration.
- Growth of population due to the construction of railways, roads connecting Colombo with other places leading to exchange of goods.
- Birth of new towns such as Hatton and Nuwara eliya due to the concentration of estate workers brought from India.

## Rural Settlements

- Rural settlements are places where people engaged in primary activities live. Accordingly cultivation become permanent and supplemented by other activities such as
    - Gathering fruits and yams
    - Hunting
    - Rearing of animals
    - Fishing

  which reflect primary economic activities
- In rural settlements, people who are engaged in primary activities as their second employment and also people engaged in secondary or tertiary jobs also live. for example carpentry work, masonry and weaving of mats
- Sometimes, based on such jobs, names of villages have been created e.g. Kumbalgama, Wadugoda.
- When we look at the historical evolution of rural settlements, it is clear that there were people who had put up temporary settlements even after the permanent houses in the New Stone age.




### Several types of rural settlements can be identified in Sri Lanka

1. Ancient villages
2. Mahaweli villages
3. Estate settlements

## Ancient villages

Traditional villages built-up on the inherent features of Sinhala culture are called "Purana villages" (ancient villages)

- A villages is not a land area or a few farmers' houses which maintain traditional life. It is a lively environment where all the elements are mixed together.
- The Marxists have shown that the village is the main unit of the social and economic life where ancient citizen was in isolation.
- The term village is used to call the smallest populated unit among the settlements of Sri Lanka.
- The ancient villages (purana village) are mainly of two types
  1. The villages situated in association with the tanks in Nuwarakalaviya
  2. The other wet zone villages
- Very often the name of the tank is used to identify the names of ancient villages. The physical and cultural life of ancient villages has emerged out of the tank, field, chena, higher land and temple.
- The physical location of a purana village is mainly based on water.

An ancient village consists of six parts

1. Settlement
2. Tank
3. Ancient field
4. New field
5. Chena cultivation or higher land
6. Forest

In the Tank villages of the Dry Zone, land utilization patterns which are specifically for them are seen. This is a system of land utilization based on the tanks. Shown below is a simple model of the land utilization pattern of an ancient village in the Dry Zone.

- In a rural settlement during the early period, features such as houses, tank, fields, higher land, pastures and forest were present
- The higher land was set aside for houses, home gardens and chenas.
- The staple food was provided by paddy cultivation.
- The chenas were cultivated with kurakkan, meneri, maize, fruits and vegetables in home gardens.
- Rearing of cows to obtain milk and poultry to get eggs was carried out in home gardens.

When we consider how the rural settlements influence the economy of Sri Lanka, it is seen that most of the development schemes carried out are based on rural development at present.

## Estate Settlements

- With the colonization of Sri Lanka and the coming of Indian workers to work in the British plantations, estate settlements started.
- The infrastructure facilities in them are minimum. Hence standard of education, and health are at a low level.
- The school, kovil and shopping facilities are mostly seen in these settlements.
- Settlements are situated as lines close together .
- These are distributed mostly in the Districts of Nuwara Eliya, Badulla, Matale, Kegalle, Ratnapura and Kalutara.
- There are about 20 lakhs of people in estate settlements and it has influenced the growth of towns in the hills.
- Since gaining Independence, the state has taken several steps to raise the standard of living of the people in the estate settlements
  1. Improvement of sanitation facilities
  2. Providing single-housing schemes
  3. Construction of estate hospitals and appointing officers in order to raise the standard of health
  4. Increasing the salary scales of workers
  5. Providing food subsidies
  6. Improving community services by establishing libraries and playgrounds.

## Planned Settlements

- Settlements built up according to some plan for a specific objective is called a planned settlement.
  for example agricultural colonization schemes in the Dry Zone and Mahaweli settlements and Udagam
- The Mahaweli settlements are the foremost among them.
- In the Mahaweli area about 12053 hectares are under settlements.
- The cluster settlement scheme was introduced under Mahaweli settlements
- In a planned settlement every family is given land with irrigation facilities.
- Features such as cooperatives, schools, play grounds, Pre schools and cemeteries too are established.

The hierarchy of Planned Mahawli Settlements

1. Hamlet
2. Village Center
3. Block centre for eg. Siripura, Medagama
4. Townships for eg. Dehiattakandiya, Girandurukotte

Planned settlements are seen even in some towns for example Mattegoda.

# Teaching Learning Activities

## Activities

**Activity-1** Make an assignment including the basic features and pictures of the settlement types of Sri Lanka.

**Activity-2** Write an article to a newspaper about urbanization in Sri Lanka based on the features seen.

**Activity-3** Preparation of an Information sheet including new trends in the settlements of Sri Lanka.

Evaluate the above activities based on learning outcomes.

## Competency - 5

## Examines the main issues associated with urbanization in the world and proposes steps that could be taken in minimizing urban problems in Sri Lanka.

**Competency Levels :**

5.1 Explains the nature of world urbanization giving examples. (03 periods)

5.2 Examines the socio-economic issues of world urbanization (04 periods)

5.3 Discusses the environmental, health and sanitation issues of world urbanization (03 periods)

5.4 Examines the management phenomena of world urbanization (03 periods)

**Learning Outcomes :**

- Explains the nature of urbanization in the world
- Describes the issues in the socio-economic aspects of world urbanization
- Shows the environmental, health and sanitation issues associated with the world urbanization
- Explains the areas required in urban management.

### Introduction

Urbanization is one of the main social revolutions seen in the world. It was discussed in the earlier unit we studied that though there is no standard world criteria to define town within the settlement continuum in the world each country used various criteria to identify towns separately.

Since a town is significant as a place where diverse services such as economic, commercial, administration, education, leisure and residential purposes are centralized, a large number of people always migrate and move into the town. Hence town is a concentration of people. In developed countries as well as in developing countries, the people who live in rural and undeveloped areas migrate to urban areas with the hope of improving their socio-economic and physical (material) aspects in their life style.

Everyone who lives within the town limits are defined as urban people. When a number of people who centre round urban areas relative to the total population of a country it is called urbanization. In 1970, 32%, and 41.2% in 1980 and 45.2% in 1991 of the world population have lived in urban areas. In 2000, it is recorded as 45% while in 2008, about 50% of the world population live in urban areas. About 76% of people in developed countries and 40% of people in developing countries live in urban areas.

In this manner, urbanization is a global trend. A series of diverse problems have arisen associated with urbanization. By studying this unit it is expected to give an understanding to the students about the nature of urbanization, trends and solution to urban problems.

## A guideline to clarify subject content

### Definition of urbanization

- From the point of view of demography the concentration of people into urban areas out of the total population is called urbanization. Urban growth is the increase in urban population.
- Urbanization is a relative measurement. That is out of the total population of a country the number of people who live in urban areas as shown by the percentage.

$$\text{Urbanization index} = \frac{\text{the urban population in a country during a selected year}}{\text{mid year total population}}$$

### Characteristics of world urbanization

- Increase in urban population during the recent decades.
- The level of urbanization in developed countries shows a high value.
- The level of urbanization in developing countries shows a lower value than in other regions.
- Though Latin American countries like Venezuela, Chile, Uruguay, and Argentina are developing countries, their urbanization shows a high percentage of 90%.
- The least urbanization is seen in Africa.
- When we look at countries separately, vast differences in urbanization is seen.

| Region | 1950 | 1975 | 2007 | 2025 | 2050 | 1950-1973 | 1975-2007 | 2007-2025 | 2025-2050 |
|---|---|---|---|---|---|---|---|---|---|
| Africa | 14.5 | 25.7 | 38.7 | 47.2 | 61.8 | 2.28 | 1.28 | 1.10 | 1.08 |
| Asia | 16.8 | 24.0 | 40.8 | 51.1 | 66.2 | 1.42 | 1.66 | 1.24 | 1.01 |
| Europe | 51.2 | 65.7 | 72.2 | 76.2 | 83.8 | 1.00 | 0.29 | 0.30 | 0.38 |
| Latin America | 41.4 | 61.1 | 48.3 | 83.5 | 88.7 | 1.56 | 0.78 | 0.56 | 0.24 |
| North America | 63.9 | 73.8 | 81.3 | 85.7 | 90.2 | 0.58 | 0.30 | 0.29 | 0.20 |
| Oceania | 62.9 | 71.5 | 70.5 | 71.9 | 76.4 | 0.57 | 0.05 | 0.11 | 0.24 |
| World | 41.6 | 53.6 | 63.6 | 69.2 | 77.8 | | | | |

**Urban Population in a few selected countries**

| Country | Percentage of urban population | Country | % of urban population |
|---|---|---|---|
| World | 47 | Mexico | 74 |
| Developed countries | 75 | New Zealand | 77 |
| Developing countries | 40 | Papua Newguinea | 15 |
| Canada | 78 | Iraq | 68 |
| U.S.A. | 75 | Israel | 91 |
| Great Britain | 90 | Afghanistan | 22 |
| Sweden | 84 | Bangladesh | 21 |
| Germany | 86 | Indonesia | 39 |
| India | 28 | China | 37 |
| Sri Lanka | 30 | Russia | 73 |
| Singapore | 100 | Italy | 90 |
| Australia | 85 | France | 74 |
| Japan | 78 | Switzerland | 68 |
| Maldives | 27 | Denmark | 85 |
| Argentina | 90 | Saudi Arabia | 83 |
| Brazil | 81 | Thailand | 31 |
| Pakistan | 33 | Philippines | 47 |
| | | Nepal | 11 |

- The world's urban population which was 3.3 billion in 2007, is estimated to be increased to 6.4 billion that is it will double in 2050 A.C.
- However the urban population in developed countries is increasing at a low rate. In 2007, 0.9 billion urban population will increase to 1.1 billion by 2025.
- In regions of less development urbanization in Latin American and the Caribbean countries is 78% and it is a higher percentage than in European countries (72.2% in Europe).
- In less developed Asian countries the urbanization percentage is at a low level in 2008, in Asian countries it was 40.8% and in African countries it was 38.7%.

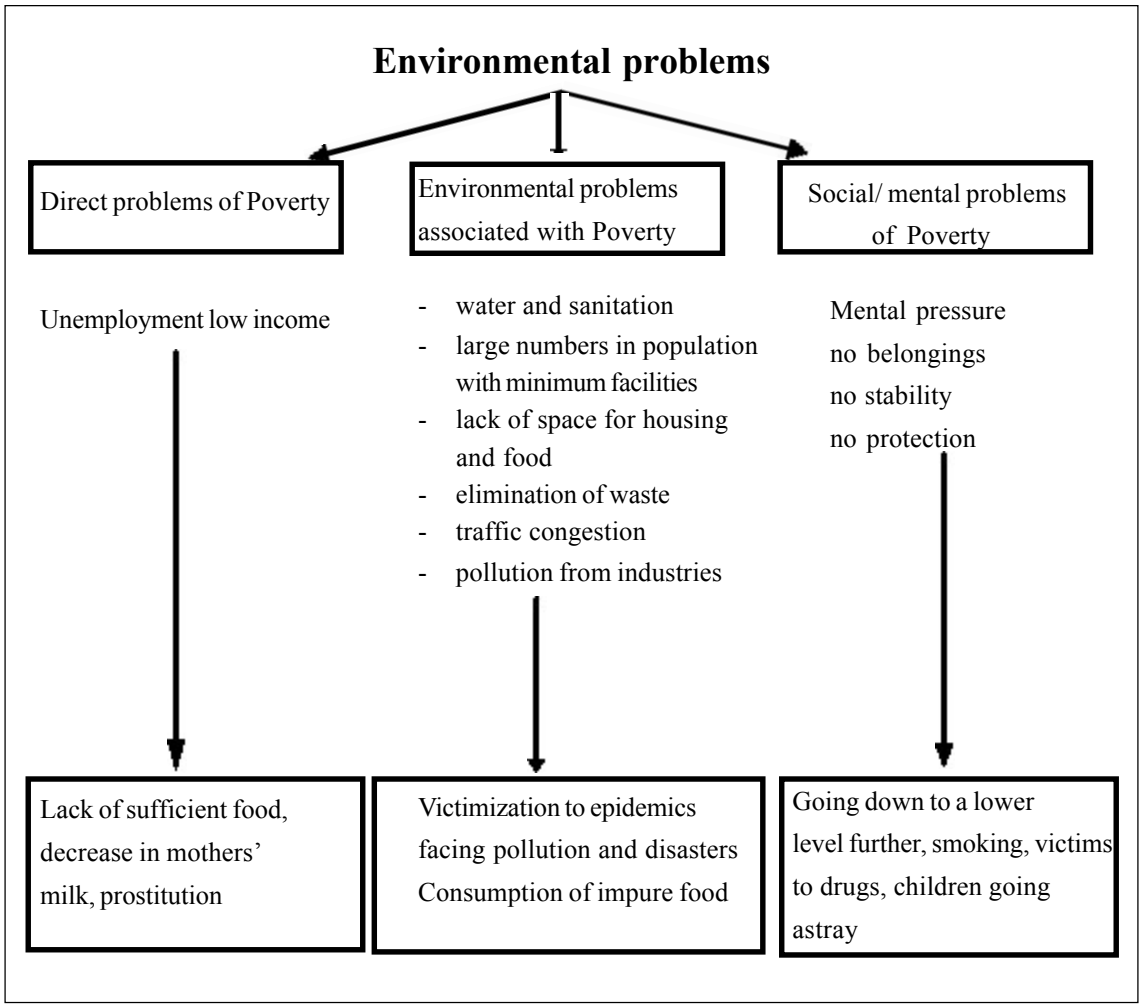
**The problems of urbanization**

- With the rapid urbanization taking place within a short period, in most of the countries, social economic and demographic repercussions are seen.
- Special characteristics and a series of problems associated with urbanization can be identified.
- The increase in low income group of families in urban areas (increase in urban-poor). This is one of the most serious problems in developing countries.
- Since it is not possible to find permanent jobs, the majority are attracted to activities like small trading, and providing various services which are jobs in the informal sector while some others resort to anti-social acts such as selling drugs, thefts, prostitution, begging and burglary.
- Since such crowds do not have a way of earning a living or a place of shelter, a large number have put up temporary houses within a small space of land and live. Very often these are unlawful shanties.
- These illegal shanty-dwellers do not have sufficient water and latrine facilities. Therefore they use common latrines and common taps.
- Hence the development of diverse social, economic problems in the communities who live under various disadvantages is a natural situation.
- Therefore a series of problems such as birth of a large crowd of unemployed youth, increase in a crowd who are engaged in unlawful activities due to lack of employment and conflicts in health, education and social aspects are seen.

## Urban Environmental Problems

- A strong impact is made on the urban environment through the elimination of artificial and solid waste by the factories, common welfare buildings and hotels as well as from the traffic congestion. This has contributed to –

    water pollution
    air pollution
    bio pollution
    noise pollution and
    land pollution




- There are a number of environmental health problems associated with urbanization.
- Problems with regard to drinking water.

## Urban Management

- Removing shanty and slum dwellers from their temporary houses and giving them lands from other areas.
- Improving slums and shanties and providing services and facilities. Under this, buildings and roads are improved and services and facilities are provided.
- Providing the facilities required in building houses and helping them.
- Preparation of a methodical programme of action for the elimination of waste and urban waste and recycling of waste.
- Preparation of strategies in improving community health.

# The Teaching-Learning Activities

## Activity

Preparation of a report to identify world urbanization and problems associated with it.

- This could be organized as a single activity or a group activity.
- Make sure that all the students are provided with the activity.
- Instruct them to find a world Atlas beforehand.
- Get the students engaged in the activity and give them the required guidance and instructions.

(1) Given below are the 19 cities over 10 million people in the world by 2007. Mark and name those countries in an outline map of the world.

**The million cities in the world in 2007**

| City | Population in million | City | Population in million |
|---|---|---|---|
| 1. Tokyo | 35.7 | 11. Los Angeles | 12.5 |
| 2. New York | 19.0 | 12. Karachchi | 12.1 |
| 3. Mexico City | 19.0 | 13. Cairo | 11.9 |
| 4. Mumbai | 19.0 | 14. Rio de Janeiro | 11.7 |
| 5. Sao Paulo | 18.8 | 15. Osaka | 11.3 |
| 6. New Delhi | 15.9 | 16. Beijing | 11.1 |
| 7. Shanghai | 15.0 | 17. Manila | 11.1 |
| 8. Calcutta | 14.8 | 18. Moscow | 10.5 |
| 9. Dacca | 13.5 | 19. Istanbul | 10.1 |
| 10. Buenos Ayres | 12.8 | | |

Source: United Nations, World Urban Profile 2007

Ø Data on urban percentage of population in the particular regions of the world are given in the Table below.

| Main Region | Urban percentage | | | |
|---|---|---|---|---|
| | 1950 | 1975 | 2007 | 2025 |
| Africa | 14.5 | 25.7 | 38.7 | 47.2 |
| Asia | 16.8 | 24.0 | 40.8 | 51.1 |
| Europe | 51.2 | 65.7 | 72.2 | 76.2 |
| Latin America and Caribbean Islands | 41.4 | 31.1 | 78.2 | 83.5 |
| North America | 68.9 | 73.8 | 81.3 | 85.7 |
| Oceania | 62.0 | 71.5 | 70.5 | 71.9 |

Source: United Nations, World Urban Profile 2007

- Mention 4 trends in the world urbanization during the period 1950-2025 from the above Table.
- Identify the factors that have led to the trends mentioned.
- Explain four problems associated with the urbanization in the world.

* Evaluate the above activities based on learning outcomes.

# Competency - 6

## Examines the main Issues in urbanization in Sri Lanka and presents suggestions for more effective urban planning.

**Competency Levels :**

6.1 Examines the nature of urbanization in Sri Lanka. (07 periods)

6.2 Analyses the socio-economic Issues of urbanization in Sri Lanka. (07 periods)

**Learning Outcomes :**

- Explains the nature of urbanization in Sri Lanka.
- Analyses the socio-economic issues of urbanization in Sri Lanka.
- Describes the future urban plans of Sri Lanka.

## Introduction

In Sri Lanka the criteria used in separating towns from the rest of the settlements is administrative functions. According to the Local Government Act of 1987, areas which are administered by Municipalities and Urban Councils are considered as urban settlements.

In 1980, there were 83 Town Councils, 37 Urban Councils and 14 Municipalities making a total of 134 urban settlements in Sri Lanka.

After 1987 with the implementation of the Pradeshiya Sabha Act, the Government accepted only the settlements administered by the Municipalities and Urban Councils as towns. Accordingly 42 Urban Councils and 18 Municipalities which includes 60 urban settlements are considered as towns at present (Urban Development Authority 2009)

In Sri Lanka there are only a few large scale towns. Among them Colombo, Kandy, Kotte, Dehiwala, Mount Lavinia and Moratuwa are important. Out of these towns Colombo takes the foremost place. A prominent feature in the urbanization of Sri Lanka is the evolution of Colombo as a metropolis after 1980. Hence Colombo is identified as a main city.

Urbanization in Sri Lanka is strongly seen in association with these main towns. Out of these, the urbanization rate of Colombo and satellite towns around it is very high. Though the level of urbanization in Sri Lanka is not so high as in other developing countries like Latin American countries, a series of problems associated with urbanization can be seen in Sri Lanka. These problems are more intense in areas in the Colombo metropolis.

By teaching this unit, it is expected to teach the level of urbanization in Sri Lanka, its patterns and processes and trends.

The percentage of urban population in Sri Lanka is 21.5% (2006). You will be able to get an understanding about the main issues of urbanization in Sri Lanka.

## A guideline to clarify subject - content

### Urban Settlement

- According to the Census Report of 1981, there were 134 towns but after 1987 with the change in the basis of creating towns the number of towns dropped to about 60.
- In 1981 most of the towns were small towns.
- Since 1987 the town councils were not considered as towns, a number of satellite towns and a few small towns which were in the neighborhood of Colombo and defined as towns till 1987 are considered as towns today.

### Urban level

- Relative to developing countries the growth of urbanization in Sri Lanka has taken place slowly.
- During the period 1871 to 1981 the growth of urban population has increased from 10.8% to 21.5%.
- The growth of urban population in Sri Lanka has taken place mainly in 3 ways.
  - Natural increase in urban areas
  - Migrations to urban areas
  - Naming some rural areas as urban areas

### The reasons for the low urban growth in Sri Lanka

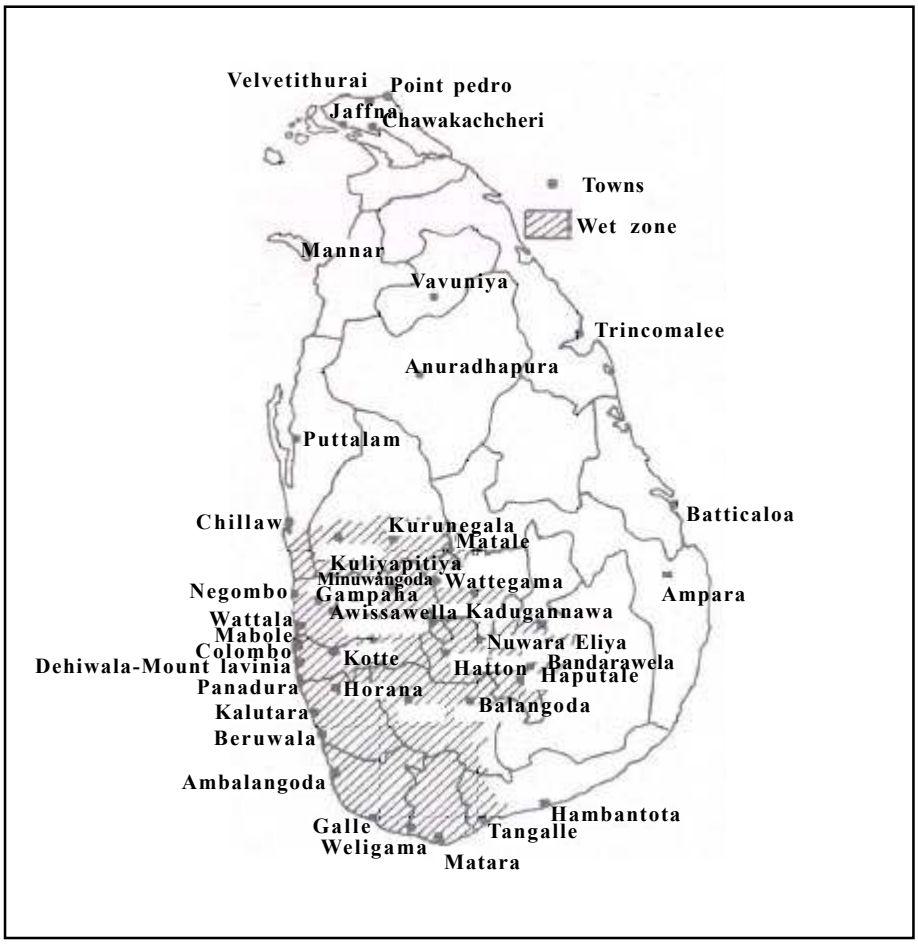
- No inequalities seen between village and town
- Resources directed towards primary regions
- With the development of transport, communication facilities the country has become smaller.
- The ability to travel to any part of the island within one day.

**The Distribution of Towns in 1981 and 1994 (including Northern and Eastern Provinces)**

| District | 1981 | Towns accepted Officially by 1994 |
|---|---|---|
| Colombo | 12 | 6 |
| Gampaha | 16 | 7 |
| Kalutara | 10 | 4 |
| Kandy | 7 | 5 |
| Nuwara Eliya | 4 | 3 |
| Galle | 9 | 2 |
| Matara | 4 | 2 |
| Ratnapura | 5 | 2 |
| Kegalle | 7 | 1 |
| Matale | 11 | 1 |
| Hambantota | 6 | 2 |
| Jaffna | 13 | 4 |
| Mannar | 1 | – |
| Vavuniya | 1 | – |
| Mulativu | 1 | – |
| Batticaloa | 3 | 1 |
| Ampara | 3 | 1 |
| Trincomalee | 4 | 1 |
| Kurunegala | 5 | 2 |
| Puttalam | 7 | 2 |
| Anuradhapura | 2 | 1 |
| Polonnaruwa | 2 | – |
| Badulla | 7 | 3 |
| Moneragala | 1 | – |
| | 134 | 51 |

Source: 1981 Census Records, 1994

## Towns in Sri Lanka, 1996




**Source: Human Geography I, Educational Publications Department**

- Only 7 cities are seen in Sri Lanka – Colombo, Kandy, Kotte, Dehiwala, Mt. Lavinia, Jaffna, Moratuwa.
- Out of these major towns, Colombo is the foremost from the point of view of population as well as urban functions.
- In 2006, the percentage of urbanization in Colombo was 54.7.
- The evaluation of Colombo and its neighbourhood as a metropolis is also a significant feature. The Urban Development Authority has accepted the whole of Western Province as the Colombo metropolis.

- Five main aspects seen commonly in a metropolis are identified in association with the Colombo metropolis

  The main parts of Colombo metropolis

  1. Central city of Colombo.
  2. The satellite towns around the central city.
  3. The rurban zone.
  4. The isolated towns within the rurban zone.
  5. Sri Jayawardenapura new town which includes the above 2nd and 3rd parts.

**The Problems in Urbanization**

- The problems associated with urbanization are most intensively seen in Colombo and the surrounding densely populated satellite towns.
- These problems are seen in other main urban areas.
-

  - **Housing Problems**

    - One of the main problems confronted by the urban low income poor people is the inability to obtain houses and the lack of sufficient water and sanitation facilities.
    - Hence the majority of the low income people living in towns live in shanties and slums without any service facilities.
    - These unlawful shanties and slums are constructed near railway lines, along roads and canals, reserved lands on either side of rivers, marshes; low lands that get inundated very often and other lands belonging to the government.
    - Usually a shanty is 100-125 sq. feet in area and the roofs and walls are covered with canvas, tar sheets, tin sheets and boards.
    - In most of these shanties more than six individuals live while in some there are more than one family.
    - Problems of water and sanitation facilities.
    - Insufficient water and sanitation facilities in shanties and slums is also a serious problem.
    - A few latrines and a few water taps provide the needs for a whole complex of shanties.

  - **Environmental pollution**

    - One of the main problems that arise with urbanization is environmental pollution.
    - One of the main reasons that cause pollution is the arrival of a large number of vehicles to the town. It is revealed that about 250000 motor vehicles come to Colombo City daily.
    - The localization of a large number of factories in the urban area is another reason for environmental pollution.

- Another factor that leads to environmental pollution is the accumulation of waste matter released by trade stalls, houses, government institutions and other places at various points in the cities.
- During heavy rains shanties and the roads around get inundated.
- Social problems arise due to the proliferation of urban poor for eg. the human-social degeneration caused by the unfavourable environment associated with shanties due to irregular trading, illicit trade, prostitution, theft, pickpockets, drug trafficking and other acts of social abuse.

## Urban Management

As a solution to the problems associated with urbanization present in Sri Lanka, solutions have been presented in the works Sri Lanka by 2003, National Physical Planning Department. It includes physical planning policy and plan, future development of physical structures and a guideline regarding environmental conservation.

### National Physical structure plan

- The relationship among eco-sensitive regions, city zones, and the infrastructure facilities of cities will be identified through the National Physical Plan.
- This structure Plan gives a guideline about reaching the fundamental elements in the National Physical Planning Policy.
- The field patterns established by the National Physical Plan expects a total development of Sri Lanka through the protection of environmental zones, encouraging urban centres and improving socio-economic activities.
- It is expected that through the fundamentals in this plan, the imbalance in the relationship among ethic groups, land utilization, transport, will be minimized.

### The Basic physical aspects in the Structure Plan

### Main urban zones

- The Southern Province Great urban zone with Hambantota as the central city
- The W estern Province Great urban zone connecting the main cities of Colombo, Kalutara and Gampaha.
- The Northern Province Great Urban Zone centred round Jaffna, the major town.
- The North Central Province Great urban zone connecting Trincomalee, Anuradhaphra, Dambulla and Polonnaruwa, the major towns.
- The Eastern Province Great urban zone connecting the main towns of Ampara and Badulla.

**The Main Roads**

- The Southern Expressway (Colombo-Matara).
- Extension of the Southern Expressway (Matara-Hambantota-Moneragala)
- Construction of Kandy Expressway
- Hambantota, Batticaloa-Trincomalee Road (The main roads connecting south and east)
- Negombo-Mannar Road
- Colombo-Jaffna Road
- Colombo-Trincomalee Road

**The Main Railway lines**

- Hambantoata-Batticaloa (Hambantota, Moneragala, Oluvil via Ampara)
- Kurunegala-Habarana via Dambulla
- Chilaw-Habarana
- Colombo-Ratnapura-Hambantota
- Hambantota-Moneragala-Batticaloa
- Batticaloa-Trincomalee
- International Asian Railway, Hambantota-India

**The Main Ports**

- Hambantota
- Kankasanthurai
- Trincomalee
- Colombo
- Galle
- Oluvil

**The Main Fishing Harbours**

- Trincomalee, Kankasanthurai, Galle harbours
- Arugam Bay, Point Pedro, Thoduwawa, Chilaw, Puduwakattuwa, Kandakuli, Dickwella, Ambalangoda, Dodanduwa, Kalametiya, Negombo

## The Proposed Power Plants

- Trincomalee – power plant associated with waves

- Chillaw
- Nuwara Eliya
- Oluvil
- Mulativu
- Hambantota

– to be powered by wind

- Kalpitiya
- Hambantota

– coal – powered

- Trincomalee
- Matale
- Ratnapura
- Mannar
- Badulla
- Nuwara Eliya

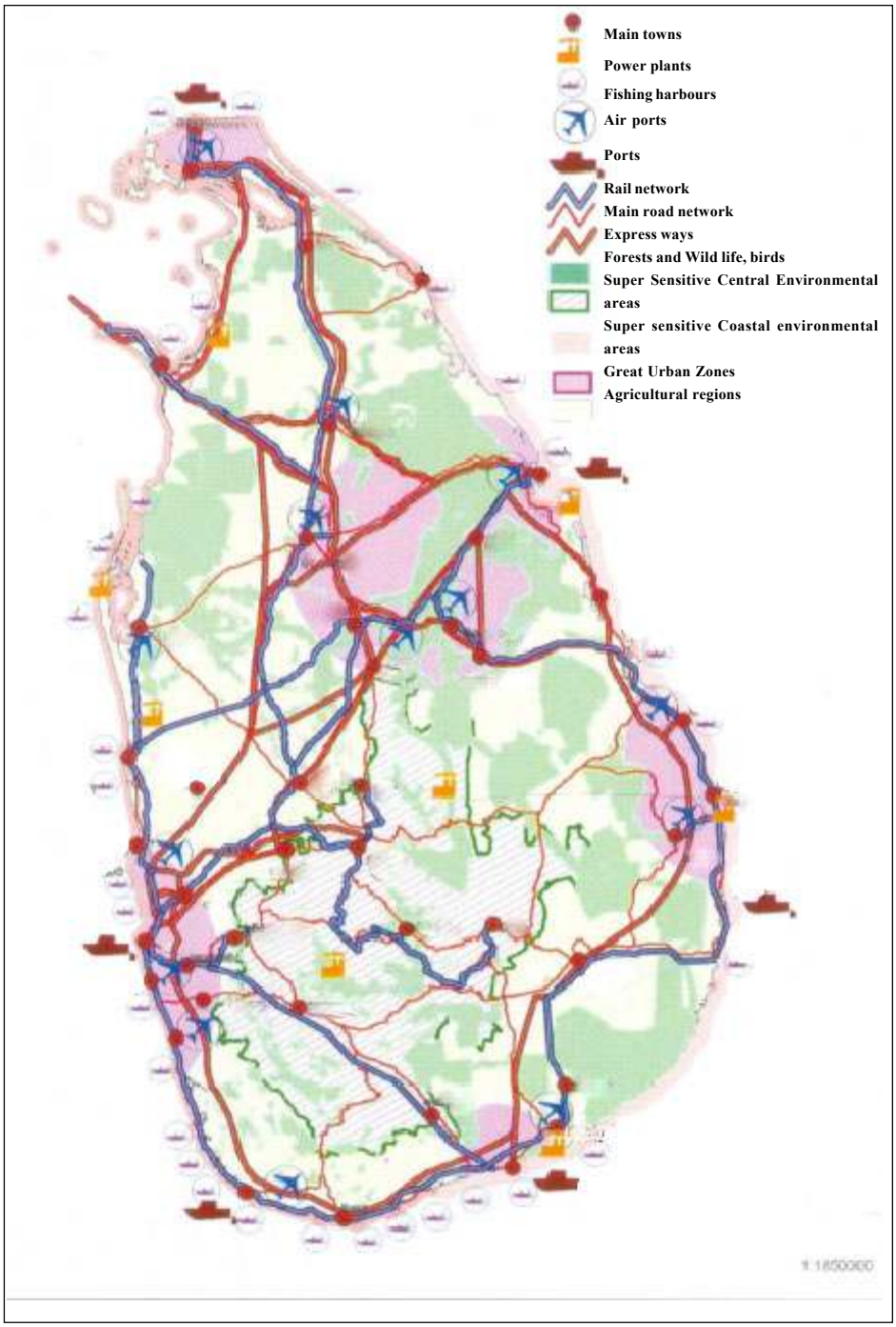
– power plants which can re-generate

## Main Air Ports

- Katunayake – 1st International Airport
- Hambantota – 2nd International Airport
- Hingurakgoda – 3rd International Airport
- Ratmalana
- Jaffna
- Vavuniya
- Trincomalee
- Anuradhapura
- Puttalam
- Dambulla
- Batticaloa
- Ampara
- Kalutara

## Capital Cities of Districts

- Mannar
- Kilinochchi
- Mulativu
- Varuniya
- Puttalam
- Kurunegala
- Matale
- Kandy
- Kegalle
- Nuwara Eliya
- Badulla
- Ratnapura
- Moneragala
- Galle
- Matara




Source: Sri Lanka by 2030, National Physical Planning Department

## Teaching learning Activities

### Activity

- Prepare a short report on the nature of urbanization in Sri Lanka referring to newspapers, magazines, source books.
- Prepare a Project in relation to socio-economic issues of urbanization in Sri Lanka.
- Conduct a brain-storming discussion about the future urban Plans of Sri Lanka.
- Evaluate the above activities based on learning outcomes.

# Geography III
# Practical Geography

# Competency - 1

## Uses Geographical Methodologies in Analysing, Interpreting and presenting Data and Information

**Competency Level :** 1.1 Examines the importance of Practiral Geographical Studies. (10 periods)

**Learning Outcomes :**

- Presents visibly the physical and human phenomena of the landscape according to time and space.
- Presents information qualitatively and quantitatively.

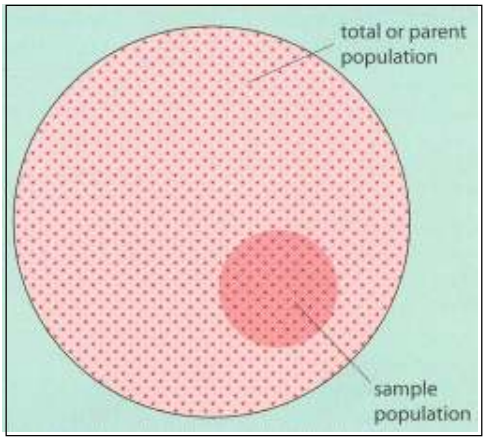
## A guideline to clarify subject content

- In studying the physical and human features on the earth through a geographical perspective, time and space is an important criteria.
- As stated by Peter J. Taylor (2003), time and space in the universe is a basic physical measurement. Time is used to measure differences. It includes changes in society too.
- In Geography, the spatial concept is important when studying the relationship between man and environment, it is important to identify the spatial pattern in the particular variables.
- Accordingly, it is a basic task of the geographer to identify the spatial pattern within each phenomena and among the phenomena. The visual presentation of physical and human phenomena in the landscape based on time and space is a prominent feature in Practical Geography.
- Distribution in time and space are studied mainly through the techniques in Cartography related to the section in Practical Geography.
- Time and space are basically represented through thematic maps. In the representation of physical facts, geological maps, soil maps, natural vegetation maps and hydrological maps are used.
- In representing human activities, political divisions, Regional maps, provincial maps, district maps, land utilization maps, population maps, historical maps, satellite maps and aerial photographs are used to show distributions in time and space.
- In the past, information was represented according to time and space by taking three-dimensional features of the earth to two-dimensional plane surfaces.
- At present, the spatial distributions in the physical and human landscape of the earth is represented three-dimensionally by means of satellite technology.

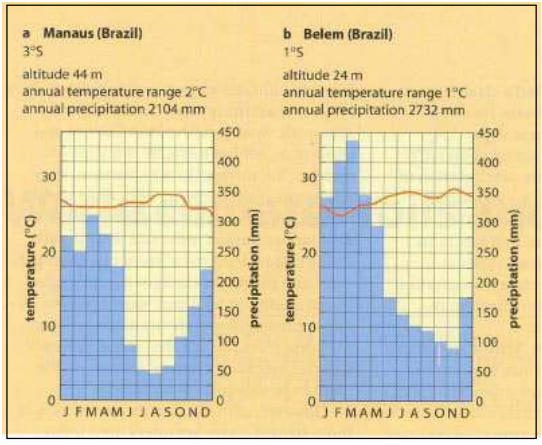
## Three dimensional satellite maps

- The three dimensional maps are used for multiple purposes.
- In the maps prevalent in the past, it was possible to identify certain places by the latitudes and longitudes. Now it is possible to identify the specific location of any place in the world at the same moment by the instrument called Global Position system (GPS). The data on time and space relevant to Practical Geography are collected from various sources and represented by various methods:
  - statistical methods
  - maps and graphs
  - models and flow diagrams

  A few examples for the above methods are given below



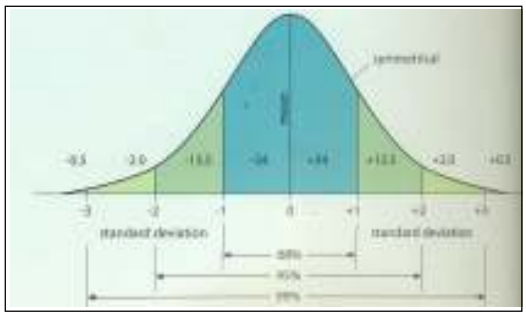

**Sample**




**Graph**

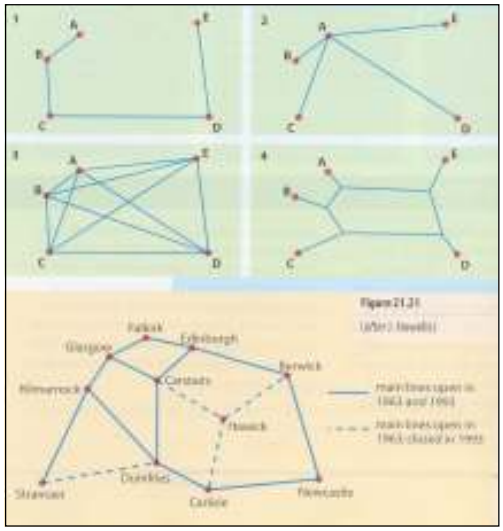
Source: Waugh David, Geography An Integrated Approach (1995)

**Standard Probability Curve**



**Graphycal diagram**

**Linegraph**



Source: Waugh David, Geography An Integrated Approach (1995)

# The Teaching Learning Activities

## Activity 1

Through this activity, it is expected to identify the basic concepts and techniques which can be used in representing time and space in geography. This is an Activity which can be done as a group activity.

- By this time students have learnt about geographical techniques to a certain extent. Though you have used them you should direct your attention in learning them theoretically through 'time and space'.
- You should also examine how geographical information is represented in geography books, newspapers, reports, magazines, world maps and Encyclopedia etc.
- Study the information mentioned above and get the students' attention to present a short report creatively done.

  For example: a flip chart, a fact file, a poster, a power-point presentation etc.
- Before doing this activity introduce the basic geographical techniques.
- It is important to explain them with examples.
- Find some Atlases, magazines, books, reports and Encyclopedic prior to the lesson.
- Direct students in exploration work.
- Give marks to the groups on the basis of learning outcomes where information is presented qualitatively and quantitatively in a creative manner.

## Activity 2

- Select a geographical problem or a situation. The Project report on it should be prepared using geographical techniques to explain it.
- This is a single activity.
- Direct students to present it creatively using correct cartographical techniques when presenting the problem or situation.

* Connect this activity under evaluating Activity 1 based on school-based assessment.

**Competency Level :** 1.2 Uses new cartographic techniques.

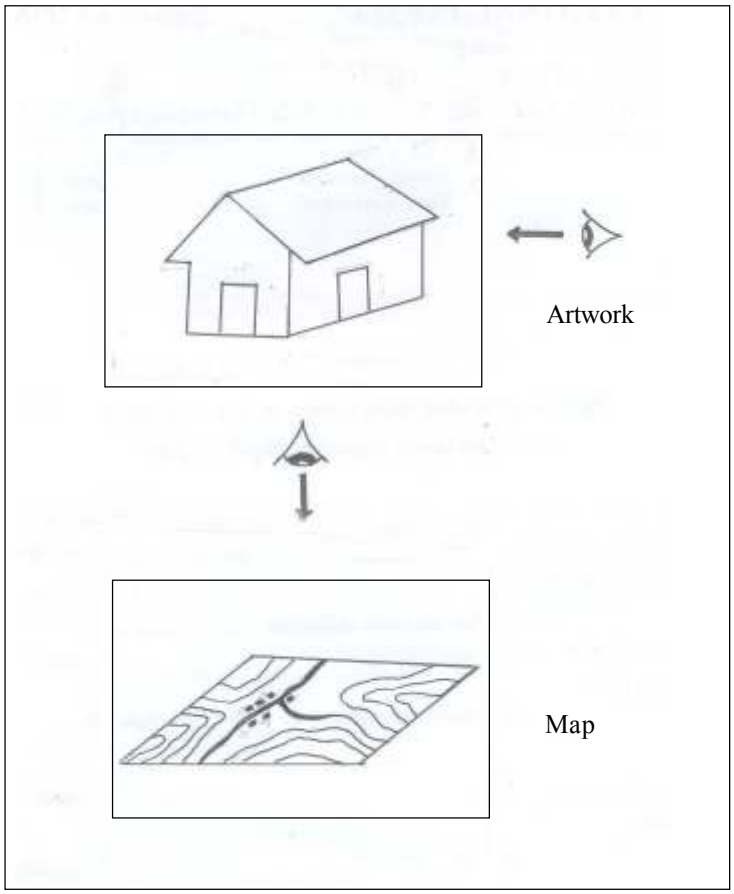
(15 periods)

**Learning Outcomes :**

- Identifies various types of maps.
- Explains the new techniques used in maps.

## A guideline to clarify subject content

- The map is the universal medium of expression to show the location of the world we live in and the exterior regions.
- Our ancient people who were engaged in various territorial discoveries, have made maps to their ability to explain to the others the world they identified and knew.
- Diverse topographical features seen on land can be shown roughly on a map.
- A map is the concise representation of a long printed description in words by using symbols, colours and letters.
- The oldest map of the world is the town plan of old Mesopotamia drawn on a clay tablet about 5000 years ago.
- Irwin Raisz has stated that map is the standard drawing of the pattern of earth as seen from above.
- A difference between a map and a drawing can be identified.
- An artwork is created by looking at an object or a landscape horizontally.




- If an object or a landscape is viewed from the sky above they are seen as a two dimensional plane.
- A landscape has a three-dimensional shape but a map drawn on a plane surface is two dimensional.

A diagram which represents various three – dimensional shaped features on the surface of the land according to a scale on to a flat surface is called a map.

## Various Types of Maps

### Thematic maps

- Maps can be used to represent various information.
- Maps are made according to the information in them under various themes.

Thematic maps which represent physical facts

- Geological maps
- Relief maps
- Climate maps
- Soil maps
- Natural vegetation maps
- Hydrological maps

**Administration maps**

- Political maps
- Regional maps
- Provincial maps
- District maps

**Land Utilization maps**

- Cultivation
- Settlements

**Population maps**

- Distribution of population
- Density of population

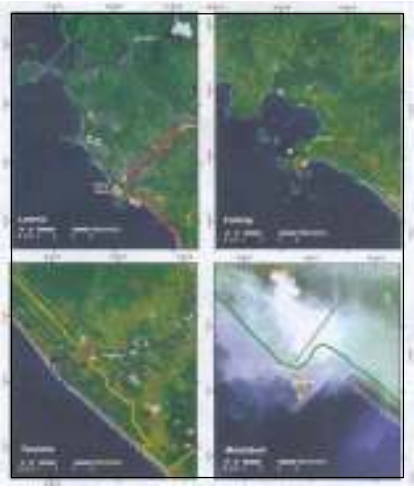
**Historical maps**

- Distribution of colonies
- Distribution of Exploration
- Ancient cities

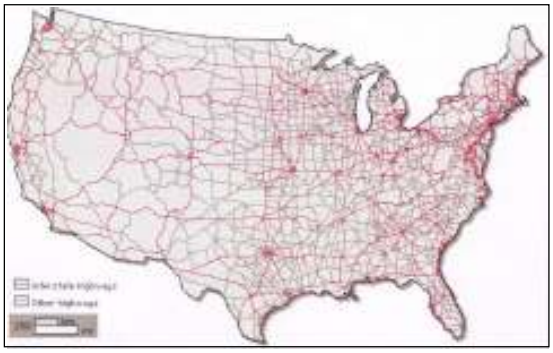
**Satellite maps**

- Aerial photographs

**Physical maps**

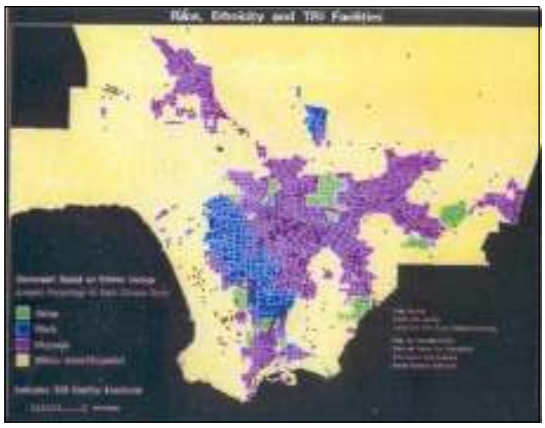


**Land utilization map**



**Political boundaries map**

**Population map**



**Historical map**

**Topographical map**

### Topographical Maps

- A topographical map is a map that shows the relief features, drainage and various cultural features on the land.
- Topographical maps are constructed to represent the form of land more effectively combining a few themes using the elements of a map such as direction, scale and location.
- In Sri Lanka topographical features were shown by the One Inch Map earlier which was converted to the Metric map now used as the Topographical map.
- 1:63360 one Inch Map was drawn using the British measurements of inches, feet, chains, furlongs and miles.
- From the 1980 decade Sri Lanka turned to use metric maps when the Sri Lanka Government accepted that she should also use the metric system for maps since it is an International measurement unit.

### The Uses of Topographical Maps

- The ability to identify the specific and relative location of any place on the land.
- Identifying different types of physical features and understanding the connection between topographical features.
- Understanding about the relationship between the physical characteristics and human activities.
- The ability to gain understanding about the physical features and human activities.
- Understanding about the relationship between relief and drainage patterns.
- Making use of these maps for development work.
- The ability to interpret the whole environment.
- Identifying political boundaries clearly.

### Use of new technology for maps

- With the development of information technology there was an improvement in the field of cartography.
- The Geographical Information System can do the analysis, synthesis and representation of geographical information correctly within a short period with the use of computers.

**A Geographical Information System map**

- After analysing the information provided by GIS map, presents various data as facts bringing out various stratum patterns.
- Every information is stored in the computer in memory pattern and can be presented comparatively through maps and diagrams when need arises.
  for example
  - Distribution of land utilization
  - Distribution of population
  - Agricultural patterns
  - Transport activities
  - Drainage
- In this manner, distribution of land could be presented comparatively with the distribution of population and could be combined with the transportation network.
- Geographical Information System facilitates to get various data for many requirements in the form of information. After 1973, the Defence Department in U.S.A. introduced this system for the first time.

## Geographical Position System (GPS)

- The Geographical Position System is a modern technological methodology used for navigating guiding air/ naval, and land means of travel at present (space-based) radio navigation system. This is operated by combining 24 satellites.
- This enables to identify the precise location of any area.
- This system supplies information throughout twenty four hours at a uniform rate.

## Teaching-Learning Activities

### Activity -1

Complete this Table referring magazines, books, and Atlases to identify Thematic maps.

| Type of Map | Name of book and heading | Why you select it |
|---|---|---|
| Geology | | |
| Relief | | |
| Hydrology | | |
| Soil | | |
| Climates | | |
| Natural vegetation | | |
| Political divisions | | |
| Distribution of crops | | |
| Animal husbandry | | |
| Distribution of population | | |
| Transport | | |
| Satellite Images | | |
| Aerial Photographs | | |

## Activity-2

### Step I

The teacher should present a power point presentation of or another type of presentation about a situation where various thematic maps could be used.

### Step II

- Group the class
- Direct students to explore about various thematic maps

### Step III

- Give the students time to present the information they found out.
- Give time to explain about those presentations.

### Assignment

- This is a single activity for the preparation of a file of various thematic maps after considering from a global and national level.
  for example, themes such as weather and climate, physical landscape, land utilization, socio economic.
- Hold an Exhibition with the creative work of every student in class.

## Competency - 2

## Acts with an understanding about the basic concepts and methodologies that help in comprehending the Physical and Human Landscape.

**Competency Levels :**

2.1 Identifies the forms of physical features shown in a map. (10 periods)

2.2 Identifies the nature of cultural features shown in a map. (10 periods)

**Learning Outcomes :**

- Identifies the physical and cultural features in the 1:50000 metric maps.
- Draws the physical features represented in 1:50000 metric maps.
- Draws the cultural features represented in 1:50000 metric maps.

### A guideline to clarify subject content

- Identifyies the physical and cultural features represented in a map.
- Identifies the physical and cultural features in 1:50000 maps.

**Physical features**

- Plain, ridge, highland, undulating land
- Slope

  Gentle slope, steep slope, convex slope, concave slope, escarpment slope, uniform slope, symmetrical slope, asymmetrical slope
- Mountain crest, conical hill, isolated hill, plateau, dissected plateau, valley, spur, gap
- Drainage patterns

  Dendritic, trellis, radial
- Sandreef, islands, bays, lagoon, headlands
- Natural vegetation

  forests, woodlands, marsh, mangroves, grassland

## Cultural features

- Irrigation
  Tank, dam, channel, abandoned tank, embankment
- Boundaries
  District boundaries, provincial boundaries, Divisional secretary divisions, Gramaseva officers divisions, Town council limit, Forest Reserve, Sanctuary
- Roads
  Main roads (A grade and B grade)
  Other roads
  Jeep tracks and cart tracks
  Footpath
- Other features related to roads
  Tunnel, ferry, causeway, bridge, footbridge, culvert
- Railway lines (single, double)
- Other features related to railway lines
  Tunnel, bridge, level crossing, unprotected level crossing, embankment, cut, railway station, road above river, road under the bridge
- Crops
  Paddy, tea, rubber, home gardens, other crops
- Other features
  Settlements, built up areas, special buildings, public service centres, religious places, tourist information

# Teaching learning Activities

## Activity 1

- Group students. Let them observe Metric Maps showing diverse physical features. Get them to identify the physical and cultural features in them. Make them to draw or create such features and give the chance to present them.
- Students should do a single activity in preparing a field book including the features thus created.

## Activity 2

- Select the physical and cultural features given below from parts of Metric maps and explain the special features in them.
  coastal areas
  hilly areas
  peneplain areas
  urban areas
- Do this as a group activity.
- Give marks to each of the groups based on learning outcomes.
- Direct the students to make a file with descriptions about the above features from a collection of such maps.
- Use the school-based 4 evaluations for this activity.

# Competency - 3

## Uses the Holistic Approach in understanding, analysing and interpreting the Physical and Human landscape

**Competency Level :** 3.1 Interprets the information included in a map.
(14 periods)

**Learning Outcomes :**

- Identifies the nature of the physical and cultural features included in a metric map.
- Comprehends the inter-relationship of the physical and cultural features included in a metric map.
- Interprets a Metric Map.

## A Guideline to clarify subject content

## Interpretation of Information in a map

### Physical features

- relief
- drainage
- natural vegetation

### Cultural features

- settlements
- transport
- agriculture
- irrigation
- others (tourist information, religious information)

### Inter-relationship between the physical and cultural features

- Inter-relationship among physical features (between relief and drainage)
- Inter-relationship among cultural information
- Inter-relationship between physical and cultural facts (cultural factors determined by physical features)
- Interpretation of maps

### Maps can be interpreted in two ways

1. Interpreting the map as a whole (relief, drainage, vegetation, roads)
2. Interpreting the map on the basis of regions (highlands, lowlands etc)

**1) Interpretation of the map as a whole**

Step 1: Relief features

valleys, spurs, lowlands, highlands, plains, ranges, plateaus, slopes and the nature of slopes

Step2: Drainage features

River systems, direction of flow, form of rivers

Step 3: Vegetation

forests, grasslands, woodlands, mangroves, marshes

Step 4: Land utilization

agricultural activities, irrigation, settlements, roads etc.

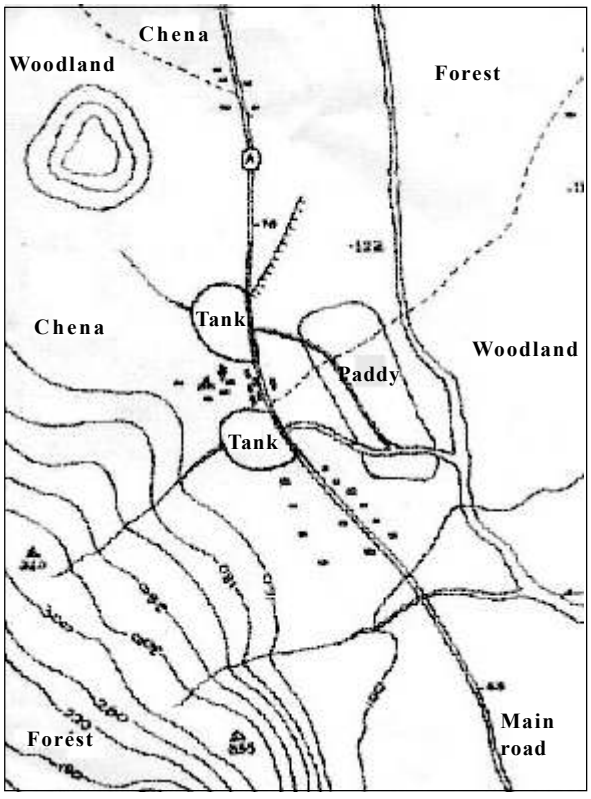
Step 5: The relationship between the physical and cultural features in the mapped area.

**2) Dividing the map into regions and Interpretation**

Step 1: Identifying the conspicuous features in the mapped area.

Step2: Division of the map into regions according to the physical and cultural features.

## Model Map



**Highland region**

- Highlands of 100-360 m in elevation in the southwestern part of the map consists of steep slopes.

**Lowland region**

- In the northern area it extends widely
- somewhat narrower in the south
- An undulating land seen

**Drainage**

- The rivers flows towards the south-east
- A few tributaries join the river
- Tanks seen associated with the main tributaries

**Natural vegetation**

- Woodlands
- Forests

**Settlements**

- Agricultural settlements
- Linear settlements

**Human activities**

- An agricultural region
- Paddy cultivation distributed near tanks
- Irrigated water

**Transport**

- Areas where main roads run
- Distribution of minor roads
- Distribution of foot paths

Relationship between physical and cultural activities seen.

# Teaching-Learning Activities

## Activity -1

In this activity attention is given to the manner in which physical facts in a metric map is interpreted.

- Introduce the physical features in the mapped area
  relief
  drainage
  natural vegetation
- How to divide the map into regions based on physical features (especially relief)
- When interpreting take extracts of parts showing special features relevant to interpretation (5x5 cm squares)
- How to analyse the physical features in the map with regard to the above

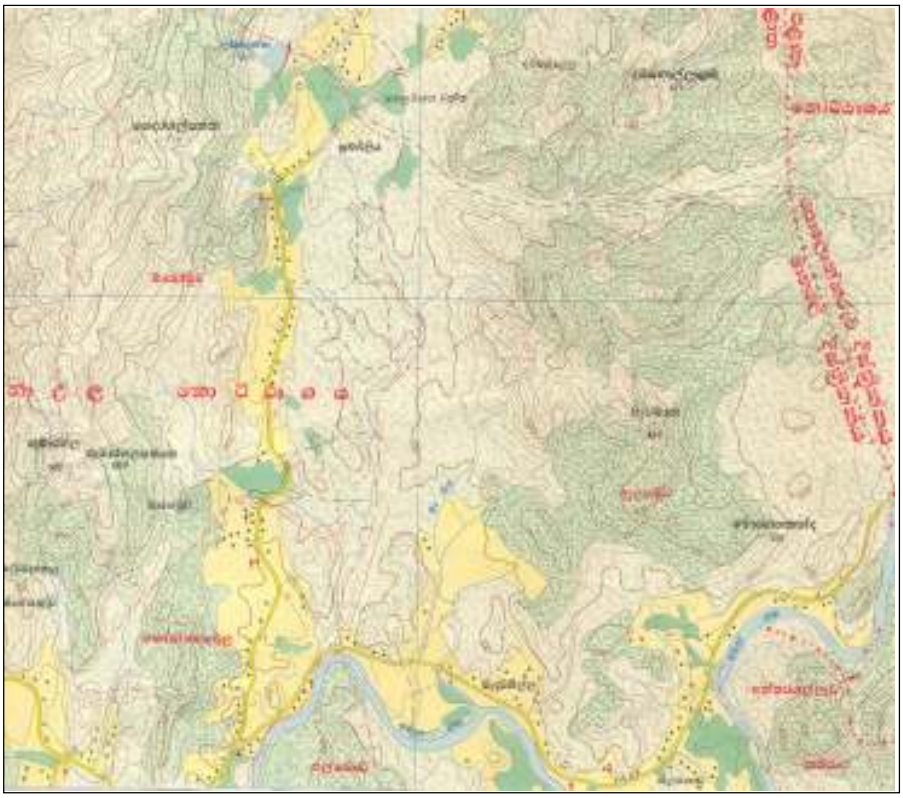
* Discuss with pupils how to interpret a map taking into consideration the above facts.

- Group the class as suited.
- Provide the Annex I to the groups (either the 1:50000 map or the maps supplied)
- Give a work sheet to each of the groups according to the instructions in it, get the students engaged in the activity while giving them instructions required to interpret the map provided.

## Work Sheet

- Divide the map into regions based on elevation. Take 2 or 3 regions as relevant.
- The physical features seen in the regions as divided – Interpret on the following themes
  nature of relief features
  drainage
  natural vegetation
- Take 5x5 cm squares – Taking extracts from the whole map of special topographical features, do an interpretation of the topographical features of the whole map.
- Give marks to student creations based on criteria given.

**Annex I**



1:50,000

## Activity 2

By this activity attention is given to interpretation of cultural information included in the metric map.

- Introducing cultural features in the mapped area
- Type of settlements, distribution and patterns of transport, crops grown, irrigation, others (historical places, special buildings)
- The relationship between physical features and cultural features
- The relationship between transport and settlements
- The relationship between drainage and agriculture
- Discuss with the students how to interpret the cultural environment in the map under the themes given above
- Make the pupils understand this

For the activity provide the map given here or a part of a map which shows clearly the cultural features. Provide sufficient maps to the groups

- Divide the class into 3.
- Provide the assignment sheets (relevant map) among the groups.
- Give instructions required for each of the groups.
- Assign the task and get them engaged in exploration.
- Give marks for the student creative work on the basis of criteria given.

## Work Sheet

### For Group I

i. Interpret the settlement patterns, settlement types, distribution of settlements in the mapped area.

ii. Identify three types of settlements and extract them from the map and draw them in 5x5 cm squares. Interpret them separately.

### For Group 2 - Work sheet

i. Present an interpretation of the nature of the transport system in the map and its special features.

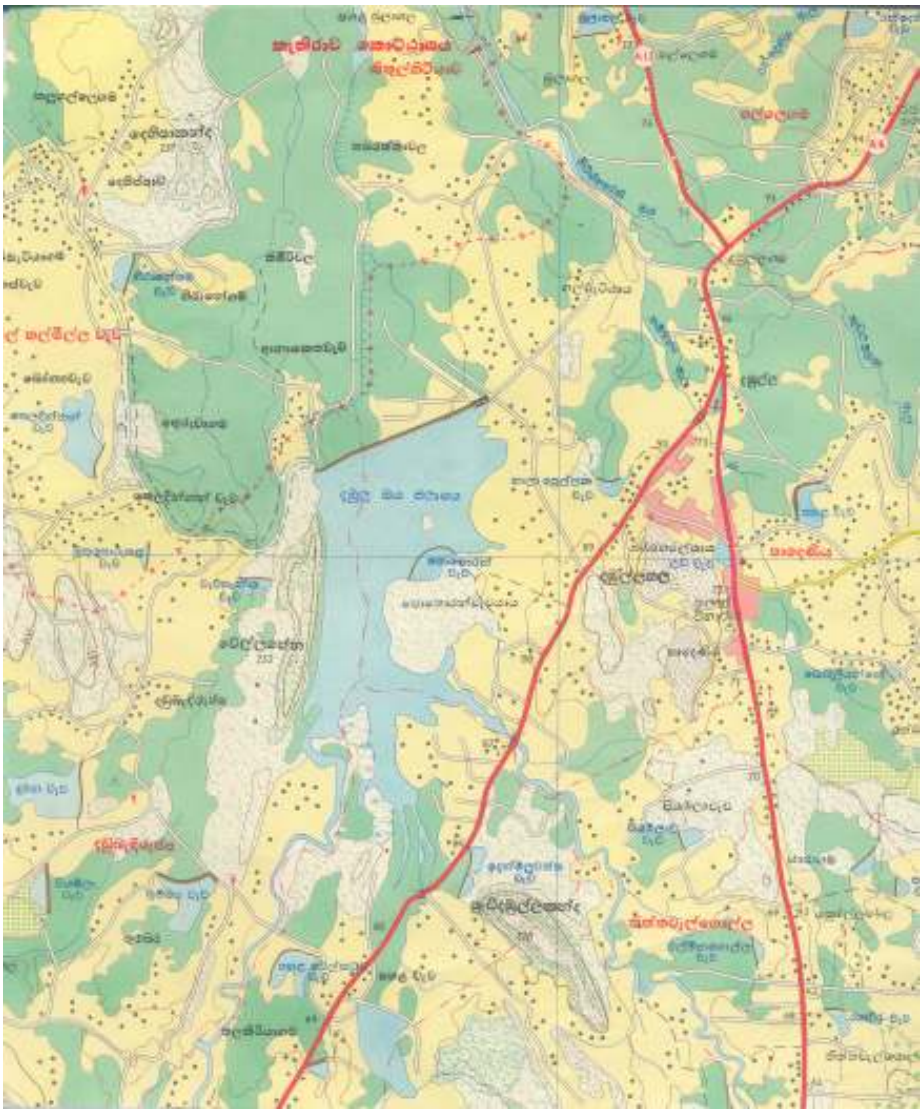
ii. Explain the relationship between the transport system and distribution of settlement patterns.

**Work Sheet**
**For Group 3**

i. Present a general interpretation of the distribution of agricultural activities, its nature and types found in the map.

i. Describe the irrigation and examine the relationship between irrigation and agriculture.

**Annex**



1:50,000

**Competency Level :** 3.2 Uses maps for purposes in real life
(10 periods)

**Learning Outcomes :**
- Uses maps for various needs

## A guideline to clarify subject content
## Using maps

### Reasons for the importance of using maps for real life situations

- That the map is the most convenient way of getting a clear understanding about the physical and cultural landscape of any region.
- That all the information about the physical and cultural landscape cannot be seen by the eyes as they are not within the visible distance.
- The ability to obtain a total understanding about the physical and cultural landscape of any area.
- The ability to comprehend the inter-relationship among the physical and cultural information in any area.

### The uses of maps in various tasks

- Determining direction
- Determining distance
- Getting an understanding about the size of the area
- Knowing the distribution
- Getting to know the nature of the location of physical features
- To know about the distribution of cultural information
- The location of other phenomena relative to any precise fact

### Various situations when maps are used

- floods
- landslides
- tourist activities (local/foreign)
- settlements
- land utilization
- unexpected emergency situations

### How maps can be used in various situations

### During a flood

Before/ during a flood/ after a flood

Show the uses of maps

- to determine areas which can give protection
- to determine areas which are liable to floods
- to decide suitable steps to be taken in minimizing the harm done during a flood.

**During a landslide**

Before the threat of a landslide/ after a landslide/ when a landslide is occurring

During each of these situations show the uses of maps

- Identifying the areas which will be affected by a landslide
- During a situation when a landslide has occurred, in providing facilities for protection and transport
- In taking steps to prevent landslides

**Tourist Activities**

- To determine the distance between two places.
- To find out the shortest and the most convenient road by which one can reach a precise place.
- To know about the nature of roads.
- To find out the location of certain places to get the services for various needs.

**Settling People**

- In separating suitable blocks of land to settle families
- In planning road patterns

**Land Utilization**

- Determining cultivable lands
- Developing lands
- Preparation of drainage systems

**Unexpected emergency situations**

- To find out the way/road when some one has lost his way during a long distance visit
- During a situation when a tourist falls ill all of a sudden
- When you have lost your way in an unknown place, to find out the location or the place and to inform others.

# Teaching-Learning Activities

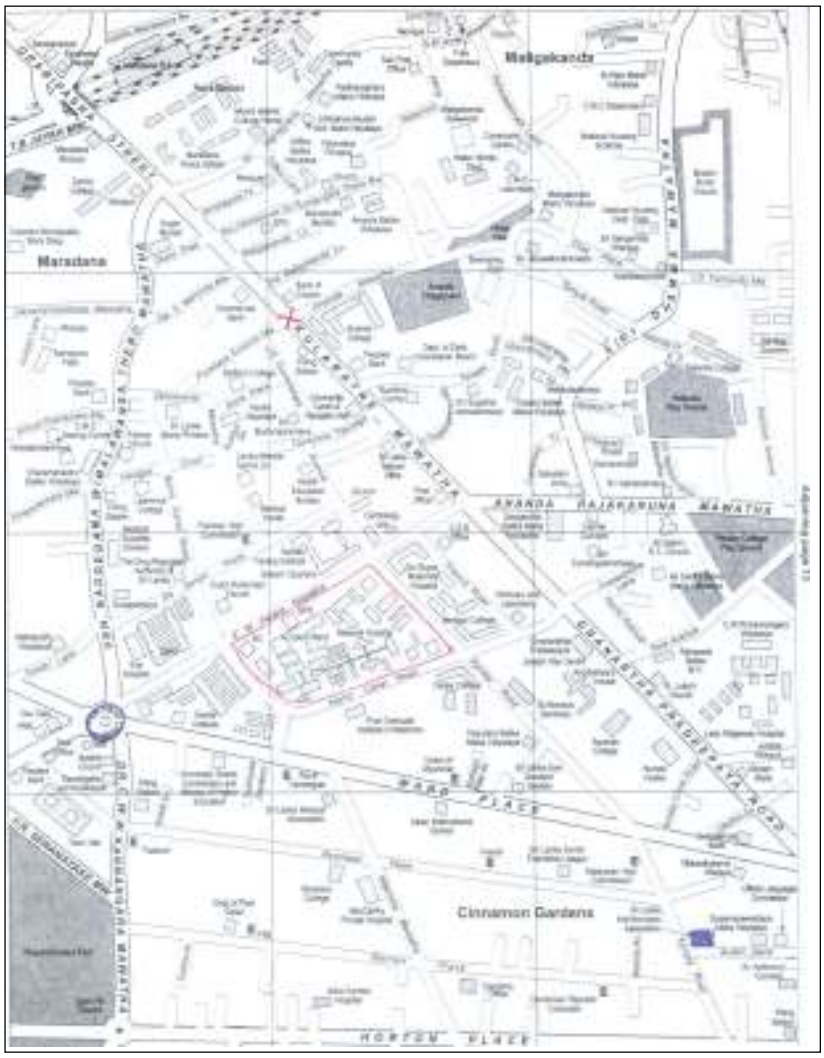
## Activity

- Give a short description about the map given for the activity.
- How to describe the location of any road or place which has to be reached.
- Pay attention in this discussion about facts like how to find out the distance according to scale.
- Group the students and engage them in the activity.
- While they are engaged in the activity give them the necessary guidance and point out the shortcomings.
- At the end, do a review of the work of all the groups.

* Give marks to students based on criteria

**Annex**

## Road pattern in Colombo-Maradana Region



## Work Sheet

A part of a map which shows the road pattern and location of places in a certain part of Colombo City is given in the map. Do the following activities in reference to it.

(1) Here, the Colombo General Hospital and the place where the Accident service ward are boxed in the colour red.
At the point marked in a red cross, a school boy met with an accident.
Since there was a traffic congestion along the main roads, show the alternative road in red colour through which the patient could be carried to the accident ward evading the congested main road.

(2) Now you are in "De Soysa" roundabout (it is coloured in blue) you are due to go to Drugs Control Board which is also boxed in blue. Since the main road along Ward Place is closed for security reasons, draw in blue colour the most convenient alternative road you can take from De Soysa roundabout to the Drugs Control Board.

(3) A number of Diplomatic offices located to the south of the main road running across Ward Place to the east from the De Soysa roundabout are shown. Out of these Embassy offices, describe the road which will lead to (1) the French Embassy (2) Iraq Embassy from de Soysa roundabout
Also find the nearest distance from De Soysa roundabout to those 2 Embassies in kilometres.

# School-based assessment - Introduction

Every teacher should know clearly that teaching, learning and evaluation are three important components in the education process and that evaluation should be done to assess the progress in learning and teaching. The teachers know that these components mutually influence one another and that they make an impact on the development of each other. According to the continuum of (happening all the time) evaluation principles evaluation should be done while the teaching and learning is taking place. It is important that a teacher should understand that the evaluation may take place during any stage whether it is at the beginning, in the middle of or at the end of the teaching-learning process. Hence a teacher, who expects to evaluate the learning progress of his / her students, should prepare an organized plan about teaching learning and evaluation.

The school-based evaluation programme is not a system of examination or holding tests. It is called a mediation applied in improving student learning and teachers teaching. This is a programme which can be carried out to achieve the maximum development of students moving closer to them and identifying their strengths and weaknesses.

Through the teaching-learning activities students are directed towards discovery learning while the teacher is moving among them and observing the tasks they are fulfilling giving them guidance. These are the activities expected when implementing the school-based evaluation programme. Here the student has to be subjected to continuous evaluation and the teacher should establish whether the development of student abilities are taking place as expected.

What is expected from teaching and learning is to provide suitable experiences to the students and to see whether the students have established these learning experiences properly. Proper guidance should be given here. Teachers who are engaged in assessment and evaluation can provide guidance in two ways. This sort of guidance is commonly known as Feed Back and Feed Forward. It is the task of the teacher to give feedback to get rid of learning problems when weaknesses and disabilities of students are identified. The teachers could give feed forward in order to improve those abilities when students strengths and abilities are identified.

For the success of the teaching learning process the students need to identify which objectives of the course were achieved at what level accordingly, it is the expectation of the teachers to determine the competency level reached by students through the evaluation programe. Hence the teachers should direct themselves to communicate with students. The best method that can be used in this regard is the school-based evaluation system.

The teachers who act with the above objective should make use of more efficient and better teaching, learning evaluation methods in order to make their teaching process and the learning process of students more efficient. In this regard, given below are a few types of approaches students and teaches could apply. These are methodologies of compiled information given to

teachers from a long time by the Department of Examinations as well as the National Institute of Education. Hence it is expected that teachers of the school system are well aware of.

Such types are as follows:

| | |
|---|---|
| 1. Assignments | 2. Projects |
| 3. Surveys | 4. Explorations |
| 5. Observations | 6. Exhibitions/ Presentations |
| 7. Field trips | 8. Short written tests |
| 9. Structured essays | 10. Tests with open books |
| 11. Creative activities | 12. Audio-tests |
| 13. Practical activities | 14. Speech |
| 15. Self- creations | 16. Group activities |
| 17. Conceptual map | 18. Dual notes journal |
| 19. Wall newspapers | 20. Do you know contests |
| 21. Question and answer books | 22. Debates |
| 23. Discussion panels | 24. Seminars |
| 25. Impromptu speeches | 26. Role-plays |

It is not expected that all the teaching-learning methods introduced here should be used for every subject and every unit. The teachers should be aware and should see that they could select a type that suits their subject and the unit.

These Instructional Manuals have mentioned the types of teaching-learning and evaluation which could be applied by the teachers in the assessment of their students. The teachers should apply them as suited in the assessment of their students. If these are not applied in class or evaded, there may be shortcomings in the development of academic abilities of students as well as in the affective characteristics and manual skills of students.

# School-based Evaluation

## Term I

(1) Select a problem prevailing in your area and prepare a project report using geographical techniques.

Examples of geographical problems

- Environmental pollution (accumulation of garbage, water pollution)
- Soil erosion
- Floods
- Traffic congestion

**Here you should draw your attention on**

- Time and spatial distribution
- Use of quantitative and qualitative facts
- Conclusions and suggestions
- Creativity

(2) Preparation of an Information File to represent the physical, economic and social data and information in a selected province of Sri Lanka, using suitable thematic maps.

Here you should draw your attention on –

- Selecting a specific land area
- Use of atleast four or five thematic maps
- The accuracy of information presented in relation to maps
- Correct use of cartographic techniques

(3) Creation of a conceptual map to introduce Geo-system. (atmospheric, hydrospheric and lithospheric and biospheric systems) This may be a single or a group activity.

- Identifying concepts correctly
- Correct location of concepts
- Use of annexes and their relevancy
- The mutual connections between variables
- Organized quality and clarity in the map.

## Term II

(4) Preparation of a Fact File to show the physical and cultural features of Sri Lanka.
Draw your attention on facts below

- Selection of the maps
- Coastal, mountainous, peneplain and urban areas
- Drawing and describing the physical and cultural features relevant to maps
- Use of correct colours and symbols
- Accuracy of information

(5) Presenting the interpretation of physical and cultural information in a metric map by a group activity.
Draw your attention on

- In this regard use the four, 1:50000 metric maps parts used in the 4th evaluation
- Focus on relief features, drainage patterns, vegetation, land utilization features when interpreting
- Explain the relationship between physical and cultural features.
- Correct use of cartographical techniques

(6) Holding an Exhibition about the cultural groups in the world population.
Facts to be focused on here-

- Draw your attention on religions, language, ethnic, tribal, indigenous populations
- Collection of data, information, diagrams, pictures and maps referring to the country as well as the world.
- File the information collected as relevant, use a suitable medium, organize them and present in a creative manner.
- Mutual relationship between variables.
- Organize this as a group activity.

## Term III

(7) Drawing a Route map to visit a specific place or a region. This should be done as a single activity.

In this regard draw your attention –

- The teacher should describe the route to be taken to reach a certain place. Here explain the important facts regarding physical, cultural and administrative aspects.
- Work out a correct route map about the relevant route to be taken.
- Use the relevant colours and symbols.
- Consider the direction and scale.

(8) Preparation of a Dual Notes Journal which establishes the need for water conservation.

The following facts should be emphasized.

- Present the following facts as relevant to the theme.
- The value of water and that it is a limited resource.
- The ways in which water becomes impure and human activities.
- That water conservation is an individual responsibility.
- The steps to be taken in conservation of water.
- Whether the student responses are logical and meaningful.

(9) Doing a survey about the social, economic and environmental conditions of urbanization in Sri Lanka.

Draw your attention on the facts below

- Plan an exploration process about the following fields
- Collection of data and information through various methods
- Presentation of the collected facts using various techniques
- Mutual relationship between variables
- Present conclusions and suggestions