Geography

Teachers' Instructional Manual

Grade 13

Department of Social Sciences
National Institute of Education
Maharagama

GEOGRAPHY

G.C.E. Advanced Level

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

PREFACE

This Teachers' Instructional Manual will be useful for the teachers to organize the teaching-learning process for Grade 13 from the year 2010.

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 every 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 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.

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Geography I - Physical Geography

Competency	Competency Level	Subject Content	No. of Periods
8.0 Contributes in the conservation of water in Sri Lanka.	8.1 Examines the hydrological properties of Sri Lanka.	• Water resources of Sri Lanka • Surface water • Ground water	10
	8.2 Explains the importance of water conservation in Sri Lanka.	• Water conservation	06
9.0 Examines the components, characteristics and processes in the physical, Human landscape and contributes to the conservation.	9.1 Explains the world distribution of biomes and their characteristics.	• Distribution of biomes • Tropical forests • Temperate forests • Mediterranean woodlands • Grasslands and savannah • Taiga forest • Deserts • Tundra	10
	9.2 Explains the distribution and characteristics of biomes of Sri Lanka.	• Distribution of biomes in Sri Lanka • Forests • Woodlands • Grasslands • Wetlands	16

Competency	Competency Level	Subject Content	No. of Periods
10.0 Examines how the interactions of physical and human activities make an impact on the physical and human environment.	10.1 Explains with examples how natural hazards occur in the world.	• Natural hazards in the world • earthquakes • cyclones • drought • lightning • avalanches • landslides • tornadoes • floods • wildfire • tsunami	10
	10.2 Examines the physical and human impacts caused by natural hazards in the world.	• The - physical impacts - human impacts caused by natural hazards	06
11.0 Acts with positive attitudes which help in the conservation and maintenance of the physical and human landscape.	11.1 Contributes actively in the management of natural hazards that occur in Sri Lanka.	• Natural hazards management in Sri Lanka • Natural hazards management cycle • facing the hazard • assessing the danger • strategies in minimizing the danger • making awareness • awareness and use early warning systems	12

Competency	Competency Level	Subject Content	No. of Periods

	11.2 Evaluates the strategies adopted for management and conservation of eco-systems in Sri Lanka.	• Selected eco-systems in Sri Lanka
		  • Wetlands - coast
		  • Forests and Wildlife Reserves
		  • Bio-systems in water-bodies/ tanks
		  • Environmental concepts and Ethics
			08

	11.3 Examines the relevance of Declarations, conventions and Draft schemes etc. concerning environment which have an influence on Sri Lanka.	• Forests and wildlife • Climatic changes • Wetlands • Chlorofluro Carbon (Cfcs)	08
12.0 Acts showing concern and attention on the earth and its inhabitants in order to promote harmonious inter-relationship between nature and society.	12.1 Examines the role of international and Regional organizations which are concerned about issues of ecological importance.	• South Asian Cooperation for Environmental Programme (SACEP) • United Nations Conference on Environment and Development (UNCED) • United Nations Environmental Programme (UNEP) • Inter-Government Programme on Climatic changes (IPCC) • International Union for Conservation of Nature (IUCN) • National Aquatic Resources Research Authority (NARA) • Central Environmental Authority (CEA) • International Water Management Institute (IWMI) • Coast Conservation Department (CCD)	20

Geography II - Human Geography

Competency	Competency Level	Subject Content	No. of Periods
7.0 Examines the recent trends in agriculture and contributes to agriculture with effective ways.	7.1 Explains the nature of world agriculture in relation to technology, production and marketing.	• World agriculture • Agricultural technology • technology related to the Green Revolution • Gene technology • Expansion in Production (wheat, paddy, vegetables, fruits, fish and animal husbandry, cattle, poultry, pigs) • Increasing yields • Extension of cultivated lands • Short term yields • Process of string and Processing • Marketing process • Policies • Multi-national companies • agro-plantations • agricultural organizations • market information	14
	7.2 Explains the nature of agriculture in Sri Lanka in relation to technology production and marketing.	• Agriculture in Sri Lanka • Agricultural technology • Use of modern machinery • green revolution • gene technology • use of organic fertilizers • irrigation technology	20

Competency	Competency Level	Subject Content	No. of Periods

		• Increasing Production
		  • Extension of land area
		  • Increasing yields
		  • Cutting down wastage
		  • Use of modern machinery
		• Marketing process
		  • Economic Centres
		  • Agreements with private organization
		  • Drawing attention on quality
		  • Showing concern on consumer taste and convenience	

	7.3 Studies the recent trends in the agricultural land utilization in Sri Lanka.	• Land utilization • Gradual loss of agricultural lands • Introduction of substitute crops • Introduction of seasonal crops	03

8.0 Examines the trends in mines and activities and contributes to protection.	8.1 Studies the nature and distribution of the world mining Industry.	• The main mine and related Products
		  • petroleum
		  • Coal
		  • iron
		  • copper
		  • gold
			05

Competency		Competency Level		Subject Content	No. of Periods
9.0	Examines the value of mineral resources in the Economy of Sri Lanka and usest those effectivily.	8.2	Analyses the trends in the world mining industry with reference to production and trade.	• Distribution • Production and other industries related to it • Trade • Problems in mining • Hazards	05

		9.1	Examines the distribution of mineral resources in Sri Lanka.	• Mineral resources of Sri Lanka
				  • gems
				  • mineral sands
				  • iron
				  • plumbago
				  • apatite
				distribution
				production
				trends
					06

		9.2	Emphasizes the importance of mineral resources in the Economy of Sri Lanka.	• The Economy of Sri Lanka and mineral resources
				  • as an industrial raw material
				  • value addition related to changes in utility
				  • employment
				  • for regional development
				  • contribution to national income
					04

Competency	Competency Level	Subject Content	No. of Periods

	9.3 Takes action to minimize the damages to the environment in the utilization of mineral resources of Sri Lanka.	• Utilization of mineral resources and its environmental impact
		  • impact on drainage
		  • impact on landscape
		  • impact on health
		• Minimizing environmental damage
		  • promoting eco friendly attitudes
		  • implementing the relevant legislation political dedication
		  • political dedication
			10

10.0 Examines the locational process of industries and presents suggestions to promote the industries of Sri Lanka.	10.1 Examines with examples the factors of location of industries in the world.	• The factors that influence the location of manufacturing industries in the world
		  • iron and steel
		  • motor vehicles, ships, aeroplanes
		  • electronic industries
		  • perto-chemicals
		  • milk products
			10

	10.2 Examines the factors of location of a few industries in Sri Lanka.	• Industries of Sri Lanka
		  • Traditional handicrafts
		  • Cement
		  • Sugar
		  • Garments
			10

Competency	Competency Level	Subject Content	No. of Periods

		• Industries related to rubber and plastic
		  • factors of location
		  • specialized factors
		  • current change
		• State Policy related to the location of industries	

11.0 Examines the Potentials in Sri Lanka for the Tourist Industry and presents suggestions.	11.1 Examines the features of the Tourist industry in Sri Lanka.	• Present status of the Tourist Industry
		• The impact of the Tourist Industry
		  • economically
		  • culturally and socially
		  • environmentally
			07

	11.2 Proposes course of action that could be adopted in promoting the tourist industry of Sri Lanka.	• Action that could be taken in the development of the tourist industry.	03
12.0 Examines the nature of globalization comparatively and presents examples which could apply to Sri Lanka	12.1 Examines information technology as a factor which influences globalization.	• What is Information technology • What is globalization • The impact of information technology on globalization	10

Competency	Competency Level	Subject Content	No. of Periods
13.0 Examines the contribution of information technology on the socio-economic transformation in Sri Lanka and contributes to it.	13.1 Examines comparatively how information technology has influenced the socio-economic transformation in Sri Lanka.	• The use of information technology in the socio-economic changes in Sri Lanka • Economic • Political • Cultural • Social .	10
14.0 Examines the role of multi-national corporations in international trade and Contribute to empower the nation's economy	14.1 Examines comparatively the impact of multi-national trade.	• International Trade • In capital investment • In transfer of technology • In the extraction of resources	10
15.0 Examines the role of Regional organizations and tends to regional coorporation.	15.1 Examines the functions of a few selected Regional Organizations.	• In management • Regional organizations • Sourth Asian association for Regional Cooperation • South East Asian Association • European Community • North American Free trade Association • African Economic Commission	10

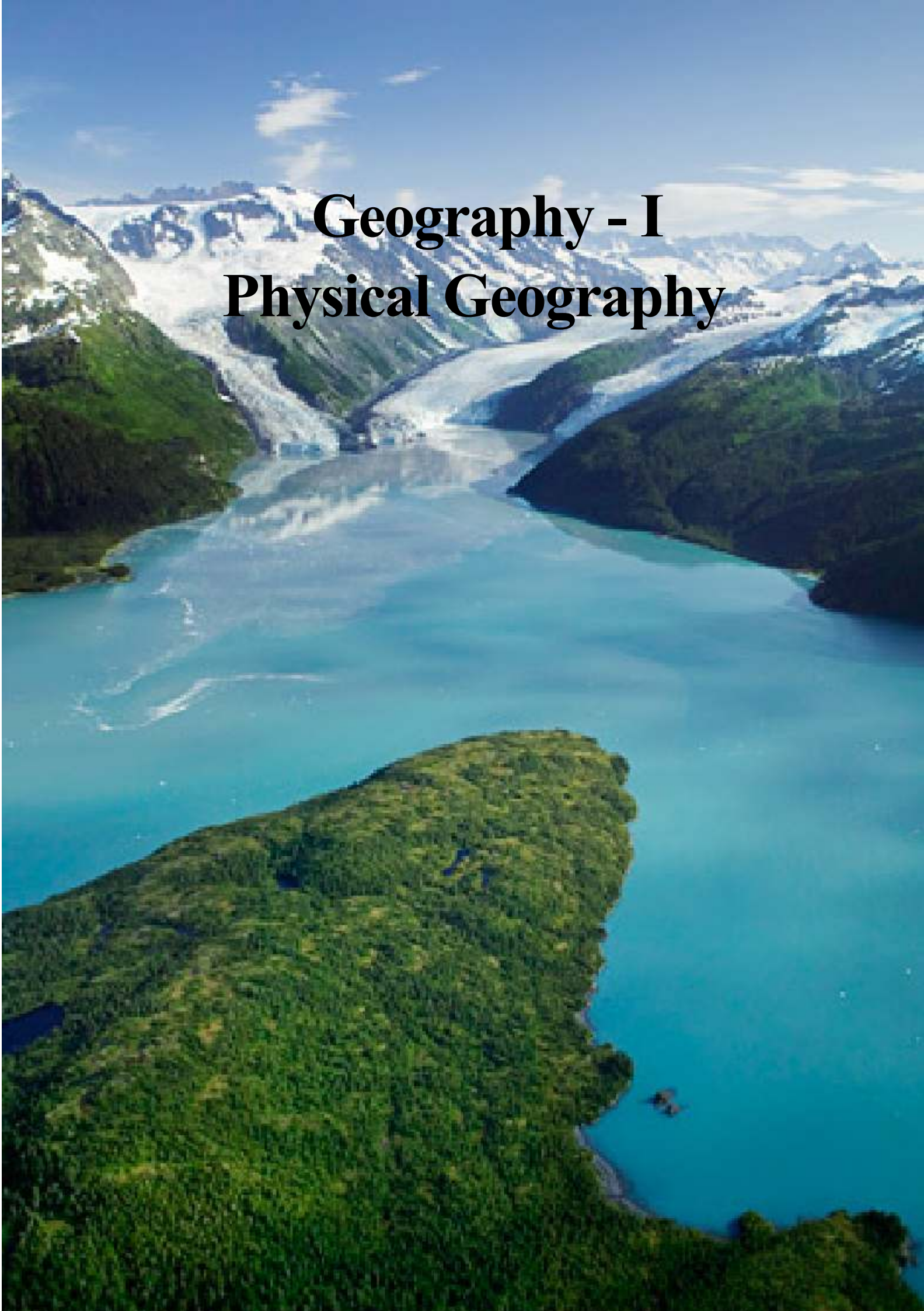
Geography III - Practical Geography

Competency	Competency Level	Subject Content	No. of Periods
4.0 Uses statistics and graphical methods in analyzing, interpreting and presenting data and information.	4.1 Examines data sources.	• Identifying data • Definition • Special characteristics of data • Type of data • Data bank • Data generation • Classification and Tabulation • Presentation of data	10
	4.2 Examines methods of collecting data.	• Collection of data • What as meant by a sample • Observation • Measurements • Discussions • Questionnaires • Library sources • Computerized sources • Maps, aerial photographs, satellite images, and pictures	15

Competency	Competency Level	Subject Content	No. of Periods
	4.3 Analyses and interprets data.	• Analysis and interpretation of data • Organising and tabulating data - Frequency Table Preparation • Using simple statistical techniques for spatial data • Central tendency –mode - mean –median • dispersion measurement - Range - Quartiles - Inter quartile range - Mean deviation - Standard deviation • Representation of data • Graphs and Diagramms-Introduction • Graphs - Histograme - Frequency Curve -Frequency Polygon -Cumulative Frequnce and Percentage Cummulative frequency	16

Competency	Competency Level	Subject Content	No. of Periods
5.0 Shows correctly the spatial distribution of the physical and human components of the world.	5.1 Marks and names on outline maps of the world locations and distributions.	• Diagramms * One Dimentional Diagrams -Bar diagrams (simple, complex, pyramid) - Scatter diagram * Two Dimentional Diagrams - Wheel diagrams - Linear diagrams * Three Dimentional Diagrams * Pictorial Diagrams * Choropleth maps & Isopleth maps • Marking on outline maps of the world • Places and regions of geographical importance • Principles of map marking and activities	16

Note: *It is expected that during particular teaching learning situations, the distribution maps relevant to all the units should be mapped out and interpreted.*



Geography - I
Physical Geography

Competency – 8
Contributes to the conservation of water resource of Sri Lanka

Competency Level 8.1 Examines the hydrological properties of Sri Lanka
(Number of periods 10)

Learning outcomes

- Describes ground water of Sri Lanka quantitatively.
- Explains the nature and sources of ground water of Sri Lanka.
- Explains the relationship between water utilization and varied human activities in Sri Lanka.
- Distinguishes ways of water pollution with examples.
- Points out the prospect need of water conservation.
- Suggests the ways that should be followed for water conservation.

Introduction

Sri Lanka is rich in water resource. The water resource of our country is fed by the consistent heavy rains brought by monsoon winds, inter-monsoon rains, and depressions. Rain serves as the key factor of distinguishing the climate zones of Sri Lanka.

Water, which is essential for the existence of human beings, is considered the vital resource of all the resources of the earth. Considering the water distribution, water can be classified into two as, surface water, for example, water in rivers, streams, brooks, lakes, lagoons etc., and ground water, which is stored within the earth.

The objective of the lesson is to examine comprehensively the amount of water resource of Sri Lanka, its distribution, and the ways of utilizing water resource.

A guide to identify with the subject matter

The water resource of Sri Lanka is determined by the rainfall.

Rainfall of Sri Lanka

Sources of rainfall

Inter-monsoons
Southwest monsoons
Northeast monsoons
Depressions

Period of rainfall

Inter-monsoons 1(March- April)
Southwest monsoons (May- September)
Inter-monsoons 2 (September- November)
Northeast monsoons (November- February)

Amount of rainfall

Average annual rainfall 2000 mm
West hill slopes - over 5000 mm (e.g. Malimboda)
East hill slopes - under 3500 mm
Least rainfall in southeast and northwest coasts – 935 mm (e.g. Ambalanthota)

Rainfall zone

Wet zone – >2350 mm
Intermediate zone – 1450 mm
Dry zone – 1000 – 1450 mm
Arid zone - < 1000 mm

According to the place where water resource is stored, it can be classified into two.

Surface water (Subaerial water)
Ground water

In accordance with the quality of water, it can be categorized into three groups.

Fresh water
Salt water
Brackish water

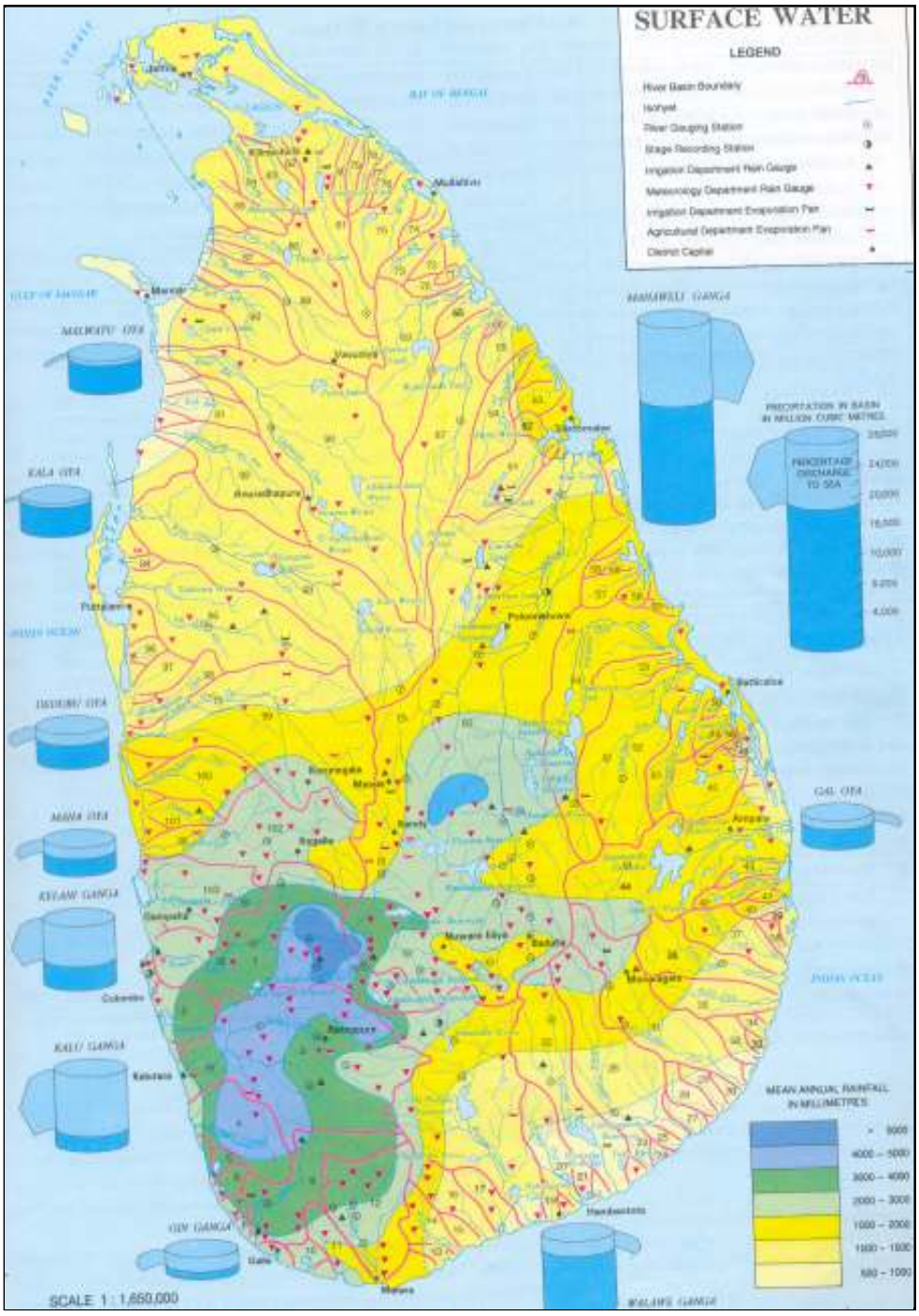
Surface (Subaerial) Water

Surface water is the water found in rivers, streams, brooks, lakes, and lagoons. Most of the surface water is fresh. In lagoons, the water is a combination of salt and fresh water known as brackish water.

Rivers in Sri Lanka

- There are 103 main rivers in Sri Lanka. Of these, eighty belong to the dry zone and many are not perennial (seasonal rivers).
- The rest are in the wet zone. These can be considered perennial rivers flowing throughout the year (perennial rivers).
- Mahaweli is the longest of all and it is nourished by both the wet and the dry zones. It is 335 km long and the catchments area spreads over about 10327 km^2.

Map 8.1.1 Distribution of river basins of Sri Lanka



Source: Arjuna's Atlas Sri Lanka (1997)

Table 8.2.1: Length of the rivers (>100m) and spread of catchments areas (k.m^2)

River	Length (k.m)	Catchments area (k.m^2)
1. Mahaweli	335	10327
2. Malwathu Oya	164	3246
3. Kala Oya	148	2772
4. Kelani	145	2278
5. Yan Oya	142	1520
6. Daduru Oya	142	2616
7. Walawe	138	2442
8. Maduru Oya	135	1541
9. Maha Oya	134	1510
10. Kalu	129	2668
11. Kirindi Oya	117	1165
12. Kumbukkan Oya	116	1218
13. Manik	114	1272
14. Ging	113	922
15. Mee Oya	109	1516
16. Gal Oya	108	1792

- Most of the rainfall received to the earth is carried off to the sea by rivers and it is called the runoff.

- Runoff in the wet zone is higher than that of the dry zone. The runoff of the river Nilwala is 1152 million cubic meters and it is 49% as a percentage while the runoff of the river Mahaweli is 4009 million cubic meters and it is 20%.

Interior water reservoirs of Sri Lanka

- Lakes and ponds are interior water reservoirs. Total land in Sri Lanka is 65610 km^2 and out of it, 2905 km^2 is covered by interior water reservoirs.

- The North Central province possesses the highest rate of land covered with interior water reservoirs, and it is 731 km^2. The Sabaragamuwa province has the least rate of all the provinces, which is 47 km^2.

- Lagoons

  Lagoon, which is separated by sand ridges or a beach from the sea, consists a narrow opening known as an outfall. In a lagoon, there is brackish water and short rivers flow to some lagoons. Some of the main lagoons in Sri Lanka are Batticaloa, Puttalam, Lunawa, Bolgoda, Dedduwa and Kalamatiya.

Map 8.1.3
Distribution of ground water of Sri Lanka

Source: Arjuna's atlas Sri Lanka (1997)

Ground Water

- The water that trickles into the earth depends on porosity and permeability of the earth.
  Porosity is the amount of pores in the rock.
  Permeability is the ability to trickle through the joints and pores.

- The main contributing factor of the ground water level of Sri Lanka is the rainfall. The distribution of ground water is connected with the geological structure.

- The island can be divided into three main geologic zones in relation to ground water.

  1. Miocene limestone belt spreads over Puttalam to Jaffna and then to Mulathev. The ground water stored along this margin is obtained from jack-wells (*Ândia* wells).

  2. Along the Eastern, North-eastern, and Western coasts, there is 3-5 m amount of ground water, which is obtained from shallow wells.

  3. In the other regions of the island, the bedrock is hard and almost 80% of Sri Lanka belongs to this zone. Ground water gathers round the joints of these rocks.

Methods of obtaining ground water

- By shallow wells
  These are the most common wells in the island. Shallow wells are used to obtain fresh water stored in regions full of bedrocks such as granite, nice etc., flood plains and regions associated with river valleys and in coastal areas.

- By tube wells
  Mass amount of ground water is found among pores, joints, and cleavages in hard rocks. In dry zones, tube wells are used to obtain this type of water.

- By artesian-wells
  The river basins in some areas of Sri Lanka are compressed and water naturally wells up the Earth's surface as these places are incised to the aquifer. These are called artesian wells, E.g. Mulathew, Palavi, Murugan

- By deep wells
  Since drainage on the Earth's surface is not possible in regions where limestone is common, ground water is stored in mass amounts in these areas. Thus, in Northwestern and Northern provinces ground water is obtained by deep wells.

- By fountains
  Fountains are common in highlands due to its relief. Sources of water for the people in these areas are fountains.

- By hot springs
  Hot springs can be seen in Kinniya, Maha-oya and Mahapellasse situated to the east of the river Walawe.

Water utilization in Sri Lanka

- Water is used for various purposes.

    - Drinking water
    - Domestic work
    - Agriculture
    - Hydro-electricity generation
    - Industry
    - Fishery (fresh water and associated with lagoons)
    - Tourism (minimum)
    - Transportation (minimum)

- Percentage utilize

    - Agriculture 85%
    - Domestic 6%
    - Other 9%

  Source: New prospects for water resource, Ministry of Water Resource Management

- Per capita water utilization of Sri Lanka is 31 litres per day. But the required quantity is 50 litres per day

Competency Level 8.2 Defines the importance of water conservation in Sri Lanka
(Number of periods 06)

Objectives

- Understands how the water resource in Sri Lanka is polluted.
- Identifies the future need for water conservation.
- Suggests the possible ways that should be followed to conserve water resource of Sri Lanka.

Introduction

As water resource of Sri Lanka could be directly utilized before several decades, there were not problems of water conservation. Yet, at present, surface as well as ground water is being polluted due to diverse causes. The process of water pollution is rapidly increasing with the increasing complexity of human activities.

Water pollution can happen naturally or owing to human activities. In our country, large amount of water is wasted due to over utilization and improper use. Thus, need to conserve the water resource of Sri Lanka has become vital.

Studying the need for conserving water resource and importance of taking necessary actions for that are focused in conservation of water resource of Sri Lanka.

Water pollution

- Several decades ago, both surface and ground water resources could have being utilized directly for human activities. Yet, presently, water in most of the rivers, streams, brooks, and open fountains cannot be used in the same way.

  E.g. Bere Lake, Kandy central brook

- Due to water pollution, the quality of water decreases as well as it becomes unhygienic. There are two main reasons fro water pollution in Sri Lanka.

  - Decrease in water quality due to natural causes.
  - Water pollution due to human activities.

Decrease in water quality due to natural causes

- Mixing with salt water - fresh water is obtained from shallow wells dug in the plain coastal. However, in the seasons during which rainfall is less, salt water flows into these wells owing to decrease in ground water table. This process is observed in Puttalam and Kalpitiya.

- Aggregation of waste (naturally)
    - Animal waste
    - Minerals
    - Decomposing bodies
    - Micro organisms

  These waste matters add into water when it flows on Earth's surface and through the ground.

Water pollution due to human activities

- Use of artificial fertilizer
- Use of pesticide
- Use of weed-killers
- Elimination of industrial waste
- Mixing of chemicals
- Elimination of domestic waste
- Mining for sand
- Mining for clay
- Mixing of toxic gases with water (gas emitted by industries and vehicles)

Need for water resource conservation

- Out of present world population, about 33% lacks pure water for their minimum requirements. By the year 2025, almost 60% would face difficulties of obtaining pure water.

- In our country, drinking water has become a problem. In some regions, both surface and ground water cannot be used (Jaffna, Anuradhapura).

- Aquatic organisms and plants are threatened with extinction by aggregation of waste in water.

- During the dry season, salt water comes to *Ambathale* Pump House due to deepening of riverbed because of sand mining at the Kelani River. Hence, many difficulties arise in supply of drinking water to Greater Colombo.

Procedures to prevent water from mixing with waste matters

- Development of public awareness.
- Execution of laws.
- Imposing laws to limit sand and clay mining.

Water conservation

- There are two fundamentals in water conservation process.

    1. Prevent over utilization of water.
    2. Prevent water pollution.

- Water resource can be conserved in several ways.

    - Conservation of water used for domestic needs.

        Prevention of overuse of water in bathing, washing, cleaning etc.
        Reuse of used water after recycling.

    - Proper water management in agriculture.

        Use only required quantity of water according to the crop variety.

    - Stop wasting water in industries.

- Prevention from water pollution is important in water conservation.

    - Stop water pollution in service centres (vehicles) and laundries.
    - Stop water pollution in agriculture and industries.

- In the dry zones of Sri Lanka, large rainwater tanks are used for gathering rainwater. In water conservation, extending of this method to other regions is important.

Future prospect:

- Water pollution has become a common problem in Asian countries where the population is very high.
  E.g. India, Malaysia, Indonesia, Singapore

- Ground water conservation processes through projects for cleaning river basins in these countries are successfully .

  E.g. The project started in 1977 for cleaning Kalath basin and the Singapore River. The *Pure Ganga* project in India to clean the River Ganges.

- Projects to conserve surface and ground water resources in Sri Lanka should be implemented shortly.

Learning Teaching Activities

Activity – 1

Prepare a poster to present the importance of water conservation and to demonstrate a clear and complete idea of water resource of Sri Lanka.

Activity – 2

- Prepare an entry about variation of the ground water table of your area.
- For this, take notes periodically covering the dry and wet seasons.
- Keep timely entries on how the water levels in wells fluctuate in accordance with rainfall and then prepare an account with graphs following these entries.

Competency – 9
Explains components, characteristics, processes in physical and human landscape and contributes to conservation

Competency Level 9.1 Explains the world distribution of biomes and their characteristics.

(Number of periods 16)

Learning outcomes

- Defines the term 'biome'.
- Identifies the biome types.
- Presents world distribution of biomes with a map.
- Examines the characteristics and climate of biomes.
- Compare and contrast the characteristics of world biomes in relation to Sri Lanka.

Introduction

When the hierarchy of the biosphere is considered, 'biome' can be identified as the top category that comes after 'ecosystem'. There are many ecosystems in the world and several such identical ecosystems coming together generate biomes. Hence, there are many biomes in the world. According to the characteristics and world distribution of biomes, several biome types; such as large, medium, and small can be identified.

Forests, which spread over large areas, can be classified as a biome. Thus, climate is the key factor determining the distribution of biomes in the world. Climatic impacts, based on temperature and rainfall, decide the characteristics and subsistence of both the man and the physical environment.

This chapter focuses on providing the students with comprehensive knowledge about biomes, their characteristics, and world distribution.

A guide to identify with the subject matter

Biome types

- Tropical forests
- Temperate forests
- Mediterranean woodlands
- Grasslands and savannahs
- Taiga forests

- Deserts
- Tundra

Defining the Biome

- A biome is a grouping that has a specific number of animals and plants with a specific vegetation structure.

- A biome is not a bio-geographic but an ecological area (Ecological Dictionary).

- A biome is a complex of animal and vegetation living as one sociological unit.

Tropical Forests

Distribution

Amazon, Zaire, West Africa, Malaysia, Cambodge, Myanmar, Laos, Thailand, North Vietnam, North-Australia, New Guinea, Central India

Climate

- The total rainfall year round is high, ranging from 2500 mm- 5000 mm.
- Rainfall is well distributed the whole year round.
- The relative humidity is always high, between 75-90%.
- The temperature is between 27-30 C° throughout the whole year.

Vegetation

- High biodiversity.

- Evergreen vegetation.

- Trees grow dense (closely spaced trees) and high.

- Many of the trees have straight trunks and are wider at ground level.

- Most of the trees bear flowers and large fleshy fruits.
- Trees are cauliflory- the development of flowers (and hence fruits) directly from the trunk, rather than at the tips of branches.

- There are lots of epiphytic and climbing plants.

- There are strata of plants (stratified).
    - Emergent Layer - scattered trees of 35 m- 45 m height
    - Canopy Layer - closely spaced trees of 25 m- 39 m of height
    - Sub-canopy Layer - trees of 10 m- 15 m height
    - Ground flora - about in 5 m height

- Weaker undergrowth due to little sunlight.

These are common characteristics and according to the regional variations, there can be sub divisions.

- Tropical rain forests/ tropical monsoon forests

The main vegetation consists of mahogany, ironwood, palms, ebony, teak, bamboo, sandalwood, acacia, eucalyptus, and epiphytic varieties.

Fauna

- Ape species, reptiles, insect and bird varieties

According to vegetation and climate, tropical forests can be classified as

1. Tropical evergreen forests
2. Tropical monsoon forests

Temperate Forests

Distribution

Australia, South Africa, California, South China, North- New Zealand

Climate

- Annual rainfall ranges from 150 mm- 750 mm.

- Temperature varies from - 30° C to 30° C.

- Temperature varies throughout the whole year and comes to its highest in summer.

Vegetation

- Flora diversity is not high as in tropical forests and flora density is low.
- Includes evergreen and deciduous flora.
- Trees do not grow tall and vegetation strata are uncommon. Shrubs, grass, moss, and tall plants can be seen.
- Among flora varieties, oak, magnolia, eucalyptus, and pines are important.

Temperate forests can be classified under two groups according to the minor changes occur in climate and vegetation.

1. Temperate Deciduous Forests
2. Temperate Evergreen Forests

Fauna

Dear and bird species and aquatic animals

Mediterranean Woodlands

Distribution

Lowlands around the Mediterranean Sea in Europe, Africa, and Middle East. Cape Town, California, Central Chile, and coastal areas in southwest and southern Australia.

Climate

- The Mediterranean climate is characterized by mild and rainy winters, and summers.
- Temperature in summer ranges from 26.6 °C – 32.2 °C and in winter from 12.2 °C –10 °C.
- Rain falls occur in winter and the annual rainfall is below 762 mm.

Vegetation

- There are evergreen flora and species adapted to hot dry weather conditions.
- Xeromorphic flora with thin leaves or small leaves covered with a waxed cuticle to reduce transpiration can be seen.
- Flora is characterized with nodal trunks and thick barks.
- Many trees have long roots to drag in ground water.

Fauna

Beautiful bird species and deer species

Grasslands and Savannahs (Savanas)

Distribution

The Veldt of South Africa; Nigeria, Gynia, Niger, the Campus of Brazil, Venezuela, the Llanos of Colombia, the Steppes of Russia, the Pampas of Argentina; the Downs of Australia

Climate

- The greatest temperature in winter season is 18 °C.
- Evaporation rates are higher.
- Annual rainfall totals are usually between 1016 - 1524 mm.
- Dry season is longer while the rainy season is shorter.
- There are speedy winds.

Vegetation

- Among central flora varieties, tall and short grasses are common.
- Tall grass grows nearby the forests while short grass is seen at deserts. Trees and bush plants are scattered all over the place.
- Trees with varied leaves and with different forms are to be seen.

Among flora species grass species, acacia, baobab are common.

Fauna

Byson, leopard, cheetah, giraffe, gazelle, zebra

Taiga forests (boreal forest)

Distribution

Taiga forests spread along from the western coast to the eastern coast of North America and from western coast of Northern Europe to the coast of Eastern Asia as a ribbon.

Climate

- Rainfall is well distributed whole of the year round.
- There are long winters and shorter summers.
- Climate is characterized with wide range of temperatures between the lows of winter, 6 °C, and highs of summer, 20 °C.

Vegetation

- Needle-leaf trees (coniferous) are dominant.
- Trees are straight and timber is mild.
- Some are evergreen trees.

Among flora species pines, spruce, larch, fir, burch, cypress, seeders, poplar are common.

Deserts

There are two types of deserts.

1. Hot deserts
2. Cold deserts

Distribution

California in USA, Arizona, Atacama in South America, the Sahara of Africa, Kalahari, Arabian, Namibian, Thar, western deserts of Australia, Gobi, Nevada
In USA, Turkestan

Climate

- Temperature is extremely high.
- Rainfall is very low.

Vegetation

- No huge trees but species such as moss are common.
  E.g. Aloe vera

- Small canopy can be seen in oasis and in places that receive sudden rainfall.

- Plants are mainly ground-hugging shrubs and are widely scattered.

- Plants are xerophytes
  1. Trunks are fleshy.
  2. Leaves are "replete" and small.
  3. Leaves are thick.
  4. Leaves are covered with a wax like cuticle.

- Long root system can be seen.

Among flora species cactus, thorny bushes can be identified.

Fauna

Camel, kangaroo, deer species, wolves, lizard species

Tundra

Distribution

Polar Regions (to the north of Arctic Circle) and hilly areas; e.g. Everest

Climate

- Very short summer period of 2 - 4 months.
- There is frost in summers.
- Annual rainfall ranges between 250 mm – 300 mm.

Vegetation

- Due to snow cover, there is no canopy.
- There is only moss and other small flora species.

Fauna

Lemmings, reindeer, penguin

Other than the above-mentioned biomes, there are many wetland biomes in many regions of the world, for example, Pantanal of America, Amazone river basin, Sundarbans etc. These spread over all the world climatic zones and there are lirroral- wetlands.

Learning/teaching Activities

Activity – 1

Group students and to each group assign a biome type. Ask the groups to gather information on the biome type they are assigned to. Ask them to present creatively the collection data.

Competency Level 9.2 Explains the distribution and characteristics of biomes of Sri Lanka.

(Numbers of periods 10)

Learning outcomes

- Identifies the biome types of Sri Lanka.
- Prepares tables on the distribution of biomes of Sri Lanka.
- Examines the characteristics of biomes of Sri Lanka.
- Presents data regarding the flora diversity in biomes.
- Suggests proposals for environment conservation realizing the ecological importance of biomes.

Introduction

Sri Lanka is a tropical country and many biomes of that climate are outstretched in the island. The biomes in Sri Lanka are small-scale. Even though there are not extreme climate differences, several forest types have been identified in Sri Lanka for it being an island and its elevation.
Distribution of biomes of Sri Lanka is discussed in this section with examples. In addition, climatic traits and vegetation distribution of these biomes are examined.

A guide to identify with the subject matter

Distribution of biomes of Sri Lanka

- Forests
- Woodlands
- Grasslands
- Wetlands

Forests

The main forest biomes of Sri Lanka can be grouped in to three.

1. Tropical rainforests
2. Mixed dry evergreen forests
3. Montane forests

Tropical Rainforests

Distribution

Wet lowlands and central wet zone
E.g. Sinharaja, Kanneliya, Dadiyagala, Nakiyâdeniya

Climate

- High annual rainfall ranges between 2500- 5000 mm.
- Rainfall is well distributed the whole year around.
- Heavy rains are received in South- West monsoons from May – September.

Vegetation

- High biodiversity and there are 100- 140 flora species.
- Three are many endemic varieties.
- Evergreen vegetation is common.
- Trees at ground layer grow tall and spread closely.
- Several vegetation strata can be seen.
- May trees branch out at the very top, and have straight trunks.
- Many trees have large leaves and drip tips.
- Buttresses are common.
- Leaves at the ground level are large due to lack of sunlight.

Among flora species, Hora (*Dpiterocarpus zeylanicus**), Badulla *(Semecarpus coriacea*),,* Dorana *(Dipterocarpus glandulosus*),* Waldel *(Artocarpus nobilis*),* ironwood *(Mesua ferrea),* Atamba *(Mangifera zeylanica**), Keena *(Calophyllum pulcherrimum),* Diyapara *(Wormia triquetra*),* Godapara *(Dillenia retusa*),* Kitul *(Caryatid urns)l,* Cardamon *(Coscinium fenestratum*)*, Wesak- Mal *(Dendrobium macccarthiae*), Wewel(Calamus rotang),* can be seen.

* = Endemic species

Fauna:

- Ceylon Leopard (*Panthera pardus kotiya*), reptile species, insect species, bird species, snail species.

Mixed dry forests

Distribution

Mixed dry forests are the most common forest type in Sri Lanka. E.g., dry lowlands, Ruhuna National park, Udawalawa, and Yala.

Climate

- Annual rainfall is less and ranges between 1250 mm – 2000 mm.
- Rainfall is not well distributed the whole year round.
- May – September is the drought season.
- Normal temperature ranges between 30 C^o - 35 C^o.

Vegetation

- The number of dominant species is high but species diversity is not high as in wet forests
- Both evergreen vegetation and trees that fall leaves during dry season can be seen.
- trees are short and ranges between 15- 20 m
- Great amount of sunlight receives forest and vegetation strata can not be clearly identified.
- A shrub layer can be seen.

Among flora species Halmilla *(Berrya cordifolia)*, Milla *(Vitex pinnata),* Palu *(Manilkara hexandra),* Weera *(Drypetes sepiaria),* Burutha *(Chlorxylon swietenia)*, Margosa (*Azadirachta indica*), Ebony *(Diospyros crumenata)* are common..

Fauna:

Jackal *(Canis aureus lanka),* Monkey species, Migrating birds species, Elephant *(Elphas maximus maximus)*

Montane forests

Distribution

Montane forests grow above 1200 from sea level.

E.g. Huggala, Pidurutalagala, Samanala Kanda, Knuckles

Climate

- Rainfall is well distributed throughout the year and is higher than 3500 mm.
- Daily/annually varying low temperature is observed.

Vegetation

- Flora diversity is low.
- There are evergreen floras with small long leaves.
- Trees are less in number and height of the trees ranges between 10m- 15m.
- Trees are characterized with nodal and twisted trunks and branches in order to protect from speedy wind.
- Ground floor is covered with Orchid, Moss, and lichens.

Fauna

Deer *(Muntiacus munntijak malabaricus)*, sambhur (*Cervus unicolour)*, bird species, lizard species, wild bore (*Sus scrofa cristasus*)

Woodlands

Woodlands of Sri Lanka can be identified as a separate biome type.

Distribution

Can be seen in Hambantota, Mannar, Puttalam.

Climate

- Annual rainfall is below 1250 mm.
- Temperature is higher and it is over 30 ^{0}C on average.
- There is a drought season.
- Soil has an acrid stratum.

Vegetation

- Prickly shrubs are common.
- A few numbers of short trees typical to dry zone can be seen.
- Trees have deep, penetrating root systems.
- Trees store water by leaves, trunks, and roots.

Among flora species Nawahandi *(Euphorbia tirucalli),* Eraminiya *(Hemidesmus indicus),* Kukul katu *(Pistacia integerrime),* Ranawara *(Cassia alata),* Cactus *(Euphorbia nerifolia)* are important.

Fauna

Peacock , Bird species, Wild boar (*Sus scrofa cristasus*), wild buffalo

Grasslands

Grasslands are also one of the forest biomes of Sri Lanka. Grasslands are categorized into four types in relation to climate and regional differences.

1. Wet Patana
   - Bopatatalawa, Hortan plain, Sandathanna, Agara patina, Ambewela (above 5000 feet)
2. Dry Patana
   - Rakwana mountain range, Welimada (between 1500- 3000 feet)
3. Flat
   - Galoya, Polonnaruwa
4. The Villu
   - Somawathi, Manampitiya

Climate

Rainfall is low. Elements supporting the growth of trees are weak in wet Patana grasslands even though it receives high rainfall.

Vegetation

- Grass species are dominant.
- Shrubs and short small trees can be seen.
- Among flora species Maharthmal, Seetpera, Bovitiya species, Keena, Orchid species, Moss, and Citronella grass can be seen.

Fauna

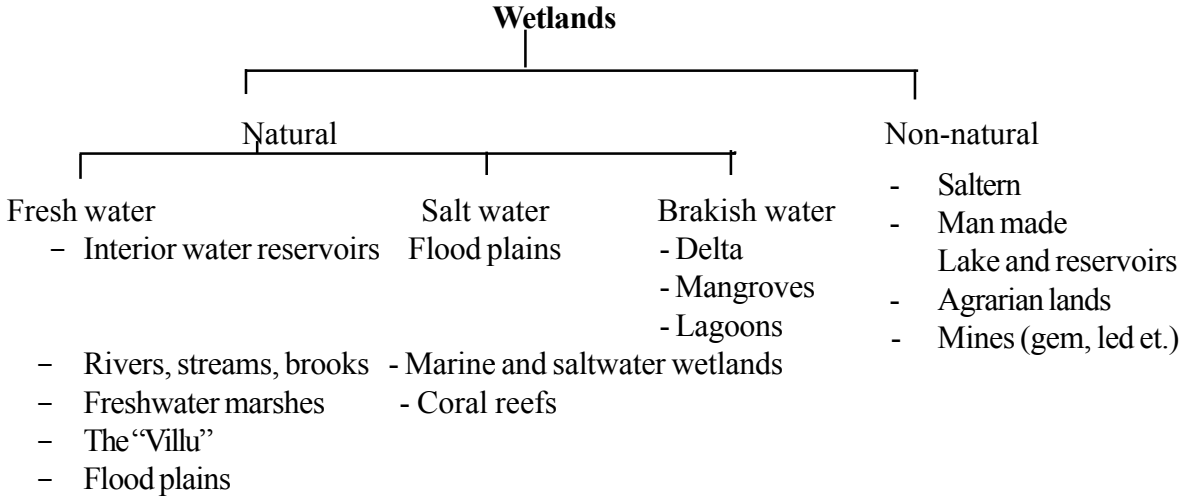
- Monkey species, Reptile species, Bird species, Wild bore (*Sus scrofa cristasus)*, Sambhur (*Cervus unicolour)*

Wetlands

Wetlands are one of the biomes of Sri Lanka. The Ramsar Convention has defined wetlands as:

> "Area of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters"

Classification of wetlands



As shown in the classification above, wetlands are classified into two main categories and then into sub categories. Here, wetlands should be considered all together.

Distribution

Aththidiya, Bellanvila, Muturajawela and in many coastal areas of Sri Lanka; Negombo, Trincomalee, Galle, Matara, Hambontota, Jaffna, river mouths and Coral reefs.

Characteristics

Biodiversity is high, including various aquatic vegetation and animals.

Out of 55 mangroves species of the world, 23 can be seen in Sri Lanka [Maha kadol *(Rhizophore mucronnata),* Kirala *(Sonneratia caseolaris)*]. The number of various animal species here is greater than that of in tropical rain forests. E.g. whip-snake *(Passerita mycterizans),* Rajasiyakkaraya *(Phoeicopterus rubur),* Kiri ibba *(Lissemys punctata)*

This is a residence of a large number of residential and migratory bird species. Among residential species Alukoha *(Ardea cinerea),* Poru-kedatta *(Anthracoceros sinensis),* Punchi-diyakawa *(Phalacrocorax niger),* and among migratory birds Rjasiyakkaraya *(Phoeicopterus rubur)*, and Caspian sea gulls are important.

There are many trees with prop roots and stilt roots, and growth of other plants in the areas of mangroves is disturbed. As a barrier to heavy winds in these areas, trees have grown with a canopy, which is well packed with tree crowns, with the help of prop roots and stilt roots, which are capable of holding sediments brought from high ground. Some trees are characterized with twisted trunks, such as Kirala.

Wetlands are important as fishery. As wetlans are rich in nutrients, fishes swim in with tidal currents, and use wetlands as their breeding places. Thus, fishing is possible at low-cost.

Among flora species Maha-kadol *(Rhizophore mucronnata),* Hin-kadol *(Aegiceras corniculatum)*, Punkanda *(Ceriops tagal),* Kirala *(Sonneratia caseolaris),* Malkadol *(Brugniera gymnorhiza)* are important.

Learning Teaching Activities

Activity -1

On a map of Sri Lanka, mark two examples for each biome given below.

- Tropical rainforests
- Mixed dry-forests
- Montane forests
- Grasslands
- Wetlands

Activity - 2

Group students and give each group a biome type. Ask each group to prepare a record of

- Distribution
- Climate, and
- Vegetation of the given biome.

Competency – 10

Examines how the interactions of physical and human activities make an impact on the physical and human environment.

Competency Level 10.1 Explains with examples how natural hazards occur in the world.

(Number of periods 10)

Learning outcomes

- Distinguishes between disasters and hazards.
- Identifies and names natural disasters.
- Expresses that a disaster occurs when human lives and property are damaged by hazards.
- Proposes ways to minimize harm caused by natural disaster.

Introduction

"Hazard" means a phenomenon, which harms community, property, or environment, arisen out of natural or human activities. The damage caused by this, is called "Disaster".

Hazard can be categorized into two type as; hazards that occur due to natural causes or due to human activities. Earthquakes, floods, tsunamis, thunderstorms, cyclones, avalanches come under the category of natural hazards while hazards that occur owing to improper resource management and harmful activities of man are called human hazards. Industrial pollution, road accidents, and varied conflicts are example for human hazards.

Above mentioned phenomena can became hazards due to various human activities. Even though an earthquake is a nature phenomenon, it can became a disaster as it can cost many human lives and cause severe damages to property when the affected area is inhabited and utilized by human beings. When human beings reside at the areas of volcanoes, it can fatally influence inhabitants and it influences other countries as well. E.g. impact of Netilla volcano eruption of Iceland to the air traffic of European countries.

Most natural phenomena like earthquakes, tsunamis, floods, thunderstorms, volcanic eruptions etc., have become disasters, because people have unheeded them. As well, circumstances such as poverty, political objectives, population density, ignorance, poor infrastructure cause a hazard to become a disaster.

Natural hazards can be categorized into three groups.

1. Multi hazards (tsunami with earthquakes/ floods and cyclone with depression)
2. Hazards in perennial regions (earthquakes, volcanic eruptions, tornados, avalanches)
3. Natural hazards in any region (cyclones, lightening, floods)

Hazards caused by above mentioned phenomena can became destructive according to the nature of its operation. Natural hazards cannot be prevented even if it has been tried to manage abrupt natural hazards such as earthquakes, tsunamis, cyclones, floods, or regular disasters. What can be done is to take preventive measures in order to protect lives and property.

Thus, to study the way natural hazards occur and their physical and human impact is focused in this section.

A guide to identify with the subject matter

Earthquakes

- An earthquake occurs when Earth's crust suddenly shifts at owing to the sudden release of energy stored within the interior of the Earth.

- An earthquake is a natural phenomenon, which is common alone earthquake-prone regions, associated with plate boundaries.

- Science is still not able to predict when or where earthquake would occur.

- The degree of damage to lives and property varies according to the intensity of earthquake.

- Even though science is able to identify the earthquake-prone regions, people still inhabit these places. Hence, this phenomenon can become a disaster. E.g. Japan, China, Mexico city

- To reduce the damage caused by such a disaster, the following preventive measures should be followed;

    - Removing people residing at earthquake-prone areas.

    - Constructing earthquake resistant buildings, which are sustainable in tremor conditions.

    - Use of light material in constructions.

    - Educating people on precautionary measures and measures that should be taken to reduce disaster risk, loss of lives during earthquake.

- Educating community on possibilities of electric leakages, fire hazards due to broken gas or oil pipes, and other possible dangers.

- Educating people residing at earthquake-prone areas on methods of conducting during an earthquake.

Cyclones

- Cyclones can be identified as a climatic phenomenon causing a temporary change in the normal weather condition of a particular location.
- Cyclones are caused by winds blowing around a central area of low atmospheric pressure within the tropical regions and its influence expanses 100 km from there. Cyclones occur in the Northern Pacific Ocean and Northern Atlantic Ocean, are called Typhoons and Hurricanes respectively. Only in the Indian Ocean, they are known as Cyclones.
- Generally about 80- 100 of cyclones occur in the tropical regions per year, and cause physical and human disaster conditions.
- Cyclones can be extremely destructive as it brings heavy rains, floods, fierce winds, and cyclone dissipations with it.
- Cyclones are destructive as they damage property and are able to cause landslides and floods by the accompanied heavy rains. Thus, cyclones come under the category of multiple-hazard.
- Cyclones are natural phenomena and cannot be prevented. Thus, the risk should be reduced by taking preventive measures.
- Here, pre - disaster preparedness is very important. The measures such as trimming of treetops and branches well clear of homes, setting power lines safely, avoiding traveling by coastal areas, strengthening the construction of communication systems etc., reduce cyclone risk.
- As cyclones can cause in flooding, keeping a stock of drinking water is a measure of preparedness as this prevent people from infections.
- In order to survive cyclones, gaining knowledge about it and following the safety procedures are essential.
- People can survive cyclones by responding instantly to the situation when cyclone warning is issued.
- Even though the danger of cyclone lapses with time, the damage to the environment could be great. Knowledge about after cyclone safety procedures can assist to minimize the cyclone hazard.

  E.g. Beware of damaged power lines, bridges, buildings, trees etc.
  Prevention from drinking unclean water
  Purifying of wells using apt chemicals

Droughts

- A drought is a condition occurred due to inadequate water supply to fulfill the water requirements of a community.

- Droughts are two types of:
    1. Droughts caused by lack of rain (This is a climatic drought)
    2. Droughts caused by lack of water supply

- A climatic drought is a hazard, as there is not a direct alternative for it.

- Droughts occurring due to lack of water supply can be reduced by taking required measures.

- Droughts in long - run can be a hazard owing to the defects in the following measures,
    1. Inadequate water reservoirs in regions characterized by low rainfall (E.g. Ruinous tank system in the dry zone).

    2. Lack of domestic water reservoirs, which can be used in drought seasons, and negligence of conservation of prevalent reservoirs.

    3. Excessive use of ground water (use of tube wells/ agrarian wells in the dry zone).

    4. Clearance of forestlands.

    5. Excessive and irregular water utilization (Agriculture: paddy utilization).

    6. Cultivation of crops that absorb much water (E.g. tobacco).

How do we face droughts?

- Avoid the aforementioned measures and adhere to the necessary procedures

- Community should be educated on the importance of food conservation for droughts.

- Researches should be carried out to produce new crop/cereal varieties, which are sustainable in drought conditions.

- Use of various methods to store water, which is a very rare resource during drought conditions E. g. rain water tanks

If the above-mentioned measures were taken into action, even into a considerable level, a drought, which is a natural phenomenon, would never be a hazard.

Lightening

Lightening is one of the natural phenomena on the Earth. It can occur anywhere on the Earth and can become a natural hazard. Its impact on Sri Lanka is immense as well.

Lightening accompanied by thunder starts from cumulus clouds (cotton like puffy shape clouds) developed in worm, wet and unstable atmospheric conditions. In Sri Lanka cumulus clouds grow during inter monsoon periods in which the convectional process is accelerated.

- This natural phenomenon has become hazardous to human beings, due to negligence. The below mentioned facts can make the lightening hazard a disaster in which many lives and property are endangered.
    - Staying outdoors during a thunderstorm
    - Framing outdoors during lightening
    - Use of electric equipments
    - Staying at higher grounds
    - Swimming or walking though water

Avalanches

- Snow- packs are created due to the extreme cold in summits of high mountains and in any region at high latitudes with long winters. Avalanches happen when these snow-packs suddenly fall down.

- Owing to global warming, snow melts and thereby a large amount of snow or ice suddenly flows down a slope or a cliff.

- Avalanches become human disasters when people inhabit or travel in avalanche-prone areas.

- Specially, ships sailing in Northern Atlantic and Northern pacific Oceans can strike against huge ice burgs, which are being slipped into oceans because of avalanches.

Landslides

A landslide is a common natural hazard that occurs in many regions of the world. Landslides occur when rock, earth, or debris flows on mountain slopes or steeper slopes of land, due to the gravity.

A landslide is a natural hazard, but it can become a disaster through extreme human interference. Landslides can become disasters due to many human activities.

- Unplanned use of land (unplanned intensive cultivation).
- Non - engineered constructions and inapt technology used for constructions.
- Blocking of natural water flows and storing of water at high grounds.
- Constructions at mountain slopes and construction of elevated banks under road constructions. E.g. landslides in Walapane, Badulla
- Unwillingness of people to abandon the landslide-prone areas.
- Lack of standards in regional developmental activities.

Hence, the natural phenomenon landslide can damage both human lives and property.

Tornados

- A tornado can be identified as an intense climatic phenomenon associated with cumulonimbus clouds.

- The rotating winds in tornado phenomena pick up dirt, dust and other debris from the ground. Waterspouts, (tornados over bodies of water) pick up fish and water.

- As the wind speed of a tornado is intense, as about 500- 800 km per hour, the hazardous condition is threatening.

- Hazardous condition of a tornado is aggravated by high velocity of winds and its violent nature. E.g. tornado occurred in USA in 1931 had lifted up five coaches with passengers and had thrown them away.

- Occasionally, a tornado that occurs in an area crowded with buildings can explode the buildings.

- The hazard is aggravated by heavy rains and speedy winds.

- As a tornado is a climate phenomenon, which suddenly starts and ends within a shorter period, the damage intensity is high.

Floods

Among world natural hazards, floods are frequent, and it affects many regions. Hence, flooding is a natural and inevitable process.

Floods occur when a river channel cannot hold all the water supplied to it by its watershed. When a river floods in the lower part of a watershed, water spills out onto a floodplain- the low-lying land is adjacent to the river valley. Other than floods associated with rivers, urban flooding can occur due to lack of drainage in an urban area.

Floods that occur owing to constant influx of water into river and sudden overflow of it, is a natural phenomenon. This became a disaster when people reside and carry out economic activities at flood plains. Here, many facts that cause a natural hazard a disaster can be identified.

- People inhabit the low-lying land adjacent to rivers and streams.
    - Owing to population increase and lack of land, floodplains are increasingly used by people for residing and various economic activities.
    - Lack of awareness about hazards
    - Poverty
    - Political influence

- Economic activities associated with riverbanks (associated with the river *Kalu* and Rahnapura region).
    - Mining and sand mining
    - Cultivation

- Use of paddy fields, which are water reservoirs, for constriction purposes in suburb E.g. Floods occur in regions situated near by the Gangees of India, Nyle of Africa, the Ryne of Europe, and the Amason of South America.

Wildfires

Wildfires occur naturally due to corrosion. Many difference natural conditions such as dry whether, high temperatures, long droughts and heavy blow of winds etc, can trigger wildfires. As well, lightening and magma flows are igniters and can cause wildfires. Wildfires can become disastrous due to the following facts.

- Establishment of human settlements near bush-land areas
  Owing to lack of land, people settle near forestlands and if a bushfires occurs, the settlements are destroyed.

- Constructions and highways

  Destruction caused by a wildfire can be enhanced by construction of buildings and highways near/within forestlands and by launching development projects.

- Destruction of water sources

Owing to human activities, water sources in forestlands are destroyed and it can intensify the damage caused by wildfires.

Tsunamis

Tsunamis are natural phenomena limited to certain areas of the world and have become hazards.

When a tectonic plate on Earth's surface slides on another plate, huge volumes of ocean water on the forced down plate are suddenly pushed upward and a series of huge waves are formed. These waves known as tsunami reach the coast. In addition, Tsunami waves can be made by an earthquake, landslide, volcanic eruption, or meteorite impact happen in ocean.

Owing to a number of facts, the natural phenomena Tsunamis can be a hazard.

- People lack knowledge of how to behaviors in a Tsunami situation.

- Hence, people normally advance towards the sea when Tsunamis initially causes the water near the shore to recede, exposing the ocean floor. This is dangerous.

- Lack of preparedness
  Should react quickly to the Tsunami warnings and unpreparedness is also a hazard.

- Construction of houses and other buildings at Tsunami - prone coastal areas

- Removal of vegetation cover at coastal areas

- People are not alert to Tsunami warnings, and not attentive to mass media

Competency Level 10.2 Examines the physical and human impacts caused by natural hazards in the world

Learning objectives

- Explains both direct and indirect physical impacts caused by natural hazards that occur in the world.
- Explains direct and indirect human impacts caused by natural hazards.
- Comprehends the importance of developing awareness about physical and human impacts caused by natural hazards.

Introduction

Natural hazards can be defined as adverse and negative effects of natural phenomena intermittently occurred in the physical environment.

Even though varied negative natural phenomena occur in the physical environment, at present, the intensity of these occurrences have been aggravated with the increase of population and development of Science.

Numerous natural phenomena occur inside the Earth as well as in the atmosphere. Earthquakes, volcano eruptions, landslides, cyclones, lightening are some of them.

According to the duration of the hazard, its impact varies. The impact of a natural hazard that lasts for a short time is diverse. Even though earthquakes, cyclones, tsunamis last for short periods, they affect large areas. In addition, some occurrences bring favorable effects, for example, deposit of silt after floods and eroded lava deposits make rich soil due to abidance of mineral in the rock.

Even so, natural phenomena influence both the human and physical environments severely. This impact has been aggravated by human activities. This section focuses on examining the physical and human impacts caused by natural phenomena.

A guide to identify with the subject matter

Earthquakes

Physical impacts

- Earthquakes result in sudden shift of tectonic plates and break in the rock crust of the Earth's surface.
- Earthquakes occurred in oceans create tsunamis and thus, coasts are severely eroded.

- Earthquakes occurred in mountain regions cause landslides.
- Earthquakes occurred in snowy mountain regions cause avalanches.
- Earthquakes occurred in regions associated with rivers; cause floods owing to split of river valleys.

Human impacts

- Collapse of constructions including houses.
- Collapse of water and sewage pipe systems.
- Collapse of communication and electricity cords.
- Loss of human lives. E.g. In 1970, 70, 000 were killed by an earthquake in Peru.
- Cities are destroyed by earthquakes. E.g. In 1972, the Managuwe city, Nicaraguva

Cyclones

Physical impacts

- Occurrence of sudden heavy and speedy winds.
- Occurrence of floods due to cyclones accompanied with heavy rains.
- Occurrence of heavy rains and lightening.
- Landslides due to heavy rains.
- Water becomes unhygienic.
- Occurrence of cyclone dissipations.
- Coasts are eroded by cyclone dissipations.

Human impacts

- House and other property are destroyed.
- Electricity and communication cords collapse.
- Drinking water is lacking due to unhygienic water after cyclones.
- Epidemics spread. E.g. Dengue, Malaria, Elephantiasis

Lightening

Physical impacts

- Nitrogen mixes to air.

Human impacts

- Loss of human lives.
- Electric appliances are damaged.
- Constructions such as houses are damaged.
- Communication systems are damaged.

Droughts

Physical impacts

- Soil becomes infertile due to lack of soil moisture.
- fertility of soil is reduced by excess evaporation.
- Atmosphere is polluted by dust.
- Water springs are dried and resultant lack of water.
- Biodiversity is destroyed.
- Scenic beauty of environment is destroyed.
- The Earth's crust is split.

Human impacts

- Farmlands are destroyed by lack of soil moisture.
- Lack of drinking water.
- Spread of skin diseases due to hot weather.
- The surface of the crust epidemics.

Avalanches

Physical impacts

- Floods occur because of avalanches. Thus, water is polluted and water is lacked.
- Landslides occur due to soil erosion.
- Tsunamis can happen due to sudden fall of huge snow packs into oceans.
- Forestlands nearby the snowy mountains are damaged.

Human impacts

- Houses at the foot of snowy mountains are destroyed.
- Farmlands associated with them are destroyed.
- Infrastructure such as highway, communication systems are destroyed due to floods and landslides.
- Loss of human lives.

Tornado

Physical impacts

- Heavy rains may occur within a short period.
- Speedy and heavy winds occur.
- Vegetation and fauna at the meeting point of the tornado with the ground are destroyed.

Human impacts

- Inflict all the beings on its way.
- Buildings and other constructions are damaged as they are picked up and blown away.

- Infrastructure is destroyed.

Wildfires

Physical impacts

- Forests are destroyed.
- Environmental equilibrium and its scenic beauty is destroyed.
- Water springs dry up.
- Regional temperature varies in short run.
- Atmosphere is polluted and clouds of smoke and dust occur.
- Environment is polluted.

Human impacts

- Loss of human lives and property associated with forestlands is damaged.
- Respiratory diseases occur.
- Air traffic is blocked by clouds of smoke occurred due to air pollution.

Floods

Physical impacts

- Silt is deposited on river valleys and riverbanks break.
- Moisture level of soil is increased and this can create wetlands.
- Soil organisms are destroyed
- Soil erosion occurs.
- Ecological balance is minimized or lost

Human impacts

- Houses and other property are destroyed.
- Loss of human and animal lives.
- Farmlands are destroyed.
- Spread of epidemics and health related problems can arise.

Landslides

Physical impacts

- Parts of hilly regions are pushed towards low-lying lands.
- Water springs dry up as their usual routes are changed.

- Novel water springs emenged
- boulders of rock in high grounds slide down.

Human impacts

- Houses collapse.
- Property is damaged.
- Electricity, telephone cords are damaged.
- Highway, railways are damaged.
- Reservoirs are filled and rivers overflow.
- Floods can occur due to broken dams of water reservoirs.

Tsunamis

Physical impacts

- Coral reefs and low-lying islands are destroyed and the costal landscape is changed.
- Soil along costalline becomes infertile due to mixing with salts.
- Water is polluted due to mixing saltwater with fresh water.
- Scenic beauty of environment is destroyed.

Human impacts

- Loss of human lives and property.
- Infrastructure such as highways and electricity is destroyed.
- Farmlands are destroyed.
- Fishery and other economic activities are destroyed.
- Social and psychological problems can arise.

Some of the physical and human impacts are common to all these natural hazards, such as, environmental pollution, collapse of environmental equilibrium and entire development, and occurrence of psychological problems. Impacts of these hazards can be minimized by preparedness and awareness programe developed

Learning Teaching Activities

Activity - 1

Natural hazards might have occurred in the region you live. What are the natural hazards that you have to undergo as a citizen of Sri Lanka? You should be aware of those hazards and should possess knowledge to face them appropriately. The below mentioned activity develops the awareness of students.

Type of disaster	Regions-prone	Physical impacts	Human impacts	Methods of managing disasters

Competency – 11

Acts with positive attitudes which help in the conservation and maintenance of the physical and human landscape

Competency Level 11.1 Contributes actively in the management of natural disasters that occur in Sri Lanka

(Number of periods 12)

Learning outcomes

- Explains the means of managing natural disasters that influence Sri Lanka.

Introduction

Same as in any region of the world, diverse natural hazards occur in Sri Lanka owing to its location. Generally, Sri Lanka experiences floods, landslides, cyclones, lightening, and droughts. As well, the island is affected by earthquakes even if it is not situated near earthquake - prone region.

These natural hazards cause loss of human lives and severely damage property. Thus, concentration on management of natural disasters is important.

A guide to identify with the subject matter

Common natural hazards in Sri Lanka:

- Floods and inundation
- Droughts
- Landslides
- Cyclones and heavy winds
- Tsunamis
- Lightening

A timely development in both natural and non-natural disasters that occur in Sri Lanka has been observed. Owing to these hazards, Sri Lanka has undergone a heavy loss of many physical, economical and human resources. Thus, a systematic approach has been adapted to disaster risk mitigation and disaster management.

- Disaster risk mitigation preparedness of Sri Lanka

    - Establishment of disaster management cabinet sub-commity in 1993.
    - Formulation of an Action Plan for natural disaster preparedness and mitigation.
    - Passed the Act of National Disaster Preparedness and Mitigation.
    - Establishment of Center for Disaster Management in May 1996 (under Ministry of Social Service).
    - Revising Disaster Management System after Tsunami hazard in 2004.
    - Launching a five-year programme including 21 members representing all the political parties to strengthen the Disaster Risk Management System, after 2004.
    - Formation of legal framework for Disaster Management in 2005.
    - Establishment of Sri Lanka National Council for Disaster Management on 13th May 2005. (The council is chaired by the President of Sri Lanka while vice chaired by Prime Minister and Leader of the Opposition).
    - Establishment of Disaster Management Center under Executive General in June 2005.
    - Establishment of Minister of Human Rights and Disaster Management in January 2006.

Figure 11.1.1

- The Disaster Management Cycle illustrates a model for phases of disaster management from the first phase (prior to the disaster) to the final phase (after the disaster).

- This model can be applied for any natural disaster. Yet, the response to the phases of the cycle can vary in relation to the type and severity of the disaster.

Preparedness

- Causes for the disaster and ability to predict the disaster
- Respond appropriately to the disaster and ability survive the disaster
  E.g. For a drought:

    - Ability to identify mens of a coming drought before it occurs is important. Then people are able to face it well.
    - Commencement of disaster risk management programmes.
    - Development of public awareness (Storing water, development of apposite cultivations methods for drought conditions, shifting to alternative occupations other than farming, alteration of life style etc., and the importance of preparedness for other natural disasters should be discussed with students)

Response

It is important to respond any sort of disaster. Such a response may differ in accordance with the type of disaster.
E.g. Landslide is a disaster.

- Provide immediate assistance to maintain life.
- Provide medical treatments to the affected population.
- Remove property from the affected area if possible.
- Assist refugees with transports, temporary shelter, or foods.
- Estimate the disaster.
- Disaster should be faced strongly.

Recovery

- In this phase rehabilitation - the victims are recovered from the physical and psychological trauma and they are assisted to return back to normal routine- takes place.

- If the estimated disaster can be mitigated, efforts should be taken to recover the disaster.

- These recovery measures should be executed in both short and long terms.

- Development of public awareness is important in this phase.
  E.g. After a tsunami disaster:

- A relief programme should be launched to assist the victims to recover from psychological trauma after the disaster is responded immediately.
- There should be programmes to recover the houses of the victims, infrastructures of the affected area temporarily as well as in the long term.
- The life standards of the affected community should be recovered in the better way, than it was before.

Mitigation

Mitigation phase of the disaster management cycle is followed by the Preparedness phase. The measures taken to mitigate the disaster are connected with preparedness. Thus, some mitigation activities look like the measures taken in the Preparedness phase.

There are a number of disaster mitigation measures.

Before the disaster:

- Disaster assessment
- Installation of emergency warning systems
- Introduction of disaster mitigation equipments
- Launching programmes on disaster mitigation
- Public cooperation
- Development of public awareness
- Enhancement of aggregate institutional strength

During a disaster:

- Caution and rescue
- Damage assessment
- Emergency activities
- Providing subsidies and assistance
- Strong coordinating mechanism

After a disaster:

- Disaster Assessment
- Strategies to recover the situation
- Reconstructions
- Awareness programmes
- Ongoing development process

Competency Level 11.2 Evaluates the strategies adapted for management and conservation of ecosystems of Sri Lanka

Leaning objectives

- Defines the term "ecosystem".
- Identifies and describes selected ecosystems of Sri Lanka.
- Marks selected ecosystems of Sri Lanka on a model map of Sri Lanka.
- Explores methods of ecosystems conservation and management.
- Examines the environmental laws of Sri Lanka.
- Examines environmental ethics innovatively.

Introduction

Biome is a large unit of many different ecosystems. Thus, an ecosystem is a branch of a biome. Sri Lanka possesses a high level of biodiversity. In view of different reasons including complex and varied relief features of Sri Lanka as well as being an island, there are many regional variations in the environment of Sri Lanka. Thus, Sri Lanka is a home to various ecosystems, which are essential for the existence of organisms. Ecosystems, which comprise water bodies, fauna, flora, etc., maintain biodiversity. In addition, food production depends on ecosystems (wetlands and oceans). As well, ecosystems maintain the environmental equilibrium and many environmental problems occur when the ecological balance is disturbed. Thus, study and conservation of ecosystems are vital. Even though a harmonious relationship between man and ecosystem was observed in the past, owing to many factors such as increasing population, complex human needs, various development projects etc., almost all types of ecosystems are endangered presently. Hence, the need for conservation and management of ecosystems of Sri Lanka has arisen. This section focuses on educating students on mechanisms of ecosystem conservation and management.

A guide to identify with the subject matter

Given below are some of the definitions of "ecosystems".

- An ecosystem is an organic community including flora and fauna living within the physical environment or in a habitat.

- An ecosystem is a unit, which consists of many interrelated entities or attributes developed in a common structure.

- An ecosystem is an active unit formed by all living beings in a region and the non-living environment, which interacts with the living beings.

For this section, the following ecosystems of Sri Lanka were selected:

- Wetlands
- Forestlands and wildlife reserves
- Coasts
- Reservoirs and biological systems associate with lakes

Wetlands

(Introduction to wetlands, their distribution, and characteristics are discussed in the section of Biomes of Sri Lanka.)

Threats pertaining to wetland ecosystems are focused here. Given below are several such menaces.

- Unplanned and illicit constructions.
- Land filling.
- Sewage disposal.
- Pillage of biological resources.
- Marginal land use.

Mechanisms to management and conservation of wetlands

- It is important to follow the RAMSAR convention.

- The convention was developed and adopted at meeting in Ramsar in 1971 and come into force in 1975.

- The RAMSAR is a " convention on wetlands of international importance, especially as waterfowl habitat"

- This is funded by UNESCO and managed by the world conservation union (IUCN).

The objectives of the convention are:

1. To consider the conservation of wetlands in national land use planning.

2. 'Wise use' of wetlands within their territory.

3. To promote conservation of wetlands by establishment of nature reserves.

4. To encourage member countries to designate all of their wetlands to the register of wetlands of international importance (Ramsar sites).

5. To designate at least one internationally important wetland of biological value to the convention (Bundala, Anavilundawa and the river Madu of Sri Lanka are included in convention).

6. To cooperate internationally on wetland conservation and sharing.

7. To prepare the annual report on wetland management.

    - Department of Wildlife Conservation is responsible for implementing the role of Ramsar under the standing committee, which oversees convention affairs.

    - Conference is held ones in three years.

    - All the member states of Ramsar convention contribute to the Ramsar Wetland Conservation Fund and thus support the wetland conservation.

Forest and wildlife reserves

Relative to the world natural forests, there is a forest system in Sri Lanka. Even though small in size, forest systems with various features based on the regional diversity, can be seen in Sri Lanka. There are a number of main forest reserve systems, such as, Sinharaja, Vilpattu, Knuckles etc.

Wildlife reserves
There are several types of wildlife reserves.

1. Strict Natural Reserves - Haggala, Ritigala, Yala II
2. Nature Reserves - Minneriya, Giritale
3. National Parks - Yala, Wilpattu, Udawalawe
4. Sanctuaries - Victoria, Randeniyagala. Samanala

Forest and wildlife reserves are endangered and some of the threatening issues are mentioned below.

- Deforestation due to lack of land.
- Deforestation for development projects.

- Firewood gathering.
- Timber extraction and logging.
- Accumulation of waste.
- Poaching.

Mechanisms for forest and wildlife reserve conservation and management.

- Enforcing strict laws against logging and loggers.
- Educating the public and development of environmental friendly activities for forest conservation.
- Among the wildlife conservation laws and regulations the following are important:

    - National Heritage Wilderness Areas Act
    - Forest Ordinance
    - Fauna and Flora Protection Ordinance
    - Imports and Exports Control Act

National Heritage Wilderness Areas Act

- This is the National Heritage Wilderness Area Act, No. 3 of 1988.
- The relevant Minister has the power to declare any area of state land and which in his opinion has ecological value.
- No person shall enter into National Heritage Wilderness Area without permission.
- Any act harmful to the environment of National Heritage Wilderness Area is strictly prohibited.
- Any person who acts in contravention of any provisions of the act is punished by the law.
- Any land, even not being state land, can be acquired for the purposes of this Act.

Forest Ordinance

- This was first rendered in 1907 and later amended in 1995, thus is called forest ordinance (Amended) Act, No. 25 of 1995.
- The Act after amendment was brought forward for the acts such as declaration of Reserved Forestlands, shifting forest boundaries etc.
- It has been declared that entrance and any act impairing the wilderness are against law.

Fauna and Flora Protection Ordinance

- This was first rendered in 1937 and has been amended later.
- This is for conservation of fauna and flora of Sri Lanka.
- By this, any area can be declared a forbidden band or duffer zone.

Imports and Exports Control Act

- Rules and regulations for exporting of forest resources and anything associated with forests are declared in the circular No 03/ 2001 of Ministry of Environment and Natural resources.
- A record of export banning was rendered with this.

National Environment Acts

- Central Environment Authority (CEA) was established in 1980 by this Act.
- This Act was amended in 1988 and 2000.
- A license from the CEA is required in any activity related to environment.
- This indicates the intervention in maximum land use, sustainable utilization of natural resources, fishery production control, forest management, wildlife conservation, and soil conservation.

Coastal ecosystems

Coast is defined as the edge of the land where it meets sea/ocean. Along the coastline, many saline as well as brackish water ecosystems can be seen. The coastline, which is almost 1580 km long, is the home for a large number of major ecosystems.

- Coral reefs
- Mangroves
- Outfalls and lagoons

The importance of coastal regions

- More than 50% of the total population of the country resides here.
- Majority involved in country's economic process employs here.
- This is a sensitive and highly vulnerable ecosystem.
- This is admired for its scenic beauty.
- A natural heritage, which can be used by any citizen.
- Possesses high level of biodiversity.
- Facilitate breeding ground for fishes.

Causes for coastal systems degradation

- Erosion of coasts due to natural causes.
- Mining for coral for lime/ ornamental value.
- Excessive sand mining on shores.
- Fishery using explosives.
- Excessive sand mining in rivers.
- Unplanned coastal constructions.

Mechanisms for coastal ecosystem conservation and management

- The coast conservation unit was established in 1978 under the Ministry of Fisheries and Aquatic Resources.
- This was rendered as Act No. 57 of 1981.
- Enrichment of the coast.
- Mining for coral and limestone is banned.
- Execution of coast conservation methods (E.g. - stone, dunes, groins, retaining walls).

Objectives of the Coast Conservation Act

- Surveying coastal zone.
- Preparation of coastal zone Management Plan.
- Administration and formalizing the developmental affaires of the coastal zone.
- Formulation and execution of schemes for coast conservation within the coastal zone.
- Amendment of required laws.

Coastal Resources Management Plan

- This is a comprehensive and intergraded approach with positive attitudes, which focuses on coastal resource management by Coastal Conservation Department.
- Exclusive study of coastal resources.
- Formation of novel management approaches by legislation, administration, researching and studying.
- Continuation of plans up to date.
- Administration of permit issuing scheme for various human activities in coastal zone.
- Acquire land/ holdings required for management purposes.
- Restoration of coastal land for environmental protection.
- To reduce coastal erosion by means of apt and accurate coastal erosion controlling technologies.
- Carrying out researches and studies to identify problems and possible solutions.
- Supply and development of research data for awareness making among public.

Bio-systems associated with water bodies/lakes

Water bodies can be natural or manmade. There are several common characteristics of these bio-systems associated with water bodies/ lakes.

- Water flows freely into the system while free out flow is controlled.
- Thus, this is called a controlled system.
- Varies organisms grow within the system as well as outside organisms enter the system.
- Basic objective of reservoirs/ lakes is to supply water.
- Bio-systems in water bodies can be seen especially in the dry zone and generally all over Sri Lanka.
- In the highland, reservoirs are constructed with the purpose of generating electricity.
- The most apt technology for constructing reservoirs at present is to make use of the irrigation technology used in ancient Sri Lankan reservoirs.
  E.g. Sorabora Lake

Mechanisms for conservation and management of bio-systems associated with water bodies/ lakes

- Establishment of silviculture associated with the ecosystem.
- Introducing only congenial crops to the system.
- Formalizing the water management (water regulation).
- Execution of environmental and forest ordinances and laws.
- Declaration of bio-systems associated with water bodies/lakes as reserved areas.

Environmental ethics and concepts

Over years, the man has maintained many conventions, customs, and certain behavior patterns to protect environment. Especially, religious background has become most influential to Sri Lankans in their conduct for environmental conservation as orients.

- Every religion highlights the importance of protecting the environment, which includes forestlands and wildlife.
- Any movement that disturbs the environmental equilibrium is harmful to the environment.
- Thus, many countries all over the world endeavor to preserve the environmental ethics and concepts.

Competency Level 11.3 Examines the physical and human impacts caused by natural hazards in the world.

Learning objectives

- Presents information regarding International Environmental Conventions signed by Sri Lanka.
- Examines the relevance of these Environmental Conventions to Sri Lanka.
- Explores the measures taken by Sri Lanka in relation to these conventions.

Introduction

Many global environmental issues have arisen and international community should act together and responsibly in order to find solutions for these issues. As states of the present world are not isolated, an environmental issue occurred in one region generally affects directly or indirectly all the other regions as well. Addressing of such an issue together than solving them alone is more convenient, efficient, and effective. Hence, Sri Lanka also has come into agreement with other nations and signed conventions in order to participate in solving these global environmental issues.

Presently, many environmental issues have arisen owing to the world's developmental process and political complexities and it has been tried to solve these through various environmental conventions. Even though there are many such conventions agreed by Sri Lanka, in this section several selected conventions are discussed. Relative to other countries, Sri Lanka has positively interacted with the environment from the past. The lifestyle of Sri Lankans was firmly connected with the nature. Yet, at present this relationship is gradually declining, and thus, it is obligatory to increase public awareness though environmental conventions.

Sri Lanka has adopted various procedures to proceed in accordance with these conventions and has established relevant organizations. The knowledge about these is essential in environmental conservation. Hence, examining the environmental conservation on which Sri Lanka has agreed upon and their relevance are focused in this section.

A guide to identify with the subject matter

- There are many global environmental problems.
- The environmental problems vary in relation to various landscapes.
- In order to mitigate the environmental problems, international conventions and declaration have been put into effect.
- Sri Lanka has signed and agreed on many such conventions and proceed with these has become a timely need.

Forestlands and wildlife

Forests and wildlife are two essential components of the environment. As long as human beings disturb the environment, they have to face environmental hazards. To minimize the harmful environmental impacts on human beings; it is necessary to limit the influence made on the environment. In order to carry out this, international conventions and agreements are elemental. When proceed according to such conventions, the environmental equilibrium will not be interrupted and there by the environmental hazards would be mitigated. There are several conventions agreed by Sri Lanka on forest and wildlife.

United Nation's Conventions on Biological Diversity

- The convention on biological diversity (CBD) was open for signature at the United Nations Conference on Environment and Development, which is also known as the Erath Summit or Rio Summit, in Rio de Janeiro in 1992.
- Here three major conventions were adopted and the Convention for Biological Diversity is one of them.
- Agenda 21 - a comprehensive programme of action for global action in all areas of sustainable development- was adopted.
- This convention became legally binding on 29 December 1993 and Sri Lanka became a member in 1994.
- As of 1996, 165 countries have ratified the convention.

There are several main provisions in the convention

1. The states have the sovereign right to their genetic resources and countries should adopt regulations to conserve their biological resources.

2. Fair access to benefits of genetic research by countries providing genetic resources.

3. The transfer of technology important for development/use of genetic resources to developing countries on preferential and concessional terms.

4. Commitment of developed countries to build capacity in developing countries in implementing the convention.

- Sri Lanka has agreed to work in accordance with above-mentioned provisions and has formulated its environmental polices in line with them.

- According to the convention, the Center Environmental Authority of Sir Lanka examines the weaknesses/strengths of environmental related activities.

There are several other conventions on biological diversity which are been signed by Sri Lanka.

1. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES- 1973).

2. International Coral Reef Initiative (ICRI).

Climate change

At present, world climate is constantly changing and this has created many environmental issues. As well, Sri Lanka is heavily influenced by these problems. Thus, the conventions and declaration upon which Sri Lanka has agreed should be concentrated. As well, their performance should be examined. There are number of such conventions.

The Rio convention on controlling global climate change

- This was open for signature at the Erath Summit in 1992 and Agenda for 21st century.
- Sri Lanka participated in 1984.
- At first only 50 states participated and at present, there are 180 member countries.
- The changes in emission of green house gases, which are responsible for climate change by countries and zones, are identified.
- All member countries agreed on the following convention.

  "All parties should agree for reducing green house gas emission to the atmosphere by human activities in order to prevent climate change occurring due to green house effects". This is the theme of the convention.

- The United Nation Framework Convention on Climate Change (UNFCCC/ FCCC), proceeds in association with world meteorological organization.

- Sri Lanka has put the following mechanisms into effect in relation to the convention.

    - Formulation of the list of green house gases.
    - Formulation of Sri Lanka's first national declaration on climate change.
    - Researching on climate change.
    - It is important to establish a center for studding climate change.

Wetlands

Wetlands, as any other ecosystems, play a major role in maintaining environmental equilibrium. Yet, at present, world wetlands are threatened by the rapid population growth together with accelerated developmental processes. This has not spared Sri Lanka; instead, this has become one of the major environmental problems of the island. Thus, Sri Lanka has come into agreement with many conventions associated with wetlands, and among them the Ramsar convention is important.

The Ramsar convention

- The convention was developed and adopted in 1971 and in May 1990, Sri Lanka became a member country (This has been discussed in previous sections).

- Three wetlands of Sri Lanka namely, Bundala, Anavilunadawa, and Madu Ganga (river) are included in the convention.

- Department of Forest Conservation of Sri Lanka monitors the proceedings of Ramsar in Sri Lanka under the standing committee, which oversees the convention affairs.

Chloro fluoro carbons (CFC)

The conventions related to climate change have been previously discussed. CFC has been identified as the type of gas, which is mainly reasonable for Ozone depletion among other ozone depleting substances. Thus, it is important to study about CFC in various environmental conventions.

CFC which is a combination of chlorine, fluorine and carbon, is invented for industrial purposes and in 1975, the two scientists Granne Moris and Mario Moline from USA discovered that CFC is responsible for ozone depletion. CFC is mainly used for refrigerators, air conditions, spray-perfume, and chemicals. Even though Sri Lanka contributes less in CFC emission, Sri Lanka has signed the conventions related to CFC. Montreal Protocol is important among such conventions.

Montreal Protocol - 1987

- The treaty was open for signature in Montreal city of Canada in 1987, 24 countries participated in it.

- A number of proposals were put forwarded to prevent the Ozone depletion owing to CFC.

1. All developed countries should restrict the use/ production of CFC by 2000.

2. The developing countries should achieve that state by 2010.

3. Manufacturing, trade, and use of harmful chemical should be concentrated.

- Sri Lanka signed the convention agreeing to proceed according to the above-mentioned objectives on 15th December 1989. Sri Lanka has been proceeding according to the convention since 15 March 1990.

    - As of 1994, 120 states have signed the convention. At present, there are 1992 member states.

    - The convention was revised again in Helsinki, May 1989 and in London, 1990 as the convention was not enough to protect the Ozone layer.

Following the Montreal protocol, Sri Lanka has put the following into effect.

1. Execution of new import restriction laws for Ozone deflecting substances (ODS) in 1996.

2. Transformation of three refrigerator manufacturing and two perfume manufacturing organizations into Ozone friendly technology.

3. Import of CFC to Sri Lanka was proposed to be ceased in 2000, and thereby, at the end of 2007 proposals were made to cease import to CFC to Sri Lanka completely.

4. In 2007, Sri Lanka National Ozone Unit was able to obtain the international award for successful accomplishment of Montreal Protocol.

5. In 2008, Sri Lanka was granted the UNEP (United Nation Environment Programme) award for outstanding achievements in the protection and improvement of the environment.

    - Other than above-mentioned environmental conventions, Vienna convention and Kyoto protocol are important conventions, to which Sri Lanka has agreed.

Learning Teaching Activities

Activity – 1

- This is an individual activity.
- Name five environmental conventions that have been sighed by Sri Lanka.
- Explain the methods adopted for one of the above named conventions in relation to Sri Lanka.

Activity – 2

- This is a Group activity.
- Select any forestland or wetland located nearby your region.
- Identify and name the components of the selected ecosystem.
- Find and present the causes (if any) for the possible pollution of the selected ecosystem.
- Examine the harmful impacts that disturb the ecosystem equilibrium.
- Explain the possible solutions that can be taken to protect that ecosystem.

Competency – 12

Acts showing concern and attention on the Earth and its inhabitants in order to promote harmonious interrelationship between nature and society

Competency Level 12. 1 Examines the role of international and regions organizations, which are concerned about issues of ecological importance.

(Number of periods 10)

Learning outcomes

- Expresses that human activities lead to create and to enhance ecological problems.
- Explains the need for an international orientation to create a better environment for future generations.
- Expresses that diverse environmental organizations are established under various names focusing on different environmental entities.
- Explains that even regional environmental organizations are established based on regional environmental problems.
- Studies the information regarding organizations, which are directly concerned with the environment of Sri Lanka

Introduction

A variety of environmental problems now affects the entire world than it was in the past. The world population has experienced continues growth since 18th century, by about eightfold. As well, population-doubling time is decreasing.

Relative to the increase in the world population, the utilization of environmental resources also increases. Additionally, with the increasing human needs, exploitation of the physical environment increases. This results in collapse of environmental equilibrium and thereby many global environmental problems.

At present, entire world has to experience environmental problems such as global warming, desertification, ozone depletion, declining forest cover, extinction of fauna species, water pollution, air pollution, sea level rising, and droughts, floods, landslides etc., due to climate change.

Moreover, global energy use has risen drastically. The amount of manufactured goods added up to intentional trade has also risen by two hundredfolds. The Erath has lost million hectares of its forestlands. The harmful gases such as chlorofluorocarbon, methane, carbon dioxide etc., added up to the atmosphere is increasing day by day. The addition of UV rays entering the earth's surface through ozone layer has continued to increase. This situation has become the basis for aforementioned environmental problems.
We are forced to act internationally as well as regionally to protect the Erath from these dreadful environmental problems, as these problems are not limited to an area. Thus, the urgent need for sustainable development is highlighted.

Presently, many state and non-governmental organizations are established seeing the necessity to protect the environment and to ensure a healthy planet for generations to come.
The prime objective of all these environmental organization is sustainable development. As it is difficult to concentrate on a large number of environmental organizations, only a few dominant organizations that operate internationally, nationally or regionally are discussed here. As Coastal Conservation Department undertakes coastal regions and ecosystems, here it is considered as an environmental organization. Additionally, environmental summits and programmes are discussed in this section.

A guide to identify with the subject matter

United Nations Conference on Environment and Development (UNCED)

The major objective of the conference was the development of international legal system, which includes fundamentals on how ecological and economic patterns of humankind as well as each nation should be controlled in order to ensure our common future.

- This conference is also known as the Rio Summit and Erath Summit.
- The conference was held Rio de Janeiro, in Brazil from 3rd – 4th June 1992.
- The conference was built upon the Brundtland Report, also known as 'our common future' from the world commission on Environment and Development (WCED) which is also called the Brundtland Commission known by the name of its chair Gro Harlem Brundtland, the former Norwegian prime Minster.
- The principle objective of the Rio conference was environment and sustainable development.
- The Erath Summit produced a number of outcomes including;
    1. Agenda for 21st century (Agenda 21)
    2. Rio Declaration on Environment and Development.
    3. The Rio forestry principles.

4. The United Nations Framework Convention on Climate Change (UN FCCC).

5. The United Nation Framework Convention on Biological diversity.

6. Protection of the rights of indigenous peoples.

The role of the conference

1. Taking rigid steps to protect the environment and to maintain the integrity between the environment and economic activities in order to ensure stable future for each human being.

2. Gather humankind towards a better future.

3. Maintenance of environmental equity and support each nation to maintain ecologically sound stable development.
   E.g. Protecting the atmosphere and natural resources, poverty alleviation etc.

The Rio Declaration has consented on many agreements regarding environment and sustainable development. Given below are some of them.

1. Human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature

2. States have a sovereign right to exploit their own resources and ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or areas beyond their limits of national jurisdiction.

3. The development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

4. A state should protect all natural resources of its people and the environment against the outside interventions.

5. Warfare is inherently destructive of sustainable development and the environmental. Sates shall therefore respect international law providing protection for the environment.

United Nation Environmental Programme (UNEP)

- This was found a as result of the United Nations Conference on the Human Environment, held in Stockhom city in June 1972 and is active since 1974.

- Head quartes of the UNEP is situated in Nairobi, Kenya.

- This is the first United Nations Organization established in a developing country.

Some of the programmes executed by UNEP are mentioned below.

The role of UNEP

- Plays a key role in designing the environmental policies of UN and its member states since 1972.

- Execution of the proposals of Agenda 21 of the Erath Summit.

- UNEP programme carries out its environment related activities under eleven separate units.

  E.g. Decertification control, environmental awareness, being alert to the global environment

UNEP has decentralized its tasks by establishing several Regional Centers to perform its programmes.

1. Bangkok - Asia Pacific Region
2. Nairobi - Asia Pacific Region
3. Mexico city - Latin American Region
4. Kingston - Caribbean Region
5. Bahrain - West Asia
6. Geneva - European Region
7. Athens - Mediterranean Region

The UNEP organization has grouped the field of environment into several topics and they are implemented under five special secretariat divisions.

Field	Secretariat Division
1. Hazardous chemicals	Geneva
2. Industry and environment	Paris
3. Control the transboundary movement and management of hazardous waste	Geneva
4. Convention on trade of the species endangered with extinction	Geneva
5. Convention on migrating species	Bonn

- Executes with the awareness that the positive changes in the environment can be produced only though the development and broadening of the public awareness.

(Further details on United Nations Framework Convention on Climate Change are provided in the Competency Level 11.3)

Intergovernmental Panel on Climate Change (IPCC)

This organization was established in association with United Nations Environmental Programmes (UNEP) in order to provide data on climate change for the researchers or any other individuals who are interests in the field of climate change.

The IPCC does not carry out its own original research work, nor does it do the work of monitoring climate or related phenomena itself. IPCC is responsible for providing scientific, technological, and socioeconomic information on the risks of man- induced climate change throughout the world in a perfect, open, and transparent manner.

As well, IPCC gathers information on mitigating the influence of climate change and ability to adopt them.

- Plays a key role in formation of the UN Framework Convention on climate change, proposed at the Rio Summit in 1992 and activated in 1994.

- IPCC concentrates on the tasks of United Nations Human Development.

International Union for Conservation of Nature (IUCN)

- IUCN is the first international organization, which was established focusing on environmental conservation.

- IUCN was established in Fontainbler city of Paris in 1948.

- IUCN is an oldest and the largest of all global environmental networks.

- IUCN is the central authority for environmental and territorial development.

- The present headquarters of IUCN is located in Gland, Switzerland.

The Role of IUCN

- To ensure environmental development by proper maintenance of renewable resources for the well- being of the human kind.

- To conserve natural resources by management and protection of undefended land and ocean areas and maintenance of considerable number of flora and fauna species.

- To protect forestlands, fresh water and seawater areas, which are consisted of representative and significant flora and fauna species.

- To formulate methods to ensure the safeguard of flora and fauna species to be born in future against extinction.

- To act in a wide range on atmosphere.

- To campaign to fulfill international conventions.

- To implement the policies of varied states, regional institutes and governmental organizations/ institutes.

IUCN is responsible of executing the following projects.

1. Conservation and development
2. Population numbers and resources
3. Conservation science
4. Conservation of fauna species
5. Flora conservation
6. Reserved area conservation
7. Urban and coastal zone conservation
8. Wetland conservation
9. Tropical forestland conservation
10. Arid land conservation
11. Education and training on conservation
12. Conservation law

IUCN publishes important annual, bi-annual, and monthly publications such as;

- IUCN publication
- IUCN magazine
- Red Data Book

World Conservation Union and Sri Lanka

- To provide technical support to the Forest Conservation Department to study the biologically diverse species in terrestrial environment of Sri Lanka.
- To provide technical support to conserve the medicinal plants of Sri Lanka.

International Water Management Institute (IWMI)

- IWMI can be identified as one of the fifteen International Research Centers.
- IWMI is supported by sixty governments.
- IWMI targets water and land management challenges faced by poor communities in the developing world, to maintain a sustainable environment.
- Within that role, the IWMI executes the following tasks.
    1. Valley water management
    2. Land, water and livelihood
    3. Agriculture, water and cities
    4. Water conservation and environment
- IWMI works through collaborative research together with partners such as varied individuals and organizations of the country, policy makers, development agencies, individual farmers and privet sector organizations.
- The headquarters of IWMI is established in Battaramulla in Sri Lanka

South Asian Cooperative Environment Programme (SACEP)

- SACEP is a regional environmental union consisted of eight South Asian countries and was established in 1982.
- SACEP is an intergovernmental organization including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka.
- The headquarters of SACEP is in Colombo.
- SACEP has identified fifteen fields of study and they are distributed among each memberstates.
    1. India – Formulation of laws, Education and Training
    2. Iran - Energy, Responsibilities and Environmental quality
    3. Bangladesh – Mangroves, Delta and Coastal zone
    4. Nepal – Tourism
    5. Pakistan - Ecosystems and Community Forestry
    6. Sri Lanka – Environmental Impact Assessment, Cost profit Analysis
    7. SACEP organization – Decertification and Regional Seas (overall)

Presently, SACEP has accomplished the following two achievements.

1. Establishment of an intergovernmental body to fill the prevalent lack of such an organization.
2. Formation of a mechanism for cooperation.

- Activities of SACEP are supposed to be extended so as to benefits the whole world besides the SACEP member countries.
- As well, SACEP assists to implement the programmes of UNISEP.

The Role of SACEP

SACEP member countries individually or cooperatively act towards conservation, management, and uplift of human environment of the member states as well as operate towards poverty alleviation, mitigation of socioeconomic disparities and uplift of the spirit of communities within the region.

National Aquatic Resources and Research Development Agency (NARA)

- NARA was established in 1981 by the Act No. 54 of 1981.

- NARA coordinates and researches on development and management of the aquatic resources of Sri Lanka.

- The main objective of NARA is to face the challenges offered by the Exclusive Economic Zone (EEZ) and the proper management of this area.

The Role of NARA

- To ensure the application and utilization of scientific and technological expertise for implementation of the National Development Programme on the subject of living and non-living aquatic resources.

- To promote and conduct research activities directed towards the identification, assessment, management conservation, and development of aquatic resources.

- To provide advisory and consultancy services on scientific, technological, and legal matters relating to the exploitation, management, conservation, and development of aquatic resources.

- To coordinate the activities of institutions engaged in exploitation, planning, research, development, conservation, control, and management of aquatic resources.

- To undertake collection, dissemination, and publication of information and data useful for management, conservation, and development of aquatic resources and the fishing industry of Sri Lanka.

- To undertake the collection and publication of hydrological and navel information and data on deep and shallow seas and internal reservoirs.

- To provide training for human resources required to carry out or assist in the work of agency.

Central Environmental Authority (CEA)

- CEA was established in August 1981 under the provision of the National Environmental Act No. 47 of 1980.

- CEA holds the responsibility of formulation of environmental policies and methodologies of Sri Lanka and coordination of relevant agency involved in management of natural resources.

- The key responsibility of CEA is to focus attention on environment and supply of environmental information on natural resources in development planning.

Role of CEA

- To concentrate on ecological focus in development planning and to supply information on natural resources and environment.

- To indicate that the environment can be improved through development projects than annihilating or violating it.

- To issues environmental impacts assessments to all the development projects carried out by public and private sector organizations since 1984.

- To ensure island wide execution of CEA responsibilities through its 25 District Environmental Agencies and to assign and monitor their tasks.

- To collect information district wise regarding impact on natural resources and to respond them appropriately.

- To conduct public awareness programmes on environmental protection through various methodologies.

CEA focuses on providing environmental education and knowledge to create a community, which is more concerned about the environment.

There are two outstanding divisions in CEA.

1. Establishment of Environment Information Center and thereby, collection of environmental information and data.
2. Formation of a database required for environmental policy making and conservation methodology formulation.

In accordance with the proposed National Environment Act, the name and the task of this authority is supposed to be changed, as National Environmental Representative Institute.

Coast Conservation Department (CCD)

- Prior to 1963, coast conservation was under taken by various departments.

- Thus, recognizing the importance of conservation, the government established a separate unit to undertake the responsibility of coast conservation under Colombo Fort Commission in 1963.

- Later, in 1978, the Coast Conservation Unit was established under the Ministry of Fisheries and in 1984, the Coast Conservation Department was established under Coast Conservation Act No. 57 of 1981.

- Then, the department proceeds in accordance with the revised Act No. 68 of 1988.

- CCD undertakes all the activities related to coast around Sri Lanka.

- With that aim, the following plans were put into effect.

    1. Coastal conservation and management plan, 1990
    2. Coastal 2000 plan, 1992
    3. Coastal conservation plan, 1997
    4. Coastal conservation plan, 2004

The role of CCD

1. To Issue permits for activities associated with coastal zone.
2. To compile National Coastal Zone Management Plans.
3. To implement management processes in selected specific areas.
4. To regulate mining for sand and coral.
5. To oversee environment related activities in the coastal regions.
6. To oversee coastal engineering activities.
7. To complete coast protecting constructions.

8. To campaign coast protecting activities in sudden disasters.
9. To involve in awareness development affairs related to coast conservation.

Learning Teaching Activities

Activity - 1

This activity focuses on preparation of database after studying about internationally, nationally and regionally operating environmental organizations. Here, students should include information about the objectives, role, and services provided by each organization referring to magazines, books and other media.

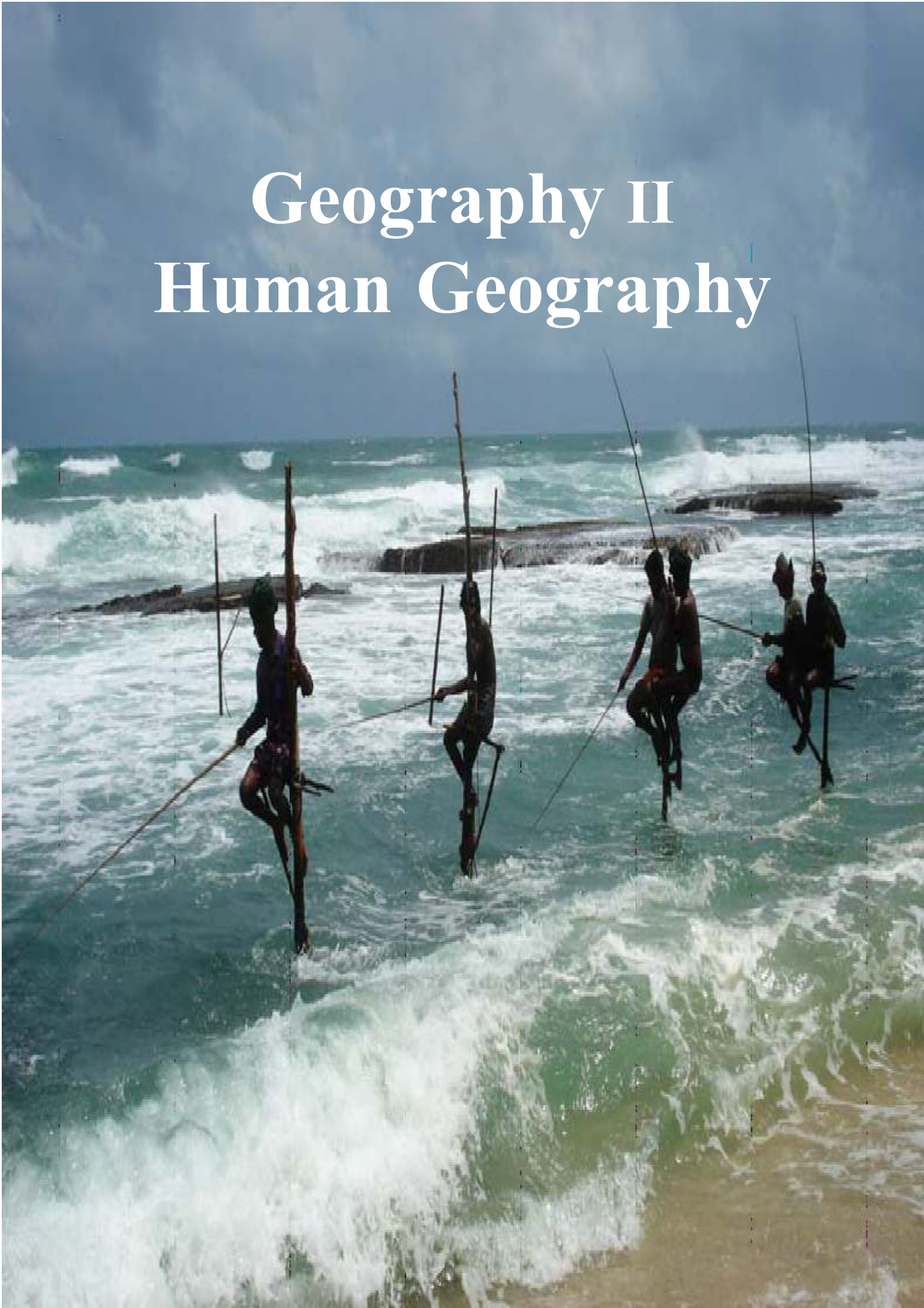
Activity - 2

Prepare articles on international and local environmental organizations to display on a notice board.

Activity - 3

Critically examine the mechanisms adapted by international and local environmental organizations towards mitigating global environmental problems and write an article on it to publish in any environmental magazine.

Geography II
Human Geography



Competency - 7

Examines recent trends and tendencies in agriculture and contributes to agricultural activities in a productive manner

Competency Level 7.1: Explains the nature of the world agriculture in terms of technology, production and marketing process.

(14 periods)

Learning outcomes:

- Explains factors that contributed to the changes in the nature of world agriculture
- Explains the contribution of green revolution in increasing world food production
- Describes how gene technology has been used to increase food production without increasing the area under agriculture
- Explains how the gene technology adopted to solve the problems created by green revolution has resulted in more complicated problems
- Describe factors underlying the expansion in world grain production during the past three decades
- Explains recent changes in the marketing process of agricultural products

Introduction

From the beginnings of the civilization man utilized plants and animals as food. At the beginning of this process the gathering of forest products and hunting of animals were dominant but with the establishment of permanent settlements the agriculture emerged. Today, the agriculture which is complex and diverse compared to previous activities has become the economic activity of the majority of the world population and it is connected to all other sectors of the world economy. With the increase in world population the demand for agricultural products rose and the scientists began to adopt various strategies to increase agricultural production. In consequence, the agricultural practices that has been in existence for thousands of years faced a revolution in the twentieth century. It is the objective of this unit to study those trends and tendencies of world agriculture.

A helping hand to comprehend the subject matter

World Agriculture

Agricultural technology

In order to satisfy the demand for food and other commodities that occurred due to the rapid increase in world population after Second World War an expansion in the use of advanced technologies in agricultural activities took place. This process of agricultural technology can be considered in two ways:

- agricultural technology associated with the green revolution
- gene technology

Green revolution

This is a process adopted to increase the agricultural production through improved technologies. It could also be described as the introduction of high yielding and environment receptive crops cultivated by applying a package of inputs such as agro-chemicals, fertilizers, pesticides, irrigated water and machinery.

- The commencement of an agricultural research project in Mexico in 1943 with a view to increasing food production could be considered as the beginning of the Green Revolution.
- Although the above project ended in 1962 with the inauguration of the World Food Programme of the United Nations Food and agriculture Organization in 1963 this process became to be known worldwide as the green revolution.
- A Consultative Group on International Agricultural Research (CGIAR) was established.

There were two aspects in the agricultural technology associated with green revolution:

1. **Production of more productive new varieties of seeds**
2. **Adoption of modern agricultural technologies**

1. **The production of more productive new varieties of seeds** was implemented in a number of ways.

Cross-breeding

This is the production of seeds with specific characteristics by crossing of two varieties of seeds of the same family.

e.g. It is possible to produce a more productive variety of paddy that is resistant to drought by crossing a resistant variety of paddy with a more productive variety

There are a number of such improved varieties:

- the IR - 8 variety produced by the International Rice Research Institute (IRRI) of the Philippines
- the Nercas variety introduced to the African region
- H4 variety
- IR 36 variety

A number of special characteristics can be seen in these varieties:

- resistance to diseases
- resistance to insects
- possibility of obtaining yields within a short period of time
- manifold increase in yield compared to traditional varieties

There are cross-bred varieties of wheat, too.

- Norin 10 produced by crossing several dwarf varieties of wheat grown in Japan

There are a number of special characteristics in these wheat varieties.

- resistance to high wind
- dwarf plants
- resistance to high rainfall and diseases
- resistance to pests

Hybrid seed varieties

A method of generating more productive varieties of seeds; a technique of obtaining seeds from the propagation of two genetically exclusive types of seeds

- BG 407 H is such hybridized paddy variety. Through hybridization of wheat and Rye improved varieties of wheat have been produced.

Tissue culture

This is also an important method adopted to increase productivity. This is done in a laboratory deriving a large number of high quality clones from the tissue of a plant.

The agricultural technologies associated with Green Revolution paid more attention to the production of seeds with high productivity. Through the worldwide use of these improved seed varieties it was possible to salvage about one million people from starvation.

2. Adoption of modern agricultural technologies

Agricultural machinery is used in

- land preparation, broadcasting and transplanting
- weeding
- use of agro-chemicals
- irrigation

A wide variety of agricultural machinery ranging from hand tractors to large tractors and combine harvesters is used.

The use of machinery made agriculture easy and the time spent could be saved. It was also a solution to labor shortages in some areas. The generation of employment opportunities in agriculture related services such as maintenance of equipment and other activities provided an answer to unemployment to some extent.

Use of artificial fertilizers

Use of artificial fertilizers was an essential factor in achieving success in Green Revolution. Artificial fertilizers were necessary to obtain high yields from improved varieties.

Insecticides and Pesticides

It was possible to prevent crop damages through the application of insecticides and pesticides and this helped not only to protect but also to increase yields.

Use of Information technology in agriculture

At present, computers are used to acquire information on crop diseases, fertilizers, insecticides and pesticides, water supply and irrigation and market conditions.

The effects of Green Revolution

The effects of the green revolution can be categorized as follows:

- effects on the growth of food production and food security
- Socio-economic effects
- Effects on the environment

These have resulted in favorable as well as unfavorable consequences.

Effects on the growth of food production and food security

- rapid increase in grain production in a large number of developing countries since the 1960s
  e.g., the countries like Mexico, India, and the Philippines that imported grains became grain exporting countries
- The growth in production was specific to wheat, corn and rice due to the increased use of improved varieties of seeds and application of fertilizer and chemicals.
- the production of wheat in India increased from 10 million in 1960 to 13 million by 2006
- Rice production in the Philippines increased by 30 per cent during the period 1966-1977
- The increase in production has augmented the food security levels in these countries (See *http://en.wikipedia.org/wiki/greenrevolution*)

Socio-economic effects

- High costs of inputs in green revolution such as seeds, fertilizer, agro-chemicals and machines and equipment made poor farmers indebted to loan providing institutions
- well-off farmers became richer
- economic disparities among farmers widened
- mechanization of farming tended to increase the cost of fuel resulting in an increase in cost of inputs

Environmental effects

Adverse effects due to the use of artificial fertilizers, insecticides and pesticides:

- insecticides and pesticides destroyed edible green vegetables and fish thereby depriving farmers of their supplementary food sources
- irrigation resulted in salinization of some lands, water logging and in some instances decrease in ground water levels
- some times indiscriminate use of fertilizers, insecticides and pesticides and failure to adopt protective measures in their use resulted in adverse effects on environment as well as farmers

Globalization of agriculture due to green revolution

- influence of agricultural research centres established under the patronage and financial assistance of American Institutes such as Rockefeller Foundation, Ford Foundation and USAID
- Many countries tended to be controlled by the multi-national corporations producing seeds, fertilizers, agro-chemicals and agricultural machinery, e.g., the Philippines

Gene technology

- Introduced as a strategy increase food production further; this is sometimes known as the second green revolution.
- In the context of agriculture gene technology a gene of a plant or an animal is crossed with the gene of another plant or an animal to produce a new plant or an animal with different characteristics from the original one

Genetic engineering technology has an impact on several agricultural sectors:

- grain production
- production of vegetables and roots
- production of fruits
- animal products

Grain production

Paddy, wheat and corn are major grains. A number of disease-resistant and insect-resistant varieties of paddy with special characteristics were introduced. e.g., IR 2061 is a variety resistant to seven insect species.

Golden rice is a vitamin integrated variety.

A variety of wheat resistant to various diseases and another variety of wheat produced by genetically crossing wheat and rye have been invented.

Vegetables and Roots

Special types of tomatoes, beans and carrots have been produced using gene technology. Another crop subjected to gene technology was potatoes. Among them, a variety produced by a team of Russian scientists and another variety produced by the International Potato Research Institute in Lima, Peru should be mentioned.

Fruit production

A large number of improved varieties of fruits have been produced with the aid of gene technology. Among them banana, papaya, grapes, apples and oranges should be mentioned. The resistance to pests, late ripening and less vulnerability to losses in transport are special characteristics of these varieties.

Animal products

Milk, chicken and pork were the main animal products. It must be noted that gene technology has been utilized to improve non-food crops also. An example would be an improved variety of insect resistant cotton developed by using cotton genes.

Advantages and disadvantages of gene technology

Advantages

- food production could be increased
- yields could be increased
- crop diseases could be minimized
- crops suitable to various environments could be developed
- wastage in vegetable and fruit production could be prevented

Disadvantages

Health risks

- in some instances the genetically modified potatoes and soybeans have affected human body adversely
- the BST hormone did increase milk production but had adverse effects on human body

Environmental risks

- destruction of insects favorable to agriculture
- emergence of weeds resistant to weed killers
- destruction of bio-diversity
- gradual decay of traditional seed varieties

Expansion in Production
(in relation to wheat, rice, vegetables, fruits, fish and animal products)

The expansion in agriculture could be discussed as follows:

- increase in yield
- expansion in land area
- short-term harvesting
- storage and processing

Increase in yield

A number of factors have contributed to the increase in yields during the past decades. They are:

- use of high yielding seeds (IR 8 paddy, Norin 10 wheat)
- use of artificial fertilizers
- use of insecticides and pesticides
- adoption of gene technology
- use of soil conservation methods
- use of advanced irrigation methods
- application of modern agricultural techniques (green houses)

The following table shows the growth of production in wheat, rice, corn, potatoes and soybeans:

Table 7.1.1

Growth of Agricultural production (in million tones)

Year	Wheat	Rice	Corn	potatoes	Soybeans
1996	585	562	576	295	130
2007	607	566	785	315*	204**
				* 2006 data	** 2004 data

Source: *http://en.wikipedia.otg/wiki/greenrevolution*

The countries that achieved a growth in production are given below:

Wheat : China, India, Russia, Pakistan, Kazakhstan

Rice : China, India, Indonesia, Bangladesh, Vietnam, Thailand

Corn : China, Brazil, Mexico, Argentina, India, Indonesia

Potatoes: China, Russia, India, United States, Ukraine, Germany, Poland

Expansion of land area

- Many countries have reached the limits in expanding their agricultural land, e.g., India, China, West European countries and Egypt
- Some countries have made attempts to expand the land area through irrigation. The expansion in land area under wheat in Saudi Arabia is an example.
- In general, the area under wheat and rice in the world has been declining.
- The area devoted to corn has been increasing.
- The use of land for other human activities has resulted in an annual decrease in area under crops.
- Due to salinization 10 per cent of the irrigated land has been withdrawn from crops.

Short-term harvesting

Gene technology and improved varieties of seeds have contributed to the development of crops that could be harvested in a short period of time.

- wheat varieties with a harvesting period of 110 days
- paddy varieties with a harvesting period of three months
- potatoes with a harvesting period of 40 days

The introduction of crops with a short harvesting period has made it possible to obtain yields several times within a year.

Many factors have contributed to the growth in vegetable and fruits production. Among them,

- deriving high yields from crops improved by the application of gene technology
- possibility of preserving for longer period of time
- use of fertilizers and advanced technologies
- Expansion in cropland through greenhouse technology, deserve mentioning.

Expansion in animal products

- Milk and milk-related products, chicken and pork are major animal products.
- gene technology and improvements in farm organization have contributed to the expansion
- the BST hormone has played a major role in increasing milk production
- In poultry farming and piggery new methods have been adopted.
- the consumability of chicken in a very short period of time has resulted in increased demand and growth in production
- United States, Russia, India and New Zealand are major milk producing countries
- China ranks high in the production of chicken and pork

Growth in Fisheries products

The expansion in fisheries products could be described under three headings:

- ocean fisheries production
- fish production in inland waters
- aquaculture

The fish production by major fishing areas of the world in 2006 are given below:

- North-west Pacific - 21.6 tones
- Southeast Pacific - 12 tones
- West central Pacific - 11.2 tones
- Northeast Pacific - 9.1 tones
- Eastern Indian Ocean- 5.8 tones

Source: FAO, 2008

Of the ten major fishing areas of the world the largest production comes from the North-west Pacific area while the lowest production is from the Atlantic region.

China, Peru, United States, Indonesia, Japan, Chile, India, Russia, Thailand, the Philippines are the major countries in fisheries production.

The conflicts among producing countries, environmental problems and security problems have retarded the expansion of fish production.

The importance of the fisheries resource management has been emphasized as a strategy for solving problems in the industry. The following steps have been taken in that d direction:

- Establishment of Atlantic Tuna Commission
- Agreement on Economic Regions 1970
- Rome Conference on World Fisheries Industry 1995
- The Pacific-Halibut Agreement between the United States and Canada in 1929

Storage and Processing

Storage facilities are needed to

- conserve surplus production
- supply products without interruption, and
- maintain stocks for future use.

The present storage process has many improved features. Among them

- the high levels of mechanization
- use of computer technology
- use of modern methods in place of high cost traditional methods, and
- possibility of assuring the protection of goods and avoiding wastage need mentioning.

Processing of agro-products

Agro processing means preparation of agricultural products for consumption. In processing many techniques are used. Following are some examples:

- canning of meat, fish and fruits
- packing of vegetable and fruits
- bottling of fruit juice and milk
- introduction of products in different forms: e.g. milk in the form of cheese, butter and powdered milk
- introduction of meat in the form of as sausages
- transform grain into powder form
- preparation of tea, coffee and cocoa in different form

In some instances, processing results in completely different products: for example, corn, soy, canola and sun flower are turned into oils.

Marketing process

It is not possible for each and every country to produce agricultural products they require. Some countries produce a surplus in some agricultural products while others are deficient in that particular product. This situation leads to in export and import trade.

- Marketing process of agricultural products is complex. It ranges from the stage of production to that of consumption. Also, marketing takes place in different forms.
- In some instances producer and consumer are connected directly.
- in other cases, there is an intermediate person between the producer and consumer

In marketing, the two main branches are wholesale and retail trade.

A number of factors affect the marketing process. Among them, the following are important.

- Policies
- Multi-national corporations
- agribusiness
- Agricultural organizations
- Information on markets

Agricultural marketing policies are concerned about,

- decisions on supply
- stabilization of price levels
- farmers' well-being, and
- international trade environment

The policies adopted by the United States in wheat trade, the protective measures adopted by the European Council in order to safeguard the production of beet sugar by its member countries, the enactment of import tariffs are some of the examples for policies in marketing of agricultural products.

Multi-national Corporations

- Multi-national corporations exert a considerable influence on the marketing of agricultural products
- In the marketing of seeds, fertilizer, insecticides and pesticides, agricultural machinery and other related products multi-national corporations play a major role

  e.g: Monsento in the United States is an example. It produces seeds, insecticides and pesticides. Another company, DuPont is famous for producing agro-chemicals and vegetable seeds. The world trade in grains is dominated by the companies like, Cargill's, Calgin, Sebageigi. Nestle is dominant in Milk and milk products marketing.
- Multi-national Corporations are profit oriented.
- Also, some multi-national corporations are influential in world politics.

Agri-business

Agri-business covers every aspect of agriculture such as production, supply of seeds and farm machinery, wholesale trade and marketing. The following are the main characteristics of agribusiness:

- Large-scale enterprises
- maximum use of technology, and
- production at commercial levels

Agricultural Organizations

Agricultural organizations have been established in order to sustain agricultural activities and ensure the well-being of the people engaged in such activities. There can be,

- local organizations
- regionl organization and
- international organizations

The organizations established within a country are called local. A few examples would be,

- Milk producers' cooperative societies
- Agricultural Board in Sweden and
- Agricultural Federation in Canada

Agricultural Development Council in the American Pacific region is an example for regional organizations.

The international organizations include,

- The United nations Food and Agriculture Organization (FAO)
- International Fund for Agricultural Development (IFAD)
- World Food Programme (WFP), and
- World food Council (WFC)

These organizations have one or more objectives and in general their services are free of charge.

Market information

Market information on every aspect of agriculture is important for the farmer, trader as well as for consumer. Market information on agriculture includes:

- Crops to be cultivated
- Their harvesting time
- Release of agricultural production to the market
- Storage
- Pricing

- At present, the electronic media play a major role in providing information on markets. They include telephones, radio, television, Internet and e-newspapers.
- Until recently it was difficult for developing countries to obtain this information but lately various modes of media have been utilized to obtain information.
- Advertising plays a special role in marketing at present and many companies spend large amounts of money to advertize their products

Competency level 7.2 : The nature of agriculture in Sri Lanka is explained in terms of technology, production and marketing process.

(20 periods)

Learning outcomes:

- examines how green revolution has affected agricultural technology
- explains favorable and unfavorable effects of green revolution
- identifies organic agriculture as a strategy for evading unfavorable effects of green revolution
- Examines the place of plantation crops in Sri Lanka's agriculture
- Explains the changes in land use pattern in Sri Lanka

Introduction

Sri Lanka has been a country based on agriculture from historic times. The state of agricultural self-sufficiency that Sri Lanka has been enjoying changed with the European domination and the country became an importer of its food requirements. The country's agricultural sector paid more attention to plantation crops and the problems arisen through that transformation remain unchanged even at present. As such, special attention has to be paid to the agricultural sector in the development programmes in Sri Lanka. It is the objective of this unit to understand the nature of Sri Lanka's agriculture in terms of technology, production and the marketing process.

A Helping hand to comprehend the subject matter

Agricultural technology in Sri Lanka

- In order to meet the demand for food generated by the growth of population in the country the advanced agricultural technologies were adopted in order to increase the production of paddy, vegetables and fruits. The agricultural technology adopted in Sri Lanka has different aspects such as,
    1. The use of modern machinery
    2. Green revolution
    3. Gene technology
    4. The use of organic fertilizer, and
    5. Irrigation technology

Use of modern machinery

- Compared to other crops the use of agricultural machinery in paddy cultivation has been on the increase.
- Use of machinery of various scales can be seen from broadcasting to rice processing
  e.g. various machinery ranging from hand tractors to combine harvesters

- Advantages of using machinery
    - making farm activities easy to handle
    - saving of time

- Disadvantages of using machinery
    - high cost
    - do away with human labor
    - difficulty of using machines in small plots of land
    - adverse environmental effects on soil
    - limitations in using machines
    - difficulty in using machines on terraces

Green Revolution

- Green revolution in Sri Lanka has made a higher impact on paddy cultivation
- Although a large number of traditional paddy varieties have been in use in Sri Lanka for a long time their yields were not sufficient to meet the increasing demand. Thus the use of artificial fertilizers took place.
- Since independence many research programmes have been conducted with a view to increasing paddy yields. The main steps of the research programme are:
- identification of suitable traditional paddy varieties separately for the Wet and Dry Zones
- Introduction of cross-bred varieties of paddy: in 1957 five H varieties, namely H 4, H 7, H 8, H 9 and H 10, were introduced.
- introduction of new varieties, like
    - High-yielding seeds
    - Short-term seeds
    - Disease and pest resistant seed varieties
    - Seed varieties resistant to salt and marshy land conditions

      e.g., BG 350 - resistant to diseases spread by insects
      AT 353 - for lands with salty water
      LD 356 - for districts of Kalutara and Galle
      BG 300 - insect resistant/ harvested in 90 days

- Spread of Green Revolution in Sri Lanka
    - introduction of new varieties of paddy (IR 8 in 1966)
    - increase in the use of pesticides
    - encouragement of fertilizer use
      (Fertilizer use increased from 20,000 tones in 1960 to 239,000 tones by 1996)
    - use of agro-chemicals
      (Use of agro chemicals increased from 28,865 litres in 1970 to 503,383 litres by 1978, according to the National Fertilizer Secretariat)

- Above developments resulted in an increase in production costs of farmers and it was unbearable.
- The damage to environment caused by the use of chemical fertilizers and agro-chemicals was immense.
- Failure to observe precautionary measures in the use of chemicals was harmful to farmers

- Farmers faced difficulties in obtaining seeds introduced by the new technologies. These varieties are produced by the multi-national corporations and their cost is high. Earlier the farmers who used traditional seeds used to produce seeds by themselves.
- Although the green revolution tended to increase crop yields the high costs of inputs created number of problems for farmers.
- The Green Revolution in Sri Lanka paid more attention to paddy at the expense of other crops. Thus it was difficult to alleviate poverty.

Gene technology

- used as a strategy to minimize the adverse effects of green revolution
- In Sri Lanka gene technology has affected vegetables and fruits more than paddy
- Gourd, bitter gourd, ladies fingers, pumpkins, tomato and brinjals are the vegetables improved by the application of gene technology. Among the fruits improved by gene technology are papaya and banana.

Use of Organic Fertilizer

- The re-emphasis on organic fertilizers with a view to avoiding problems created by the use of artificial fertilizers is a significant trend.
- Use of organic fertilizers lowers the cost of production and there is an increasing demand for agricultural products produced using organic fertilizer.
  Accordingly,
    - With the intervention of both public and private sector the production of organic fertilizers has been encouraged.
    - farmers are advised to produce organic fertilizer at small scale in their home gardens
    - Similarly, a trend of applying indigenous insecticides has been observed.
      e.g., using Khomba

Irrigation technology

- Sri Lanka is a country with a long history of high standard irrigation technology
- The irrigation technologies practiced in Sri Lanka are of two types:
    - Gravity irrigation methods
    - Lift irrigation methods

Gravity irrigation

- a large majority of irrigated land in Sri Lanka falls into this method
- gravity irrigation is connected to a network of canals
- river valley diversion schemes also belong to gravity irrigation

Lift irrigation

- highlands that cannot be irrigated by gravity methods are irrigated by lift irrigation
- At present, electricity or fuel driven pumps are used in lift irrigation
- A few such irrigation schemes can be seen at Rajangana
- cultivation wells can also be considered as lift irrigation
- Such wells can be seen in abundance in the districts of Anuradhapura and Kurunegala
- Artesian wells in Jaffna peninsula are also a lift irrigation method
- Tube wells are used to tap ground water
- A number of methods are used to distribute water for cultivation
    - Basin irrigation
    - Furrow irrigation
- Basin irrigation method is adopted to supply water to paddy fields
- Furrow irrigation is used in vegetable cultivation
- A modern method of water supply for crop cultivation is drip irrigation
- In Nuwara Eliya district sprinklers are to supply water for vegetable cultivations

Expansion in Production

The expansion in agricultural production in Sri Lanka can be discussed in many ways:

- expansion in land area
- increase in yields
- minimization of wastage
- use of modern machinery

Expansion in land area

- Expansion in land area is due to many factors
    - addition of new irrigated land to cultivation E.g. Mahaweli area
    - Under new irrigation schemes land has been added
    - conversion of salty and marshy lands into paddy fields
- The expansion of land area of other crops has been somewhat different from that of paddy. This is evident from the following table:

Table 7.2.1

Agricultural Land Use in Sri Lanka (ha) 1956-2004			
Type	**1956**	**1985**	**2004**
Tea	252,673	201,630	188,737
Rubber	227,549	199,030	153,064
Coconuts	250,294	300,040	442,820

Source: Land Use Policy Planning Division (2004), Land Utilization Committee Report, 1985

- according to the Table the land area devoted to tea and rubber during the period 1956-2004 has declined
- It should be noted that the decline has taken place in large estates. In fact, there hasbeen a marginal increase in land under small holdings
- although an increase in the total area under coconuts can be observed the area under large estates has decreased
- conversion of land into other crops with higher economic returns, fragmentation of cropland and transform land into development projects and housing schemes have contributed to the decrease in land area under crops like tea

Increase in yields

Many factors have contributed to the increase in yields:

- use of more productive seeds, fertilizer, insecticides and weed killers
- application of advanced agricultural techniques
- several cropping seasons in a single year
- crop diversification
- better management techniques

Minimization of wastage

Wastage in agricultural production takes place at various stages:

- at production
- in transportation
- in packing and
- storage

- wastage in grains take place at all stages mentioned above
- wastage in fruits and vegetables take place especially in transportation and packing
- wastage in rubber latex takes place at tapping

a number of methods can be adopted to reduce wastage:

- use of advanced production techniques
- use of improved packing methods
- use of improved transport methods
- improve storage facilities

Use of modern machinery

- machinery plays an important role at various stages such as production, transport and storage
    - use of containers in transportation
    - use of refrigerators for storage
    - machines are used in the production of plantation crops
    - at present machinery is used in the production of rubber and coconut products

Marketing process

- the marketing of agricultural products in Sri Lanka, too, takes place in two main ways:
    - wholesale
    - retailing
- they can be discussed in terms of following headings:
    - economic centres
    - agreements with private companies
    - emphasis on quality
    - paying attention to consumer taste and comfort

- Rural markets play a considerable role in agricultural marketing in Sri Lanka. Advantages enjoyed by rural markets:
    - possibility of reaching consumers directly
    - possibility of selling without difficulty
    - possibility of satisfying a number of needs at one place

Economic centres

- offer a reasonable price for farmers' products
- salvaging producer from the intermediaries
- Possibility of purchasing products at cheaper prices
  The Economic Centres in Sri Lanka are located at Dambulla, Meegoda, Keppetipola, Divulapitiya, Embilipitiya, Welisara, Thambuttegama, Narahenpita and Ratmalana.

Agreements with private companies

- Private companies, too, play an important role in agricultural production and marketing. A number of companies providing such services in marketing of agricultural products can be cited:
    - CIC
    - Cargill's
    - John Keels
    - Jinasena

- CIC has entered into an agreement with the State Trading Corporation of Sri Lanka for marketing agricultural machinery. CIC is also engaged in farmer training, production of seeds and cultivation of fruits
- Jinasena & Company is involved in the production of threshing machines, hand tractors and water pumps.
- The companies such as Cargill's and John Keels buy farm products at the farm gate. They provide various inputs demanded by farmers.
- Private companies provide appreciable services in milk production, e.g., Milco, Nestle

Emphasis on quality

- in purchasing a product consumers at present pay attention to several factors.
    - date of production, packing and date of expiry
    - certificate of standards
    - healthiness
    - correct weight, etc
- producer is compelled to take account of these requirements and act accordingly.

Consumer taste and comfort

- producers should take account of the consumer taste and comfort in agricultural production. e.g., production of rice free of sand and stones and attractive packing of fruits
- present products to suit consumers' purchasing power: presenting products of different sizes and prices
- present goods to attract consumers

Competency level 7.3: studies recent trends in agricultural land use in Sri Lanka
(03 periods)

Learning Outcomes:

- identifies recent trends in agricultural land use in Sri Lanka
- presents with examples the loss of agricultural lands
- provide information on substitute crops and seasonal crops
- explains the changes in agricultural land use in Sri Lanka with the aid of maps.

Introduction

Sri Lanka has been an agricultural country from the distant past. The dry zone, full of paddy fields watered by the man-made tanks made Sri Lanka the Granary of the East. Subsequently, with the advent of western rule the commercial crops like tea, rubber and coconuts were cultivated in the central and western parts of the island. The excessive attention paid to the commercial crops resulted in the negligence of paddy cultivation in the dry zone. However, with the introduction of large scale irrigation schemes paddy cultivation was restored in those regions.

At present, many changes can be seen in the agricultural land use pattern in Sri Lanka. Of them, the abandonment of agricultural land in some areas, introduction of substitute crops and crop diversification must be noted. The gradual increase in population results in an increase in human needs and this leads to the allocation of agricultural land to other uses. This has resulted in changes in agricultural land use creating problems in some instances.

The objective of this unit is to study the recent trends in agricultural land use in Sri Lanka.

A Helping hand to comprehend the subject matter

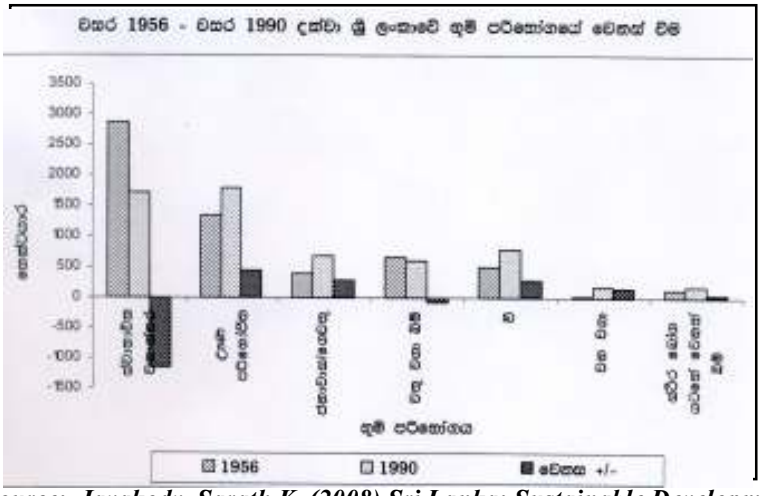
Abandonment of agricultural land

- the ever-expanding human needs and changing economic activities exerting a pressure on scarce land resources have created many problems in agricultural land use.

- Of Sri Lanka's land, one-third has been devoted to agriculture and another third to forests and biological needs. The remaining third has been allocated to various infra-structure development, settlements, homesteads, urban and land for future development.

- The following graph and table show the changes in the land area under different crops in Sri Lanka:

Figure 7.3.1



Source: Jayakody, Sarath K. (2008) Sri Lanka: Sustainable Development, Challenges and Responses

Table 7.3.2
Land Use in Sri Lanka (1956 - 2004)

Land use type	1956		1985		2004	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Paddy	511,074	7.8	800,470	12.3	877,994	13.6
Tea	252,673	4.0	201,630	3.1	188,737	2.9
Rubber	227,549	3.5	199,030	3.1	153,064	2.3
Coconuts	250,294	3.9	300,040	4.6	442,820	6.7
Mixed and other	80,154	1.2	140,830	2.2	295,470	4.5
Homesteads	576,846	8.8	781,280	12.0	889,350	13.7

Source: Land Use Policy Planning Division (2004), Land Utilization Committee Report, 1985

- According to Table 7.3.2, the extent of land under paddy in 1956 was 7.8 per cent of the total. This increased to 12.3 and 13.6 per cent in 1985 and 2004 respectively.

Several special features can be seen in the distribution of area under paddy:

- The area under paddy has increased due to large scale irrigation schemes like Mahaweli project. This increase has taken place especially in the dry zone.

- On the other hand, area under paddy in the wet zone has decreased due to land filling owing to population growth and the allocation of land for other needs.

- The extent of land under tea in 1956 was 4 per cent of the total. It decreased to 3.1 and 2.9 per cent in 1985 and 2004 respectively.

- A special feature in tea cultivation has been the decrease in land area under large estates due to the replacement of tea with other crops and the development of settlements. However, a marginal increase in land area can be observed in small holdings of tea.

- The area under rubber also has decreased from 3.5 per cent in 1956 to 3.1 per cent in 1985 and 2.3 per cent in 2004. Although the area under large scale estates has declined a marginal increase in the area under small holdings can be seen.

- Meanwhile, the area cultivated with coconuts has grown from 3.9 per cent in 1956 to 6.7 per cent in 2004. Several features could be observed in the area under coconuts also.

- allotment of land for sale and allocation of coconut lands for other human activities have resulted in a decrease of the land area under larger estates.

- An increase in land under small holdings can be observed.

- The extension of coconut lands to the dry zone has resulted in an increase in the area Land devoted to mixed crops and homesteads has increased

Introduction of substitute crops

- The uncertainty arising from the dependence on a few plantation crops has led to crop diversification in recent times. Under this programme various substitute crops were introduced to different regions.

    - Potatoes, maize, sugar cane, ground nuts, soybeans, Bombay onions, foliage plants, girkin, flowers can be identified as such substitutes.
    - recently, more crops like dragon fruits and oil palm have been added as substitutes
    - also, experiments are made to cultivate banana in rubber plantations
    - pepper, coffee, mangoes and papaya cultivated in coconuts lands are examples

Introduction of seasonal crops

- A number of coarse grains such as millet, maize, gingelly, sesame, green gram and mustard have been introduced
- Another example for seasonal crops is the sugar cane cultivation in place of paddy in the Gal Oya project area At present a number of land use problems have emerged in Sri Lanka.
- competition for land for agricultural uses and other human activities in the Wet Zone
- problems arising from cultivating the slopes in central highlands
- The land use problems due to unfavorable political situation prevalent in the North and East

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- Peiris, G.H. (1982) Development and Change in Sri Lanka, New Delhi.

Teaching learning Activities

Activity 1

Preparation of a report on the impact of changes in agriculture of Sri Lanka during recent times (past three decades) on its growth

In this exercise attention should be paid to the following:

- subsistence agriculture
- plantation crops
- export agriculture

Activity 2

Preparing a detailed article on recent trends in the marketing process of agricultural products

Activity 3

Preparation of an information leaflet on recent trends in the agricultural land use in Sri Lanka

P.S. Above three activities may be organized as group or individual activities.

Competency 08

Contributes to the conservation of mineral resources by examining trends in mining and quarrying activities

Competency Level 8.1 studies the nature and distribution of world mining industry (05 periods)

Learning outcomes

- presents details on the nature of mining industry in the world
- describes the distribution of selected mining industries

Introduction

The extraction of minerals on the surface of earth or underground can be identified as mining. Minerals are extractive resources which are depleting or non-renewable. For example, resources like petroleum, coal, iron ore, gold and gems take millions of years to form.

Minerals are categorized according to their nature. A major classification would be metal and non-metal minerals. Metals are further classified into ferrous and non-ferrous metals. Non-metal minerals can be divided into fuel and non-fuel minerals (examples for above classification are given in Chapter 2 of the Geography Teachers' Guide for Grade 12). In this unit the nature and distribution of some selected mining and quarrying products are discussed.

A Helping hand to comprehend the subject matter

Major mining and quarrying products and their distribution

Petroleum

- Mineral oil extracted from the earth is called crude oil. After refinement of crude oil fuels like petrol, diesel and kerosene are derived. The by-products of the process are grease, plastics and gas.

- Petroleum is used for motor vehicles as well as for machines. In the countries where petroleum mining is found the Gross National Income is high.

Distribution of petroleum

- the major countries producing petroleum, namely, Saudi Arabia, Russia, United States, Iran, China, Mexico, Canada, United Arab Emirates, Venezuela, Kuwait, Norway, Nigeria, Brazil, Algeria and Iraq account for 75 % of the World production.

- the Middle East alone accounts for 50% of the world's petroleum production. About two thirds of the world petroleum stocks are found in the Middle East.

- Changes in world distribution of petroleum occur with time since many countries have begun scientific petroleum exploration.

- At present, petroleum exploration is being conducted in the North Sea, Australia, Palk Straits, Siberia, Alaska and Greenland. In Sri Lanka, too, petroleum exploration work is being conducted.

Coal

- Coal is still the world's main fuel. It has been formed by the decayed vegetation buried in the earth about millions of years ago. The decayed plants deposited between rock strata become solid carbon with the passage of time.

- The quality of coal depends on its carbon content, humidity and vapor gas.

    - carbon content in the range of 45 to 60 per cent is called lignite
    - the carbon content in the bituminous coal is between 60 to 70 per cent
    - the carbon content in Anthracite coal is over 90 per cent

- Since the amount of heat generated by anthracite coal is high it is used for smelting iron ore and steel making.

Distribution of coal

Nearly 95 per cent of the coal fields in the world are found in the Northern Hemisphere. Although the distribution of coal is worldwide, they are abundantly located in the old shield areas. Another special feature is that nearly two-thirds of the world's coal is located in the United States. The United States and China together account for 55 per cent of the world's coal production. There are four major areas in coal distribution. They are:

- Central and Eastern United States
- North-west Europe
- Russian region, and
- East Asia.

Iron Ore

Iron ore is the main raw material in iron and steel industry. Although the distribution of iron ore is worldwide the high quality iron ore can be found only in a limited area. It must be noted that 5 per cent of the earth's crust consists of iron.

In terms of iron content iron ore is divided into four main types.

- Red Hematite: iron content is 72 per cent; considered as high quality ore.
- Magnetite: iron content is about 70 percent.
- Limonite: iron content is 60 per cent.
- Siderite: iron content is about 30 percent; considered as low quality ore.

Major areas of iron ore
In the following regions iron ore can be found in abundance.

- Great Lakes region in the United States
- Ukraine and the Kuznets region in Russia
- Manchuria and Shensi in China
- Brazil in South America
- Hamersley range in Australia, and
- South Wales, the midlands, Sheffield and Birmingham in the United Kingdom

(Direct students to identify these regions in a world map).

Copper

Copper is a non-ferrous mixed metal. It is found in association with other metals like nickel and chromium. Copper has been one of the minerals that man has used in earliest times. Although with the advent of Iron Age the significance of copper declined somewhat the growth in the distribution electricity increased the utility value of copper.

- Since copper is mixed with other minerals its separation is done through a chemical process

- the utility value of copper is high due to its special characteristics like ability to conduct heat, free of rust, heat absorptive capacity and flexibility

- Copper can be found mainly in Chile, Peru, United States, Russia, Japan, Canada and Zambia
  (Direct students to identify these regions in a world map).

Gold

Evidence shows that gold has a long history in human civilization. Rust freeness, brightness, flexibility, and scarcity, have made it the most valuable metal in the world. Gold is extracted from the gold mixed soils obtained from the mines. In addition, gold is extracted as a by-product from copper and other mines.

Gold is used for making jewelry and people keep it as an asset also. Although it is widely used for making jewelry, states, banks and individuals maintain gold stocks as a mode of accumulating assets.

Distribution of gold

Gold can be found only in a limited number of places. Among them following are important:

- Rocky mountain region in the United States
- Witwatersrand region in South Africa
- Kalgoorlie and Coolgardi in Australia
- Lina valley and Altai mountain range in Russia
- Canada and
- China
  (Direct students to identify these regions in a world map).

Competency Level 8.2 Analyses trends in World mining industry with reference to production and trade

(05 periods)

Learning outcomes

- presents details of production in several minerals selected from the mining industry of the world
- gather information on trends in mining industry with reference to its production and trade
- describes mining conflicts and disasters associated with mining resources

Introduction

The production of various machinery and equipment with the progress of world's industry and the resultant demand for metals and fuel resources led to an increase in mining. Accordingly, an expansion in extraction of metals such as iron ore, aluminum, copper, lead and tin and power resources like coal, petroleum and natural gas took place. The discovery of these resources paved way to a rapid growth in extractive industries.

The production and trade in some minerals have become one of the dominant economic activities of the world. They have become the decisive factors that decide the economic strength of those countries. Meanwhile, some of the mining industries are facing problems.

Petroleum production and associated industries

- The mining industry part of this mineral includes oil exploration, mining and extracting crude oil. Refining of crude oil, production of by-products and petroleum constitute the manufacturing part of the industry.

- In the past, Romania, the United States, Germany and Poland were the main producers of petroleum. By 1970s, the highest production came from the states of Texas, Louisiana and Wyoming. Today countries like Indonesia, Malaysia, China have surpassed the countries in the middle East like Oman and Kuwait.

- At present, it is believed that 60 per cent of the world petroleum resources are concentrated in the Middle East. Saudi Arabia, Iran and Iraq have become the leaders in world's petroleum production and the high level of per capita income in the Middle East countries has been a trend associated with petroleum production.

- Another trend associated with petroleum production has been the attention drawn to produce energy using renewable energy sources as a response to the depletion of oil fields in some countries. The renewable energy sources include solar energy, wind, heat and hydro-electricity.

- Exploration of oil resources is important in petroleum production. Satellite technology is being utilized in oil exploration.

- Since petroleum is a depleting resource its conservation for future is important. At present attention has been paid to conservation of oil stocks.

Table 8.2.1
Petroleum Production (billion litres)

Region	2000	2007
North America	763.2	778.7
South and Central America	99.7	155.0
Europe and Eurasia	939.2	1053.3
Middle East	208.1	357.6
Africa	130.1	204.4
Asia Pacific	272.1	396.3

Source: BP Statistical Review of World Energy, June 2009

In crude oil refining in addition to the main fuels such as petrol, diesel and kerosene, several by-products namely lubricant oils, LP gas, tar, grease, plastics, insecticides and chemical fertilizers could also be obtained.

Table 8.2.2
Daily Crude Oil Production

Producing Nation	2006 (10^3 bbl/day)	2007 (10^3 bbl/day)
Saudi Arabia	10,665	10,234
Russia	9,677	9,876
United States of America	8,331	8,481
Iran	4,148	4,043
China	3,845	3,901
Mexico	3,707	3,501
Canada	3,288	3,358
United Arab Emirates	2,945	2,948
Venezuela	2,803	2,667
Kuwait	2,675	2,613

Source: http:/en.wikipedia.org/wiki/petroleum

Trade

The petroleum trade had been taking place without any obstacle from the major producing regions such as the United States, Russia and the Middle East to the rest of the petroleum defiant countries of the world.

- However, a trend that could be seen at present in the world trade of petroleum is the non-supply of surpluses to the market as a conservation strategy, e\g., United States, OPEC countries

- The major industrialized countries like Japan and France consume large amounts of petroleum and their imports of petroleum have increased.

- A major feature in the world trade of petroleum has been the increasing demand for petroleum in comparison to other power resources. A major reason has been the dependence of some countries on petroleum more than one-third of their power resources.

- Japan, United States, France, Italy, Germany and the Netherlands are among the major petroleum importing countries.

- with the discovery of the Internal Combustion Engine in the early 20th century the demand for petroleum for rail engines and aircrafts increased.

- With the emergence of industrial countries there was an increase in the ability to purchase petroleum.

- With the establishment of organizations like OPEC the world trade in petroleum was subject to the control of such organizations. This situation has led some non-OPEC countries to venture into petroleum exploration.

Table 8.2.3

The Major Petroleum Exporting Countries - 2006

Exporting Country	10^3 bbl/day*	10^3 m^3/day**
Saudi Arabia	8,651	1,376
Russia	6,565	1,044
Norway	2,542	444
Iran	2,519	401
United Arab Emirates	2,515	400
Venezuela	2,203	350
Kuwait	2,150	342
Nigeria	2,146	341
Algeria	1,847	297
Mexico	1,676	267
Libya	1,525	242
Iraq	1,438	229
Angola	1,363	217
Kazakhstan	1.114	177
Canada	1,071	170

*1000 barrels per day; ** 1000 cubic meters per day

Source: US Energy Information Administration

Coal Production and associated industries

- In the past, as an energy resource coal was more important than petroleum
- However, at present, coal production has grown at a slower rate compared to that of petroleum mainly due to the high costs of coal mining, transport and storage
- China has become the world's main producer of coal. The growth in coal production has contributed to China's rapid economic growth.
- In other industrialized countries the level of coal production is comparatively low.

Table 8.2.4

Major Coal producing countries (production in million tonnes)

Country	2003	2004	2005	2006	Share in
China	1,722.0	1,992.3	2,204.7	2,380.0	38.4
United States of America	972.3	1,008.9	1,026.5	1,053.6	17.1
India	375.4	407.7	428.4	447.3	7.2
Australia	351.5	366.1	378.8	373.8	6.0
Russia	276.7	281.7	298.5	309.2	5.0
South Africa	237.9	243.4	244.4	256.9	4.1
Germany	204.9	207.8	202.8	197.2	3.2
Indonesia	114.3	132.4	146.9	195.0	3.1
Poland	163.8	162.4	159.5	156.1	2.5
World	5,187.6	5.585.3	5,886.7	6,195.1	100.0

Source: http://en.wikipedia.org/wiki/coal

Associated Products

The major associated products are,

- ammonium products
- dye
- scents
- plastics
- nylon fibre
- insecticides

Trade

In the early period coal was abundantly used in the iron and steel industry (in the early years nine tons of coal was required to smelt one ton of iron ore). It was used to smelt other metals also. However, there was a decrease in demand for coal with the use of gas hearths. The decline in use resulted in a decrease in demand for coal in international trade. The rail engines also used coal as an energy resource in the early years but that also has been substituted by other resources.

- Some coal exporting countries are also the coal importing countries.
- The United States was a major exporter of coal mainly due to the low cost of production. But today other countries have become major exporters.
- Australia is the world's major exporter of coal.
- Although coal has been used as a fuel from the earliest times, factors such as the loss of European markets, development of hydro-electricity by some coal importing countries, the use of petroleum and gas, increase in cost of production, have contributed to its retreat as a commodity in international trade.

Table 8.2.5

Coal Exporting countries (million tonnes)

Country	2003	2004	2005	Share of the total in 2005 (%)
Australia	238.2	247.6	255.0	27.2
Indonesia	107.8	131.4	142.0	15.1
China	103.4	95.5	93.1	9.9
South Africa	78.7	74.9	78.8	8.4
Russia	41.0	55.7	98.6	10.5
United States of America	43.0	48.0	51.7	5.5
Canada	27.7	28.8	31.2	3.3
Poland	16.4	16.3	16.4	1.7
Vietnam	-	10.3	14.1	1.5
Total Exports	713.9	764.0	936.0	-

Source: http://en.wikipedia.org/wiki/coal

Production of Iron Ore and associated Industries

Table 8.2.6
Estimated Iron Ore Production - 2006 (million tonnes)
(according to United States Geological Survey)

Country	Production	Share (%)
China	520	30.8
Australia	270	15.9
Brazil	250	14.8
India	150	8.8
Russia	105	6.0
Ukraine	73	4.4
United States of America	54	3.5
Other Countries	268	15.8
World	1690	100.0

Source: http://en.wikipedia.org/wiki/Iron

- China, a rapidly industrializing country ranks high in iron ore production.
- China has surpassed India, Russia, and the United States of America. It has made an attempt to productively utilize the hitherto less valued low using advanced technologies.

Associated Industries

- Iron and Steel
- Motor Vehicles
- Ship building
- Other manufacturing industries associated with Iron making

Trade

- World's major importers of iron ore include Japan, United States of America, South Korea, Germany and China
- World's major exporters of iron ore include Australia, Brazil, Venezuela, Sweden and Canada
- At present, iron ore mining is located in proximity to markets also; e.g. Lake Superior Ore
- Australia, Brazil, Venezuela utilize large amounts of iron for their own industries although they iron exporters
- The demand for iron is growing rapidly

The Production of Copper and associated Industries

- Copper can be produced at a low cost since deposits are located near the earth surface. However, only five tons of copper can be produced from every thousand tons of copper mixed soils.
- In the early years the major copper producers were western United States, Canada and Mexico. Zimbabwe and Congo in the continent of Africa were also copper producers.
- However, in the recent past the world's copper producing countries have changed.

Table 8.2.7
World Production of Copper
(countries producing over 50,000 tonnes/year)

Country	2002	2003	2004	2005	2006
Chile	4,581	4,904	5,412	5,320	5,360
Indonesia	1,171	1,005	840	1,065	816
United Kingdom	1,140	1,120	1,260	1,140	1,200
Australia	868	839	854	916	858
Canada	603	557	563	595	607
China	593	620	752	777	889
Argentina	204	199	177	187	180
Other	4,439	4,554	4,941	6,998	5,188
World	13,600	13,800	14,700	15,000	15,100

Source: http://www.indexmundi.com/en/commodities/minerals/copper

- with the development of technology the increase in copper use has led to an increase in copper production

Industries

- production of coils for motors
- production of cables
- use in the production of radio and electronic equipment
- production of by mixing copper and tin
- production of various parts for products like refrigerators
- copper sheet production

Trade

- the main buyer of copper is the United States of America
- A large amount of African copper is sold to European countries
- The largest producer of copper is Chile.

Production of Gold and associated industries

- Although about 70 countries in the world produce gold South Africa leads in production

Table 8.2.9
World Gold Production (tons)

Country	2002	2003	2004	2005	2006
Australia	266	282	259	262	244
Canada	151	140	124	119	103
China	192	205	215	225	245
Indonesia	142	141	91	130	164
South Africa	398	373	337	294	272
Other Countries	1,379	1,417	140	1,438	1,430
World	2,530	2,560	2,440	2,470	2,460

Source: ***http://www.indexmundi.com/en/commodities/minerals/gold***

- There has been fluctuations in the gold production.
- In countries and regions like South Africa, New Guinea, California and Western Australia economic growth paralleled gold production.

Associated industries

- Production of coins and jewelry
- equipment for dentistry
- electronic industry
- production of medicines

Problems in mining

(what follows is applicable to all mineral resources discussed in preceding sections

- Due to over extraction most minerals have depleted and this has led to deep mining at high cost and increased effort

  e.g., this situation can be seen especially in gold mines in South Africa and coal fields in China.

- Another problem has been the withdrawal of labor from mining due to low levels of wages, risks involved in mining and health problems.

- wastage in extraction, transportation and refining has created problems.

- In some countries companies have attempted to reduce labor with the improvements in technology resulting in unemployment problems.

Disasters in mining industry

- Accidents have taken place tunnels of deep mines. This type of accidents have occurred frequently in mines in China.

- Disasters have occurred due to fires also. Fires occur especially in coal mines.

- Workers have met with accidents due to leakages of poisonous air.

- the adverse effects of mining on environment also can be considered as a disaster. Mining has exerted adverse effects on atmosphere, hydrosphere and biodiversity of the world. Environmental deterioration has been aggravated due to non-rehabilitation of land after extraction of minerals.

- The effects on health of the mine workers also are sometimes disastrous. The workers in plumbago, iron ore, and coal mines very often suffer from respiratory diseases.

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Competency - 9

Examines the value of minerals in the economy of Sri Lanka and use them productively

Competency Level 9.1: examines the distribution of mineral resources in Sri Lanka (06 periods)

Learning Outcomes:

- Describes the location and nature of mineral deposits of gems, graphite, mineral sand, apatite and iron ore in Sri Lanka.
- gather information on the production of few major minerals
- understands the value of mineral resources in the economy of Sri Lanka
- describes recent trends in minerals in Sri Lanka

Introduction

You have already studied the characteristics and classification of minerals in Sri Lanka in Grade 12 under Physical Geography. In this unit it is expected to discuss the nature, distribution and consumption of some selected minerals in Sri Lanka.

A Helping hand to comprehend the subject matter

- Mineral resources in Sri Lanka
  - Gems
  - Graphite
  - Mineral Sands
  - Apatite
  - Iron Ore

It is proposed to discuss the distribution, production and trends of above mentioned mineral resources.

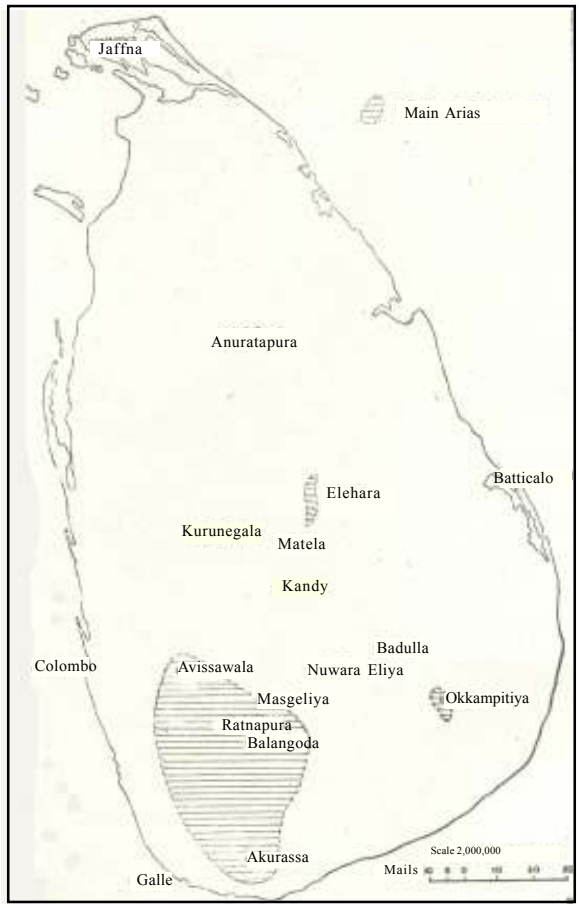
Gems

- Sri Lanka has a long history as well as reputation with regard to gems.
- In Greek writings of the first and second century and subsequently in Chinese and Arab writings it has been mentioned that gems of highest quality are found in Sri Lanka.
- The regions where gems are found abundantly are located in the rocks that belong to the highland series in Sri Lanka.
- Among the pebbles In river beds and internal plains in Sri Lanka gems are fond in abundance.
- Pebbles containing gems are residual minerals that have undergone weathering, erosion and transportation processes during the geological time

Distribution

- Gem deposits are located in a limited geographical area.
- They are mainly in the central hills and southwest Sri Lanka.
- 80 per cent of the gem pits are distributed in and around Ratnapura, the main city of the Sabaragamuwa Province.
- The areas where gems are found in abundance in Sri Lanka are shown in the map given below:

Fig. 9.1.2
The Distribution of Major Gem Areas in Sri Lanka



Source: Herath, J.W. Mineral Resources of Sri Lanka (1979).
Department of Geological Survey

Production

- The search for veins, digging of gem pits, gem cutting and making of jewelry with gems comprise the gem production process.
- The widely practiced gem mining method in Sri Lanka is lateral mining or tunneling.
- Gemming is practiced in the river beds also. In this method the gem containing pebbles in river beds are dragged onto the river banks and sorted out.
- Sometimes, river banks are also mined in search of gems.
- In most instances, gemming is practiced applying conventional techniques.
- The application of mechanical and technical methods is still new to gemming in Sri Lanka.

- In gem cutting and production of jewelry a large number of workers are employed. Sri Lanka has a niche in those skills.
- The beauty and value of a gem depends on its cut and polishing.
- Gem cutting is performed by experienced and skilled workers.

Trends

- Illicit gemming has been minimized and state assistance has been increasing.
- Gemming has spread into hitherto unknown areas.
- Gem particles that had been discarded for a long time are now being turned into high quality gems with the application of new technologies (e.g. by exposing them to extreme heat)

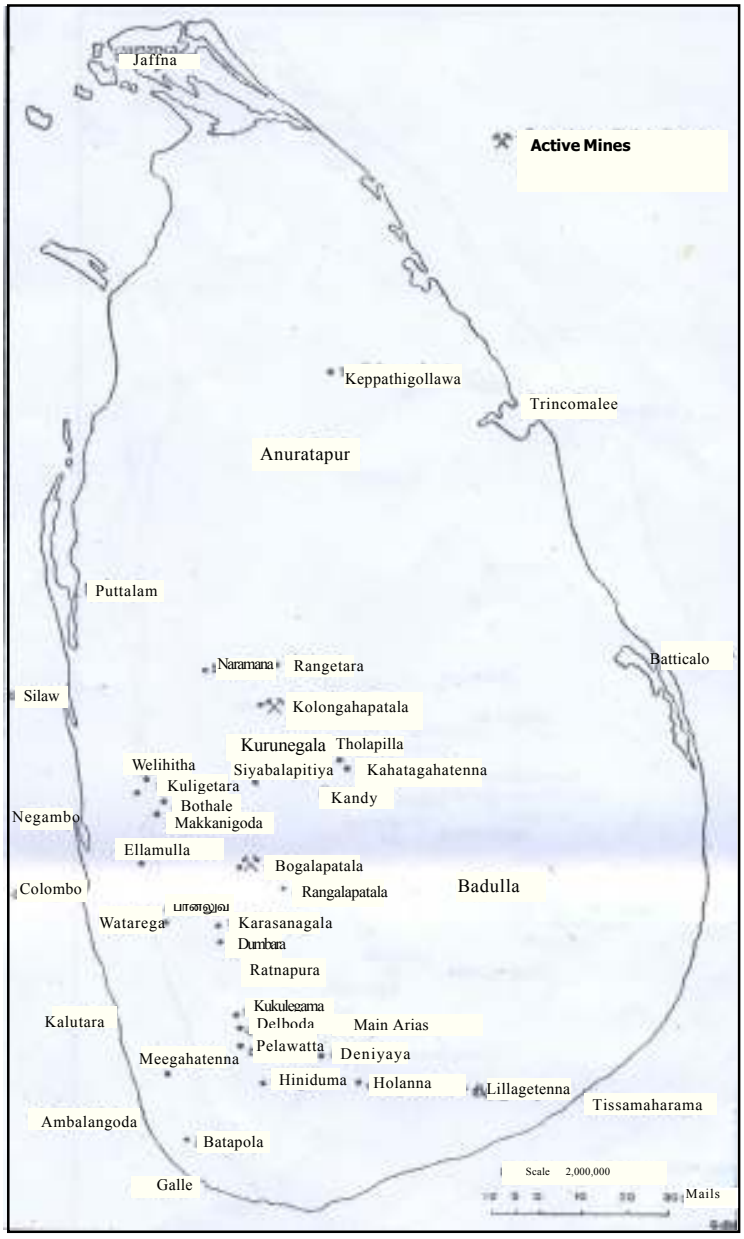
Graphite

- The graphite industry in Sri Lanka has a history that dates back to about 180 years. Sri Lanka produces high quality graphite.
- Sri Lanka's graphite enjoys high economic value due to its higher purity level (carbon content) which is around 99 per cent.
- Owing to high level of production and exports Sri Lanka had maintained a monopoly in the World graphite market during the Second World War years
- Graphite plays an important role as an industrial raw material and heat and electricity conductor.
- The graphite located as giant veins along the rock cleavages are the widely mined deposits in Sri Lanka.
- A type of graphite found as sheets or scrap is also seen in Sri Lanka. They are called Mica.
- Owing to its high ultra-electronic capacity and high toleration levels of heat, mica is widely used in electronic industry.

Distribution

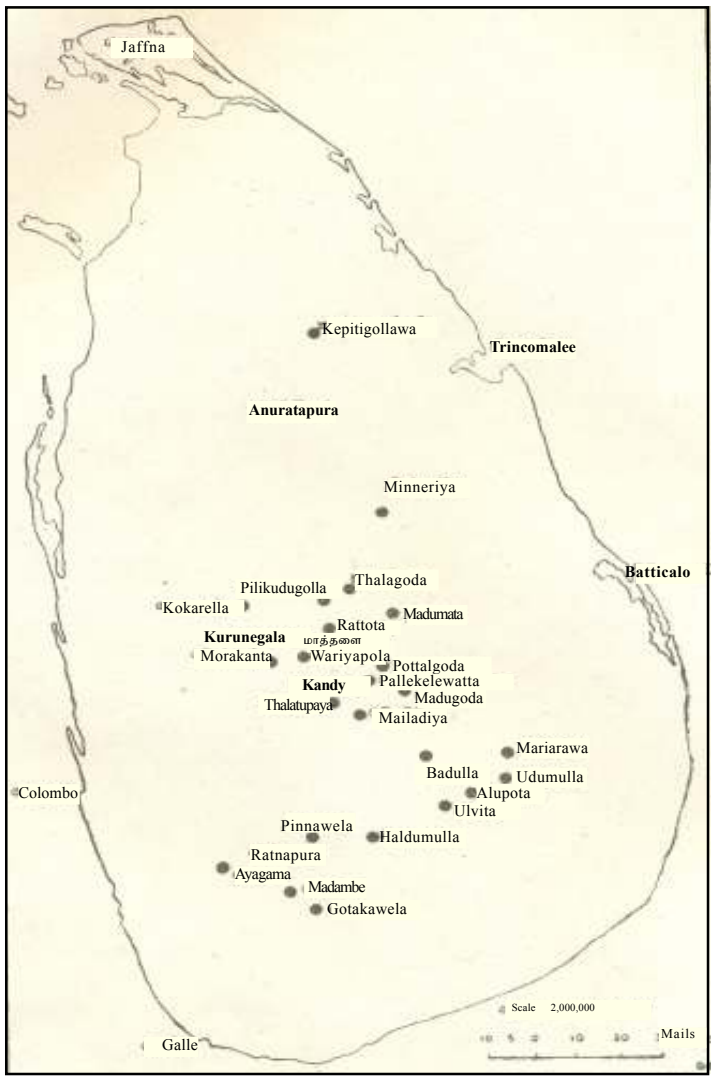
- Graphite is distributed in the central and southwest parts of Sri Lanka.
- Although about 6000 mines had been in operation during the World War years only few mines are in operation today.
- In terms of Provinces in Sri Lanka, graphite can be found in the Western, Southern, Sabaragamuwa, Nortwestern and Central Provinces.
- A map showing the distribution Vein Graphite and Mica in Sri Lanka is given below:

Fig. 9.1.3
The Distribution of Graphite in Sri Lanka



Source: Herath, J.W. (1979) Mineral Resources in Sri Lanka, Department of Geological Survey.

Fig. 9.1.4
Distribution of Mica in Sri Lanka



Source: Herath, J.W. (1979) Mineral Resources in Sri Lanka, Department of Geological Survey.

Production

- Only a small amount of graphite is used an industrial raw material locally.
- Graphite is used in the production of pencils, moulds, electrodes, conductors, and batteries etc.
- Graphite is used in the making of steel and electrical appliances.

Table 9.1.5
Exports of Graphite (metric tons)

Country	2004		2005		2006		2007	
	Qty	Value ($)	Qty	Value ($)	Qty	Value ($)	Qty	Value ($)
Australia	65	29,384	74	19,898	86	39,900	44	27,090
Bangladesh	140	34,062	60	14,745	40	11,828	20	7,100
China	220	257,822	140	153,536	60	69,400	141	127,500
Germany	328	276.552	28	2,153	80	49,295	300	217,749
Greece	20	5,400	-	-	-	-	-	-
India	25	11,610	94	53,007	544	180,746	454	-
Indonesia	-	-	-	-	-	-	-	-
Japan	1,900	794,445	1,406	719,908	1,886	1,027,631	1,440	767,506
Korea	-	-	-	-	-	-	-	-
New Zealand	-	-	-	-	-	-	-	-
Pakistan	1,080	239,480	1,400	355,140	1,500	392,314	1,580	507,200
Philippines	0.48	2,390	-	-	0.24	494	-	-
Singapore	-	-	-	-	-	-	-	3,800
South Africa	-	-	-	-	-	-	10	21,700
Taiwan	-	-	-	-	-	-	80	7,350
Thailand	40	26,315	62	19,300	80	23,580	-	-
Turkey	60	18,450	-	-	-	-	-	-
UK	674	683,303	820	1,005,630	700	707,895	888	1,200,378
USA	248	326,515	287	445,930	300	426,630	470	724,252

Source: Geological Survey and Mines Bureau of Sri Lanka (2008)

Recent Trends

- Production costs has risen as graphite is found deep down in present day mines
- At present, the private sector is engaged in graphite mining
- Graphite exports to Asian countries have grown
- United States and the United Kingdom have become the main buyers in the western world
- Local consumption of graphite has also grown

Mineral Sands

- The mineral sands found in Sri Lanka contain following minerals:

Ilmenite	-	about 70-72 per cent
Rutile	-	about 8 per cent
Zircon	-	about 8-10 per cent
Silimanite	-	about 1 per cent
Monazite	-	about 0.3 per cent

- Mineral sands deposits of very high value can be found in Pulmoddai, Kaikawala, Polkotuwa and Point Kudiramale
- The largest of them is located at Pulmoddai. The size of the deposit is about 4 million tonnes.
- Pulmoddai deposit has been identified as one of the highest quality deposits in the world and the concentration of titanium found in Pulmoddai deposits cannot be found elsewhere.
- The main minerals used to produce titanium are Illmanite and Rutile.

Distribution

- The ilmanite deposit is distributed in the coastline between Mullaitivu and Nilaveli
- The length and breadth of the Pulmoddai deposit is about 10 km 100m respectively.
- In addition, these deposits can be seen Kudiramale in the Northwest coast and Polkotuwa and Kaikawala in the South west coast.

Production

- Production is limited to isolation of ilmenite, Rutile and Zircon from mineral sands.
- Ilmenite, Rutile and Zircon is produced only for export.
- Above mentioned minerals is not consumed locally.
- The annual exports of these mineral sands are given in Table 9.1.7

Table 9.1.7

Sri Lanka: Exports of Mineral Sands

(in tonnes unless otherwise specified)

Mineral Sand	2004		2005		2006	
	Qty	Value ($)	Qty	Value ($)	Qty	Value ($)
Ilmenite	36,303	196.9	57,034	373.3	121,812	66.6
Rutile	8,162	290.0	2,,280	59.2	5,108	292.4
Zircon	23,587	1,266.0	8,321	579.6	11,136	526.4

Source: *Sri Lanka, Geological Survey and Mines Bureau (2008)*

- Sri Lanka exports Ilmenite mainly to Austria, China, UAE and USA.
- The main buyers of Sri Lanka's Rutile have been China, India, United Kingdom, Japan and Indonesia
- China, India and Italy have been the importers of Sri Lanka's Zircon.

Trends

- In the recent past there has been a drop in the production of mineral sands due to the unfavorable security situation. However, the situation has been become normal now.
- The refinery at Pulmaoddai was inactive due to terrorist activities but the Trincomalee refinery was in operation.
- In future, the situation with refinement of mineral sands will improve further.

Apatite

- This is found in Phosphate, a rock containing Calcium Phosphate (Ca_5Po_4)
- Apatite is the main mineral in Phosphate.
- Phosphorous, which is essential for plant growth, constitutes about 30 per cent of this rock. As such, it is pulverized and used as fertilizer.
- Due to its high apatite content Sri Lanka's Phosphate has a higher economic value.

Distribution

- The Phosphate deposit in Sri Lanka was discovered at Eppawala area in the latter part of 1971.
- It is distributed in an area about 6 km^2 and the size of the deposit has been estimated as about 60 million tonnes.
- The depth of the deposit has been estimated as 125 meters.

Production

- The pulverized Phosphate is issued as a raw material.
- When intensively ground they can be used as a fertilizer.
- Plants take a long time to absorb the calcium carbonate found in phosphate and therefore it has a limited value as a fertilizer with quick returns.
- This is why phosphate is useful as a fertilizer for tea, rubber and coconuts.
- Super phosphate and triple-phosphate are useful as fertilizers for short-term crops. However, this is not produced in Sri Lanka at present.

- The phosphate fertilizers produced using apatite are:

  - Rock phosphate
  - triple phosphate
  - Monoamonium phosphate
  - Super phosphate

The table below shows the amount and value of production of phosphate in Sri Lanka:

Table 9.1.8

Production and Value of Phosphates

Year	2004	2005	2006	2007
Quantity (tonnes)	44,937	41,979	44,143	40,054
Value (Rs. million)	168.9	188.2	223.8	231.1

Source: ***Lanka Phosphate Ltd.***

Iron Ore

- Since the iron content found in Sri Lanka's iron ore is very much low compared to iron ore in other countries the economic value of the deposits is low (in high quality ore the iron content is more than 60 per cent).
- The iron ore deposits in Sri Lanka are small and dispersedly distributed. This has also reduced the economic value of the deposits.
- The iron ore deposits in Sri Lanka can be divided into two broad types:
  1. Limonite located on surface or in close proximity to surface
  2. Magnetite located at depths

Distribution

- The type 1 mentioned above can be found in the districts of Ratnapura, Galle and Matara.
- Type 2 can be seen in Wilagedara, Panirendawa and Seruwila.
- The deposits found at Seruwila are considered to be useful. It is believed that the iron content is higher than 65 per cent. Also, some other minerals are also found in the area. e.g. copper.

Fig. 9.1.10
The Distribution of Ferrous Minerals in Sri Lanka

Source: *Herath, J.W. (1979) mineral Resources of Sri Lanka*

Production

- At present the iron ore deposits in Sri Lanka are not extracted.
- The main reasons have been the location and the low iron content of the deposits.
- Although it is possible to meet the local demand from these deposits the cost of production will be high. as such it is economic to import the requirements.

Trends

- Since the iron ore is not extracted. Requirements are met by imports. As such it is difficult to observe notable trends.

Competence Level 9.2: Emphasize the significance of mineral resources in the economy of Sri Lanka (04 periods)

Learning Outcomes

- describe the contribution made by the minerals resources to the economy of Sri Lanka
- reveal that many mineral resources are still utilized in raw material form
- accept that the industrial process associated with minerals has to be developed further
- Understands that industries associated with minerals can contribute to national income, employment and regional development
- describes that there can be environmental effects in the use of mineral resources and efforts must be made to minimize them.

Introduction

Sri Lanka is a country in which a considerable amount of essential mineral resources are located. However, the maximum utilization of those resources has been not possible due to the deficiencies in suitable technologies and strategies.

Although, mineral resources contribute to the economy of Sri Lanka the industrial processes associated with them have not been able to derive a sizeable economic return. It is possible to derive a considerable return if the mineral resources could

be exported as manufactured products instead of exporting them as raw materials.

A Helping hand to comprehend the subject matter

Significance as Industrial Raw Materials

Raw material	Production
Graphite	pencils, carbon sticks, conductors, electrical appliances
Gems	jewelry, polished gems
Mineral sands	Titanium Spectrum, titanium metal
Apatite	Super phosphate, triple phosphate
Iron Ore	iron

Value addition through changing the utility

- There is an opportunity to derive higher utility from mineral resources if an attempt is made to manufacture a secondary product before exporting it as raw material
- An appreciable economic gain could be achieved from the by-products if a manufacturing industry could be established with mineral resources
- A range of economic benefits could be achieved especially from such a manufacturing process with graphite, mineral sands, apatite and magnetite at Seruwila.

Examples:

- Although graphite has been exporting for centuries no attempt has been made to establish a manufacturing industry
- Although the raw gems (*Geuda*) bought from Sri Lanka are being transformed into sapphire in overseas countries no attempt is made to produce them locally
- Non production of phosphate fertilizer from the apatite deposit to meet the local requirements
- Except the separation of few minerals from mineral sands are being done no attempt is be made to extract valuable metals like titanium from mineral sands
- Large returns could be achieved from the mineral industry through the application of Nano-technology

There is grave need for establishing a manufacturing process using modern technology in order to augment the real value of the minerals in Sri Lanka.

Employment

- It is estimated that nearly 400,000 people are employed directly and indirectly in the industrial process associated with the production of clay, limestone, gems, graphite, mineral sands, silica, river sands, apatite, etc.
- It is believed that employment opportunities could be multiplied if a manufacturing process associated with mineral resources could be started as mentioned above
- Mineral production could be a good solution for the unemployment problem in Sri Lanka.

Regional Development

- The mineral resources of Sri Lanka show a dispersed distribution pattern
- The industrial process associated with mineral resources at present and in future it is possible to achieve regional development.
- Better economic and social services could be provided to people in regions through the provision of services associated with mineral production
- The development of infrastructure facilities associated with industrial process will accelerate regional development
- The indirect employment opportunities will be generated by some mineral production industries resulting in increased incomes

Contribution to National Income

- The mining and quarrying sector contributed about 2 per cent to the Gross National Product of Sri Lanka in 2004
- In addition, about 8 per cent of the industrial production process has been derived from industries associated with minerals
- In 2007, 136 million American Dollars have been earned from the exports of minerals (gem exports alone earned American Dollars 120 in that year)
- Except for gems the remaining mineral resources have contributed less in foreign exchange earnings. A reason could be that minerals are exported as raw materials

(Source: -Annual Report of Central Bank of Sri Lanka, 2007).

Competency Level 9.3: Takes action to minimize the damages to the environment that occur in the utilization of mineral resources in Sri Lanka

(10 periods)

Learning Outcomes:

- explains that in the utilization of mineral resources there would be damages to the environment
- recognizes that there will be considerable impact on the drainage and landscape due to extraction of minerals
- the workers who are directly involved in the mining industry face health risks and threats
- understands that the health of the people is also affected due to the environmental damages caused by mineral industry
- understands that there is a need for an industrial process which comprises methodologies to minimize the environmental damages

Introduction

Mineral resources are located on the surface of the earth or at some depths. In the mineral production process adverse effects on environment are expected. However, the economic benefits of mineral production should not overshadow the damage that occurs to the environment during its production process. In the utilization of mineral resources special attention should be paid to the adverse effects that it might exert on the life of the people. Otherwise, the economic benefits gained by the mineral industry will be short-lived. It should also make sure not to extract minerals without taking into account the aesthetic value of the environment.

A Helping hand to comprehend the subject matter

Utilization of mineral resources and its effects on the environment

The mineral production process from its extraction stage exerts an adverse effect on the environment, especially on landscape and drainage.

Effects on Drainage

- due to extraction of minerals (at varying depths) pit holes and heaps of soil of various sizes could be seen
- These pit holes are filled with water when it rains.
- The adverse effects of gem mining on drainage are higher than that of other mineral resources.
- Since gems are found mostly in sedimentary rock strata, river banks and beds are the places where gem pits could usually be seen. Effects of gem mining on drainage can be seen in river valleys in Ratnapura and Balangoda and *Kalu Ganga* valley in Elahera area.

- When gem mining is done in the river bed by damming the channel the direction of the river flow changes.
- Gem mining on river banks changes the width of the river channel.
- Due to washing of gem bearing soils and loosening of banks river beds are filled with silt resulting in low run-off and floods
- The Ratnapura area affected by the Southwest Monsoon is flooded frequently and gem mining has aggravated the situation.
- Gem pits on land sometimes results in landslides. Such incidents change the direction of streams.

Effects on the landscape

- The extraction of minerals, like gems, graphite, mineral sands or any other, means the removal of such minerals from a particular place and transport to another location.
- The removal of minerals sands in the coastal areas leads to coastal erosion creating new landscapes.
- Gem mining and graphite mining creates large pits thereby changing the landscape.
- Deposition of removed soils from mines creates miniature hills.
- Landslides due to gem mining change the landscape of the foothill areas.
- Abandoned gem pits are covered with water.
- Gem mining in river channels and banks change the direction of the channel creating new landscapes.
- Minerals like apatite are found in rocky areas. The extraction of such minerals create large pits and remove the hilly areas that contained the mineral.
- Any form of extraction removes the vegetation cover of the area aggravating soil erosion. This leads to a change in the landscape and destruction of natural beauty of the area.

Effects on health

- The small mineral particles that are generated in the extraction, transportation and in the production of various products cause diseases to workers involved in those activities.
- The water collected in abandoned gem pits cause in Malaria and Filariasis.
- The people living in and around gem mining areas are vulnerable to diseases spread by mosquitoes and also to diseases due to water pollution.
- Gem miners spend most of the day in water and they are susceptible to various diseases.
- The workers in graphite mines prone to diseases due to the emission of small particles from graphite
- There is a trend of these workers catching lung, eye and skin diseases.
- In addition, deaths occur in mines due to leakage of poisonous gas and inhaling carbon monoxide.
- Sometime workers die due to mine collapses.
- There is a threat to health due to emission of carbon dioxide generated by burning of lime stones.

Minimization of damage to Environment

The entire process of mineral industry from extraction to production has exerted an adverse effect on the environment. Although it is not possible to prevent the damage totally measures could be adopted to mitigate it. Following are some of the mitigating measures:

- Development of environment friendly attitudes

- Engage in extraction industries legally: a considerable damage is caused by illegal gem mining, sand mining and coral mining. In unauthorized mining mineral resources are extracted without any limit and order resulting in considerable damage to the environment.
- engaging in economic activities instead of activities like unauthorized sand mining and coral mining would minimize damage to the environment.
- Even in authorized mining environment friendly techniques have to be adopted.
- Environment friendly attitudes like filling of holes created by mineral extraction and restraining from extracting sand from the same location for a long period have to be developed.
- Observe austerity in the use of minerals (construction of excessively large houses, and surplus production lead to wastage of minerals)
- the inclusion of instructions of environment friendly mineral extraction to school curricula would lead to environment friendly attitudes.
- Attitudes of miners as well as consumers should be improved by working in association with environment organizations, institutions and non-government organizations.
- There is a responsibility for the community also to prevent environment damage caused by mineral extraction. Especially measures should be taken to make the relevant officers aware of the unauthorized mining and steps should be taken prevent it.

- Implementation of relevant Acts and Ordnances

In order to provide the legal basis for the utilization and control of mineral resources in Sri Lanka the following Acts and ordnances have been in operation.

- Act No. 33 of 1992 on Mines and Mineral Resources
- According to Sentence 26 of Act No. 33 of 1992, the ownership of any mineral located in any part of Sri Lanka belongs to the Government.
- According to Sentence 34 of the above Act, the sole authority of issuing licenses for above activities lies in the Geological Survey and Mines Bureau.
- Licenses for extraction of sand from river beds can be obtained from the Divisional Secretariat office.
- The environmental laws and regulations pertaining to utilization of mineral resources have been introduced by Regulation No. 1 of Mining (Licenses) of 1993.

The mineral industry can be sustained with control through the proper implementation of above mentioned Acts, Ordnances and Regulations and collective action of related institutions and the community.

- Political commitment

- Although there are various laws and regulations to prevent unauthorized mineral extraction it is obvious that their implementation depends essentially on the political commitment.
- There have been instances of collaboration of politicians in unauthorized sand mining, gem mining, coral mining and quarries. As such, many instances have been reported of the inability of proper implementation of acts and regulations.
- It is possible to minimize the damage caused to environment due to the ignorance of the general public and miners through a leadership committed to sustainable environmental conservation.
- It is apparent that some political intervention is necessary for relieving miners from the accidents taking place in their work places and diseases.
- It is important that such commitments be included in the policy declarations of the political parties.

References:

- Sri Lanka Minerals Year Book (2008), Department of Geological Survey and Mines Bureau, Colombo.
- Geological Survey and Mines Bureau Reports.
- Herath, J.W. (1998). Mineral-based Industries of Sri Lanka, Department of Geological Survey and Mines Bureau, Colombo.

Teaching - Learning Activities

Activity - 1

Complete the following table with information gathered on mineral resources of Sri Lanka.

Mineral	Location	Products of the Mineral	Other Special information

Activity - 2

There may be instances of economic utilization of minerals described above in your locality. If so, discuss the following factors in relation to those minerals.

- Economic importance
- Effects on environment
- Steps that could be taken to minimize the effects on environment

Competency 10

Examines the process of location of industries and make suggestions for industrial development in Sri Lanka

Competency Level 10.1 Examines with examples the factors that affect location of industries in the World

Learning Outcomes

- Name factors that affect the location of industries in the World
- State that the physical factors has affected location of industries in the past
- identifies that the human factors have overtaken the physical factors at present
- Prepares a Table showing the location factors of various industries in different countries
- Mark and name the distribution of manufacturing industries in a World map

Introduction

The process of producing finished or semi-finished products by integrating factors of production with natural resources through human intervention is known as manufacturing industry. In this process, goods are produced in industrial plants using natural resources as raw materials and energy.

Manufacturing industry has a long history. Since the beginning of the human civilization man has tended to make various things in various ways in order to satisfy his needs. In the early days he had a simple lifestyle but with new discoveries he was accustomed to use complex products. Especially, after the Industrial Revolution man began to produce complex products applying his knowledge and technology. In a way, these industrial productions may have induced the World Wars and subsequent conflicts that could be seen at present. The industrial sector has a major say in the current environmental problems, too.

The level of industrial production is sometimes used as a criterion for classifying developed and underdeveloped countries. The industrial sector contributes a higher percentage to the Gross Domestic Product of the industrial countries like the United States of America, Britain and Japan. Some countries obtain raw materials for their industries from the country itself while others importing their needs. Since the growth in the industrial sector directly affects the development in the agriculture and service sectors almost all countries make efforts to develop their industrial sector. However, different factors affect the location of industries in different countries. It is expected from this Unit to study the factors that have affected the location of industry, a major economic activity of the world, by selecting a few industries.

A Helping hand to comprehend the subject matter

Factors affecting the location of industries in the World

- when industries are located with a view to earning profits, employment generation, regional development and resource utilization locations must be able to realize such objectives.
- In some industries only one factor may have affected their location but in others many locational factors are important.
- At present, in addition to those factors, personal factors also have been important in locating industries.
- Two groups of factors affect the location of industries.
  - Physical factors
  - Human and economic factors
- The following belong to Physical factors:
  - Land
  - Raw material
  - Energy
  - Climate
  - Accessibility
- The Human and economic factors are:
  - Capital (human and physical)
  - Labour (skilled and unskilled)
  - Technology
  - Market (regional/national/zonal/international)
  - Transport
  - Government policies
  - Distance to human and physical factors
  - Other factors

Iron and Steel Industry

The iron and steel industry has been the basis of industrialization in most countries. Iron and Steel industry has contributed to the production of various products from the small domestic appliances to ships and aircrafts. Several factors have been in effect to make this industry significant in the whole industrial process:

i High standard compared to other metals in terms of longevity and strength
ii. Resistance to tension and heat
iii. Flexibility compared to other metals

The United States of America, Russia, Britain, India, Japan, Italy, France and China are the major countries engaged in iron and steel industry.

The raw materials needed for the iron and steel industry are:

- Iron ore (Hematite, Limonite, magnetite)
- Coal (Anthracite, Bituminous, Lignite)
- Lime stones
- Dolomite
- Manganese
- Water

- Most iron and steel industries have been located in proximity to above mentioned raw materials to run the industry successfully.
- Easy access to raw materials has been the main factor of location in the iron and steel industry in the Great Lakes of the United States of America and the Damodar Valley in India.
- The iron and steel industry in the Lake Michigan and Pittsburg regions in the United States have been located due to the proximity to iron ore in the Lake Michigan and Lake Huron areas and Appalachian coal deposits.
- In some instances the location of the industry has changed due to the depletion of raw materials.
- In India, the location of the industry in Jamshedpur has been due to the location of coal deposits and iron ore in the vicinity of Jamshedpur and the ability to obtain water from River Damodar.
- Transport facilities have contributed highly in the location of this industry. Raw materials and products are transported by ships sailing in the lakes and Rivers.
  e.g., The Great Lakes and St. Lawrence Seaway in the United States of America and Damodar River in India
- The conventional factors of location have not been in force in the location of the iron and steel industry in Japan. Japan imports scrap iron and iron ore for its industry. The market factor and development in transport have played a major role.
- Historically, the leaders in World iron and steel industry were the Western countries like Great Britain, United States of America and Germany. The major factor has been the advantage of having raw materials. However, their supremacy has been taken over by the East Asian countries like China and Japan and countries like India and Malaysia. The major underlying factor has been the overriding importance of human factors over the physical factors.

Ship Building Industry

- Ships are built for the use in international trade and fisheries. They differ in scale from the smallest to the largest.
- Various ships such as War ships, Fishing boats and crafts, Luxury Cruiser boats and Ships, Oil Tankers, Cargo and Passenger ships are produced.
- Earlier, the Great Britain, the United States of America and Norway were the leading ship building countries. At present, countries like Japan, China, South Korea and Taiwan have entered the industry.

- The significant factors of location in ship building industry have been the availability of a large lowland along an indented coast. A deep and indented coast is essential for a shipyard and a large adjacent lowland is needed for storing the raw material. These requirements were available in the countries like Norway, the Netherlands, Britain, United States of America, China and Japan.
  e.g. The availability of large funnel-shaped river mouths in Tyne and Tees rivers , Belfast, Vishkapattanam, Baltimore, Houston, Glasgow, Amsterdam, Rotterdam, have facilitated the establishment of a ship building industry (the Colombo Port has also been gaining significance in the recent past).
- Ship building industry has been located in places where iron and steel industry is established due to the fact that iron and steel are the major raw materials of the industry. At the same time, the iron and steel industry plants have also been located alongside shipyards.
  e.g. Osaka.
- Climate is also an important factor of location. A longer frost-free period is essential for ship building.
- Shi building industry requires a huge amount of capital. As such it needs state patronage. Wealthy countries like Britain, the United States of America and the Netherlands invest large amounts of capital in this industry. Japan and India also have this capability. Because of the inability to invest huge amounts of capital the economically backward countries do not engage in this industry.
- In addition to requirements like land, raw materials, climate and capital ship building industry needs state patronage. State should provide security and a legal framework and encourage investors. In the above mentioned countries state patronage is available.

Motor Vehicle Industry

- The motor vehicle industry could be identified as a sector that enjoyed a super status in the 20th century. At present, it has developed into an industry that could earn millions of dollars, provide employment for millions of people and provide subsidiary services various types of industries.
- The motor vehicle industry has assisted people in providing transport facilities and helping them to do a large number of activities in a shorter period of time. Earlier, the leaders in the motor vehicle industry were the countries in Europe. Today, the countries such as Japan, South Korea and Malaysia have come to the forefront.
- The existence of an iron and steel industry would facilitate the location of a motor vehicle industry/. The Great Britain, the United States of America and India have become leaders in the motor vehicle industry owing to the existence of an iron and steel industry in their countries
- Land is another factor of location. A larger space would facilitate the production of vehicles and provide storage facilities for raw materials and products e.g. Tokyo.

- Energy is an essential resource for the motor vehicle industry as in other industries. Petroleum, coal or natural gas are the energy resources used. In the above mentioned countries these resources can be seen in varying quantities.
- The availability of labour with scientific, technical and managerial skills is another factor of location. Japan is a country that utilizes human resources to the maximum possible extent in this industry.
- Market is also a very important factor since demand plays a decisive role in supply. Motor vehicles are produced for national and international markets.
- The conventional producers have change with the change in markets and regional demand. Also, in some countries companies have been integrated. e.g. Toyota.
- The markets in the developing countries have expanded. However, different models of the same make are produced for developing and developed countries.

Aircraft Industry

- This is an industry developed after the Second World War. It is an assembling industry. The scale of aircrafts vary from helicopters carrying few passengers to large aircrafts carrying hundreds of passengers. At the same time, aircrafts are used in Wars and auto-pilot planes are also produced. Aircrafts that travel higher than the speed of sound are also produced.
- A number of countries are engaged in Aircraft Industry. The major countries are,
  - Great Britain
  - The United States of America
  - Russia
  - France
  - Germany
  - Japan
  - China, and
  - India
- A major factor in the location of this industry is the availability of required types of metals within the country or the ability to import them. The main metal is Titanium. The above mentioned countries obtain this metal without any difficulty.
- A large amount of capital hass to invested in the aircraft industry. it is also a risky industry. Being rich most of the above mentioned countries are in a position to have an aircraft industry.
- Another factor of location is the availability of a scientific and technological basis. The above mentioned countries satisfy that requirement.
- Climate also plays an important role in the location of this industry. Research activities and flight testing need good visibility and less rainfall.
- Regional weather conditions are also important.
- Aircraft industry needs a large land space. A lowland without hills permits testing of aircrafts.

- In Great Britain, the United states of America, Japan and India the government patronage has helped the industry to be established. Being an industry ensuring national security the state patronage is provided.
- The production of aircrafts has increased due to factors such as increasing uses like using aircrafts for leisure and pleasure, development in aircraft technology, production of high speed aircrafts, production of aircrafts with more passenger capacity and increase in passenger mobility
- There is a tendency for both amalgamation and closing down of aircraft producing companies.
- Another tendency is to produce aircrafts with resistance to natural disasters.

Electronic Industry

- The electronic industry produces a range of products from the appliances to make the day to day life of the people more comfortable and equipment needed for information and communication technology.
- The small blender used in the kitchen, radio and the television in the living room, fans, air-conditioners and equipment used in communication such as domestic telephone, mobile phones, computer and computer accessories are all produced by the electronic industry.
- Japan, Great Britain, the United States of America, Germany, France, China and South Korea are the major countries in the electronic industry. The Newly Industrialized Countries in Southeast Asia are also leading producers in the electronic industry.
- The difference between the high-tech industry and electronic industry is very little. The electronic industry could be considered as part of the high-tech industry.
- This difference can be understood when a definition given for high-tech industry is considered. According to the Department of Labor of the United States of America the high-tech industry is '***to produce technical equipment using modern technology and research that leads to progress or demise of the mankind***.'
- According to above definition it is clear that the electronic industry is a process that produces equipment that makes the day to day life more easy and equipment needed for information and communication.
- In the early stages the electronic industry also has been started in the countries with capital and ability to engage in research. So the United States of America, Britain and other European countries took the lead.
- With the transfer of technology from the West to the countries in Asia and Latin America in recent times, the electronic industry was established in those countries, too. The countries like, Malaysia, South Korea, Japan, Brazil, India and China have been progressing well.
- In most cases, the industry in the countries of Asia and Latin America has been established and progressed with the capital invested by the countries developed earlier.
- The major reason that helped the establishment of this industry in these countries has been their ability to invest large amounts of capital for continuous research in that field.
  E.g. Silicon Valley.

- However, in recent times it has been possible to establish the industry with less capital.
- The demand for electronic equipment in both national and international markets has resulted in the establishment of this industry in many countries.

Petro-chemical industry

- Various chemicals are produced using the waste disposed in the petroleum refining process. These are called petro-chemicals.
- Following are the main products of the petro-chemical industry:
  - Tar
  - Lubricants
  - Plastics
  - Nylon
  - Antiseptics
  - Adhesives
  - Lotions
  - Insecticides
- Petro-chemical industry is largely seen in the United States of America and the Western European countries.
- However, in recent times, in the countries of the Middle East and Asia the industry has been established.
- The petro-chemical industry has distributed the world over due to high demand for its products.
  1. There are three primary petro-chemicals:
     - Ethylene
     - Propylene
     - Butadiene

  Ethylene and Propylene produce industrial chemicals and plastics. Butadiene is used for the production of synthetic rubber.
  2. Benzene is used for the production of dye and synthetic antiseptics. Toluene produces plastics and synthetic fibre.
  3. Synthetic gas is used for the production of Urea and various chemical liquids.
     - The location of this industry is mainly based on raw materials. As such, the industry is located in every country where petroleum refining can be found.
     - The industry needs large numbers of labor. As such there should be cheap labor. Also, technological knowledge is essential.
     - The industry needs large amounts of capital for buildings, research, complex equipment for separating substances from raw materials. as such, the industry has been established and developed in countries where such capital is available.
     - Land is an important factor in the location of this industry. Since the industry affects the environment it is located in areas far away from urban centres.

Dairy Industry

- The products made out of milk obtained from cows and buffaloes are known as dairy products. These are food products that generate energy.
- A place where various dairy products are manufactured called a diary production centre.
- Dairy products are made mainly from cow milk. Next in order is buffalo milk. Milk from goats, sheep, camel and horses are used in lesser amounts.
- There are number of dairy products. They are:
  - Milk Powder
  - Butter
  - Infant Milk Powder
  - Condensed Milk/Skim Milk
  - Cheese
  - Curd and
  - Yoghurt
- In the following countries dairy products are manufactured in large quantities.
  - Denmark
  - The Netherlands
  - France
  - Switzerland
  - Australia
  - New Zealand
  - The United States of America
- A main factor of location is land. An essential requirement is productive grasslands where density of human population is low.
- As such cattle farming is carried out in the countries in the temperate zone of both Northern and Southern hemispheres such as Denmark, the Netherlands, Australia, Argentina Russia and the United States of America.
- Following are the major regions in the above mentioned countries where cattle farming has developed due to favorable land and climatic factors.
  - South America - Llanos and Campos
  - North America - Prairies
  - South Africa - Weld
  - Australia - Downs
  - Russia - Steppes
- Animals must be kept in good health.
- Labor is also an important factor. Labor must be available in abundance since many people are required in dairy manufacturing activities. Also factors like the large size of the cattle farms and the necessity for keeping animals in good heath require large numbers of labor.
- Capital is another important factor of location. The industry could be maintained if both the public and private sectors are in a position invest capital. Multi-national corporations involved in this industry invest large amounts of capital in the industry (e.g. Nestle, Anchor)

- The availability of transport facilities is another factor of location in the dairy industry. In order to transport dairy products to the market in time various transport modes such as shipping, air and land are used.
- Market affects the dairy industry in a big way. The quality of the products must be maintained. Trade names are very important in this industry. Sometimes, purchasing of dairy products depends on trade names. Dairy products are introduced according to consumer tastes.

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Teaching - Learning Activities

Activity - 1

There are a large number of manufacturing industries in the world. They are classified as light industries, heavy industries and high-tech industries. In the location of these industries one or several factors have been in operation. Sometimes, instead of these location factors, a personal factor may have determined the location of an industry in your locality. In this activity it is expected from you to select such an industry and study the factors that decided its location.

- Select a manufacturing industry located in proximity to your school.
- Organize a field trip to see the factory.
- Organize students in groups or individually.
- Advice them to find out the factors that determined the location of the selected industry.
- Provide students an opportunity to present the collected information in the class room.
- Evaluate students on the basis of learning outcomes.

Activity - 2

This is an individual activity. Assign each student an industry and ask to prepare an information sheet on the factors that have affected the location of that industry using the library sources or books and magazines.

- Assign industries to all students.
- Provide a short description on what should be included in the information sheet.
- Give them an opportunity to present the completed information sheets to the class.
- The intervention of the teacher in the presentation of information sheets is very important
- Evaluate students using criteria based on learning outcomes.

Competency Level 10.2 **Examines the location factors of a few industries in Sri Lanka** (10 periods)

Learning Outcomes

- Explain the background of industries in Sri Lanka
- Describes the factors of location
- Analyze a few major industries in Sri Lanka according to their location factors.
- Present the temporal change and related government policies with regard to a few industries in Sri Lanka.
- Make suggestions for the industrial development in Sri Lanka

Introduction

The economic process activated by the utilization of resources with human intervention in order to satisfy human needs is known as industries.

It is clear from archaeological evidence and historical records that there have been industries in Sri Lanka during the time of ancient kingdoms. There have been several eras in the industrial development in Sri Lanka such as, the colonization period, the period up to the 1960s, the period between 1960 and 1970 and post-1977 period etc. The economy of Sri Lanka which had been based on agriculture in the past is now laying more emphasis on industries. At present, Sri Lanka's industrial sector has shown some progress in terms of the contribution to Gross Domestic Product and industrial employment. There are a few types of industries in Sri Lanka. Extractive, Manufacturing and Services is one such classification. In this section, attention is focused on the manufacturing industries. There are three types of manufacturing industries in Sri Lanka:

1. Large-scale industries
2. Medium-scale industries and,
3. Small-scale industries.

The cement and sugar industries are examples for large-scale industries while plastics and biscuit manufacturing can be considered as medium-scale industries. Many handicraft industries are small-scale. The attention is focused on the factors that affected the location of these various types of industries and their temporal variation. It is also expected to discuss the government policies that affected the location of industries in Sri Lanka.

A Helping hand to comprehend the subject matter

- **Industries in Sri Lanka**

  - Traditional handicrafts
  - Cement industry
  - Sugar industry
  - Apparel (garment) industry
  - Rubber and plastics industry themes

The above-mentioned industries will be studied according to following themes:

- Factors of location
- special characteristic
- temporal changes
- government policies on location of industries

- Several factors affect location of industries. Among them the following are important:

  - Land
  - Raw Materials
  - Energy
  - Labor
  - Capital
  - Market and,
  - Transport

The above factors affect the location of industries in any country. However, their individual strength can vary from one country to another. In some countries, all factors may be important but in others only some of them are determining factors. In another country, an entirely different factors may have played a role. There are some specific factors such as:

- Climate
- Entrepreneurship and,
- Seasonal needs

In some countries in addition to all those factors the government policies might play a major role. In such cases, the government makes decisions with regard to industries. They are directed at protection and development of industries.

In the case of Sri Lanka almost all of these factors have affected the location of industries. Some industries have been based on one location factor while another may have been affected by a number of factors. Also, they have been subject to change over time. Natural disasters, war, festivals and tourism industry have exerted an influence at various times. At the same time, the periodic government policies like import substitution, open economy, industrial decentralization, and tax concessions have directly affected the industries.

Traditional Handicrafts

Since the distant past, the traditional handicrafts have been enjoying a special significance in the economy of Sri Lanka. These industries are carried out in households at small scale and also known as domestic industries. Following factors are important with regard to handicrafts:

Factors of Location

- Labor as well as raw materials has affected the location of handicrafts.
- For one industry labor may have been important but in another raw materials have been the determining factor
- Mostly local raw materials are used but sometimes they are imported
- These industries are important to Sri Lanka where capital and fuel are in short supply
- In this industry the traditional technologies have been passing from one generation to another.
- The industry has declined due to the fact that the new generation does not like to engage in traditional industries.

Specific characteristics

- Specific locations for industries: Kalapura in Kundasale, Weweldeniya, Kiriwavula, Ambalangoda, Ambekke.
- Encouragement through annual exhibitions, award ceremonies, Training programmes contribute to the development of the industries
- Possibility of engaging in industry while working at home provides an opportunity for women to get themselves involved in the industry.

Temporal changes

- The traditional handicraft industry can be utilized as a solution to the environmental problems. The minimum levels of pollutants emitted to the environment by these industries, the possibility of recycling and production of environment friendly products make this industry highly time-opportune.
- The tourism industry has contributed to the expansion in market.

Government policies

- Every government in power has introduced policies for the development of the industry. The assistance provided could be seen in the establishment of institutions like of the Department of Small Industries, *Laksala*, Handicrafts Board, *Gemidiriya*, and National Fashions Centre.
- The finance institutions like *Samurdhi* Bank offer loans
- In the development of handicraft industry must take into account to produce goods to satisfy the needs of the time. Also, products must be light-weight.

Cement Industry

The cement industry can be identified as a major industry in Sri Lanka. Many factors have affected the location of this industry. The most important among them has been raw materials.

Factors of location

- The major cement factories in Sri Lanka are located in Kankesanturai, Galle and Puttalam.
- Due to terrorist activities the Kankesanturai factory had been temporarily closed.
- The cement is produced using lime stones located in the region from Puttalam to Jaffna.
- Trained labor has been a major factor in the development of the cement industry.

Special characteristics

- The location of Galle cement factory has been determined mainly by transport facilities. The Galle harbor is a major location factor.
- The market available in the Southern region itself is also a major factor.
- The construction industry that marks the rapid development process in Sri Lanka has extended a great demand for cement. E.g. Highways and Port construction

Temporal changes

- In time various products have been made.
- Use of cement products instead of products made of timber to minimize the destruction to environment
- The competition in market due to imports of cement
- The use of trade names for market promotion e.g. Holcim
- Introduction of various types of cement for different uses e.g. for plastering, tiling etc.

Government policies

- The Cement Corporation was established in 1950 and became an institution receiving state patronage in 1955. In 1957, it was restructured under the Industrial Corporations Act.
- At present, it is under the Ministry of Industries.
- All governments of Sri Lanka to date had policies for the development of the cement industry.

The cement industry has to be further developed by improving efficiency and productivity. It is important reduce imports and increase local production. It is time for the government to intervene and take necessary measures.

Sugar industry

Sugar can be identified as an essential commodity in Sri Lankan's life. Annually a large quantity of sugar is consumed by the people of Sri Lanka. However, Sri Lanka produces less than her requirements and, therefore, imports a larger percentage. Sugar factories have been located where sugar cane, the main raw material, is cultivated. The following factors affect the location of sugar industry.

Factors of location

- Since transporting the produced sugar to the market is profitable than transporting sugar cane to the factory sugar industries are located where raw material is found.
- It is profitable that labor also could be found in area itself where factory is located.
- Although people (labor) have been settled in areas where factories are located, the subsequent closure of some factories has created problems.
- Due to the clearing of forest areas for sugar cane cultivation wild animals have lost their lands. Especially the elephant-man conflict can be cited as an example.

Specific characteristics

- In sugar production ,many by-products are made, e.g. alcohol and scents.
- Many products are made using sugar: confectionaries
- industrial growth has increased the demand for sugar

Temporal changes

- At the beginning sugar factories were located at Kantale and Hingurana. Subsequently, factories were established at Pelawatte and Sewanagala.
- Earlier the industry was under Sugar Corporation. Later, the private sector also established sugar industries.
- Socioeconomic problems have emerged among workers in cultivation areas and it is necessary to solve those problems to increase the production.
- In recent years an increase in sugar imports can be seen.

Government policies

- In 1957, the Sugar Corporation was established and the factories at Kantale and Hingurana were taken over by the corporation.
- After 1977, the private sector also has been encouraged to commence sugar industry.
- Government has imposed a Tax for sugar imports with a view to protecting Sugar cane farmers. However, this has resulted in the increase of sugar prices, too.
- It is the government policy to provide concessions to farmers associated with factories and improve infrastructure facilities

Apparel (garment) industry

At present, apparel industry is the leader in the industrial sector in Sri Lanka. Although the apparel industry of Sri Lanka has a long history the period since independence has been of particular importance. After the introduction of the open economy Sri Lanka became a leading country in apparel production. In the location of this industry a number of location factors in addition to land, labor, raw materials, capital and market are in effect. In Sri Lanka a few of these factors can be seen. The major factor in our country is labor. These industries, carrying various trade names have distributed all over the country.

Factors of location

- The location apparel industry in Sri Lanka has been based primarily on labor. The industry needs cheap and skilled labor. In comparison to other countries Sri Lanka's labor is cheap.
- The locality has been decided on availability of market and transport facilities.
- Infrastructure facilities have been provided to entrepreneurs.
- The industry depends on export trade.

Special characteristics

- High level of demand for Sri Lanka's apparels
- high demand is due to the high quality of Sri Lanka's apparels
- The skill levels of labor which have been improved with time have contributed to the high level of productivity
- The trade agreements with foreign countries and organizations (SAFTA)

Temporal changes

- The apparel industry in Sri Lanka has grown with the provision of facilities from time to time.
    - the establishment of Industrial Estate at *Ekala* in 1962
    - the establishment of Free Trade Zones in 1978
    - the 200 garment factories program of 1992
    - commencement of Industrial Parks in 1995
    - commencement of industrial townships in 1996
    - industry to the villages program of 2006

- It was expected to decentralize the industries from the above programs.
- With time, the significance of labor has changed and market and transport factors have come to the prominence.
- Trade agreements have been playing a major role in the export of apparels. Such agreements provide export quotas.
- New markets are being found through Trade exhibitions
- Introduction of new products (different types of garments) has been another change with time.

Government policies

- The governments since independence have taken various measures to develop the apparel industry in Sri Lanka. Especially, following the establishment of the Industrial Estate at *Ekala* especial attention was focused on this industry.
- Under the Greater Colombo Economic Commission (GCEC) was established in 1978, export processing zones were located at *Katunayake* and *Biyagama*.
- In 1992, Sri Lanka Board of Investment (BOI) was establish by expanding GCEC.
- The government that came into power in 1994, too, encouraged the apparel industry by decentralizing the industry under various names.

Rubber and Plastics industry

The rubber and plastics products manufacturing is a widely distributed industry in Sri Lanka today. Sometimes rubber products are used as a raw material in another industry and on the other, it is a finished product.

Factors of location

- Industries that use rubber as a raw material are located in proximity to rubber growing areas and industries using semi-finished rubber are located in industrial areas.
- Rubber product manufacturing industries can be seen in the rubber growing areas of *Kegalle*, *Ratnapura* and *Kalutara*.
- A tire and tube manufacturing industry has been located at *Kelaniya*.
- Shoe and carpet manufacturing industries also can be seen.
- The plastics making is a by-product of oil refining. The making of products from plastics is alight industry.
- The plastics products manufacturing can be seen in industrial estates and industrial parks and it can also be seen as a small-scale household industry as well.
- Market, transport facilities and labor have been the factors of location of the plastics manufacturing industry.

Special characteristics

- Introduction of various types of products; increase in demand due to the production of high quality goods.
- Higher demand for household utility products due to their light weight and unbreakable nature.

Temporal changes

- Due to deforestation and high cost of timber products the demand for plastics products has grown
- A range of household goods are made of plastics
- The quality of plastics products have improved (toys, household goods)
- Some trade names are high in demand (Phoenix, ARPICO)
- However, environmental pollution due to plastics products waste has increased

Teaching and Learning Activities

Activity - 1

- Complete the following table with information on industries in Sri Lanka.

Industry	Location	Factors of Location	Recent Trends

Activity - 2

Select an industry located in your area and discuss the problems associated with it. Describe your solutions for the problems.

Competency - 11

Examines the potentials of Sri Lankan Tourist Industry and make suggestions for its improvement

Competency level 11.1: Examines the characteristics of tourism industry in Sri Lanka

(07 periods)

Competency level 11.2: Suggests measures that could be adopted to improve tourism industry in Sri Lanka

(03 periods)

Learning Outcomes:

- explains geographically the basic concepts related to tourism industry
- describes factors that attract tourists to Sri Lanka
- Describes how tourism affects the economy
- Analyses the impact of tourism on the culture of Sri Lanka
- Describes the environmental impact of tourism
- Suggests measures that could be adopted to develop tourism industry

Introduction

Tourism industry is considered as an enterprise that offers maximum profit with a minimum level of costs. Also, it is a sector that gives maximum profit with minimum damage to the environment. From this unit it is possible to gain an understanding of the basic geographical concepts associated with tourism, factors that attract tourists to Sri Lanka, impacts and returns of tourism and measures that could be adopted to develop tourism.

A Helping hand to comprehend the subject matter

Tourism industry

- Tourism industry is one of the largest and growing industries in the present world.
- Tourism is the moving from one country to another or from one region to another for various reasons. It can be planned or unplanned.
- The planned tourism is based on a commercial foundation.

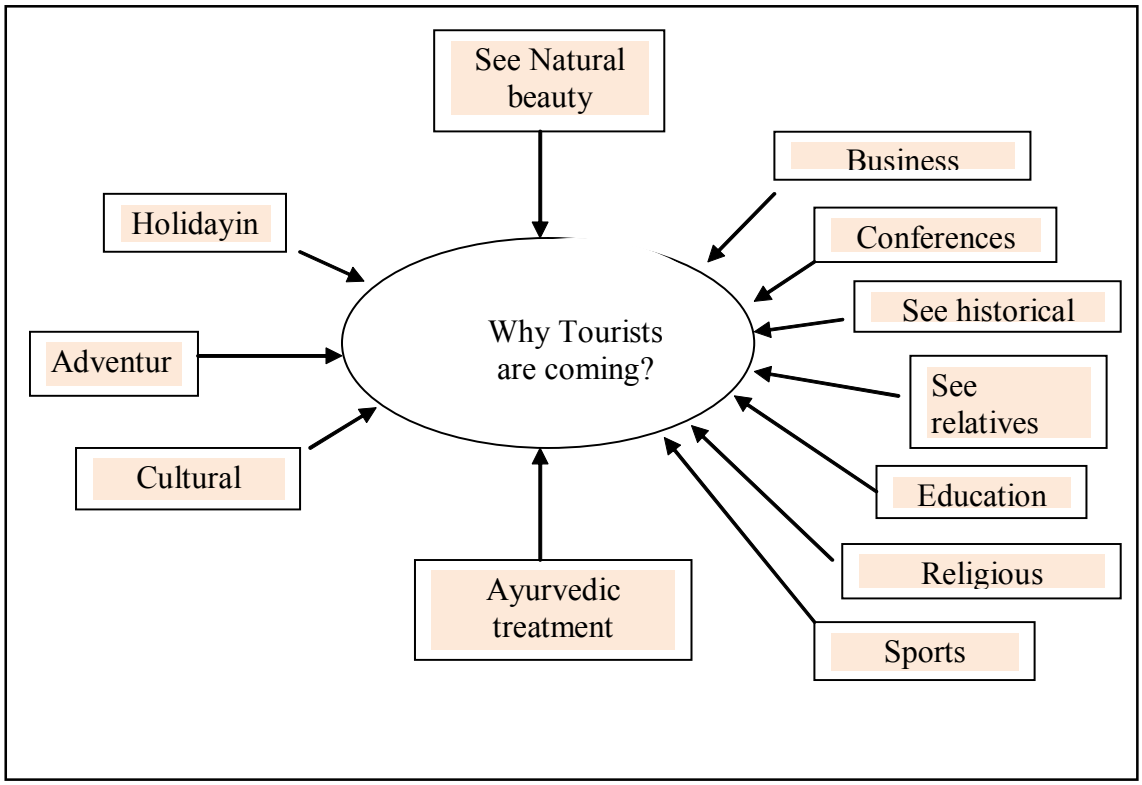
- Many people tour tropical countries following the seasonal changes in climate especially with a view to free themselves from the harsh winter conditions.
- The high levels of per capita incomes have been the major factor inducing people in the developed countries to engage in tourism
- It has been a habit of every employee to take an annual holiday in the winter season.
- An added factor is the possibility of obtaining pay leave to spend the holiday away from the workplace.
- Another factor has been the possibility of spending the holiday in another country with less cost.

Tourism industry in Sri Lanka

- According to international definitions, in Sri Lanka, a tourist is defined as a person who is spending at least one night in the country.

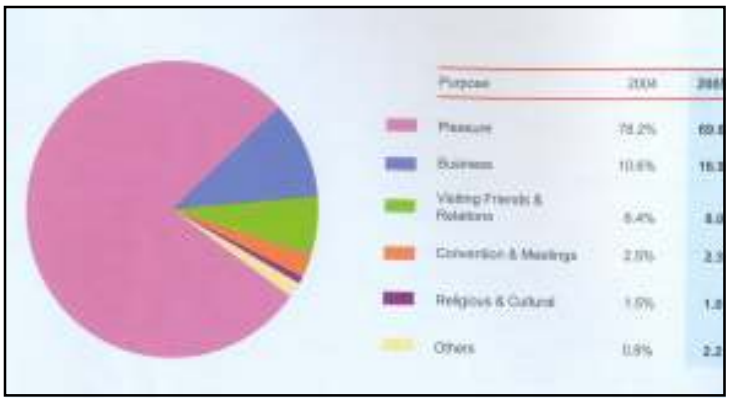
Fig. 11.1.1

Why tourists are coming to Sri Lanka



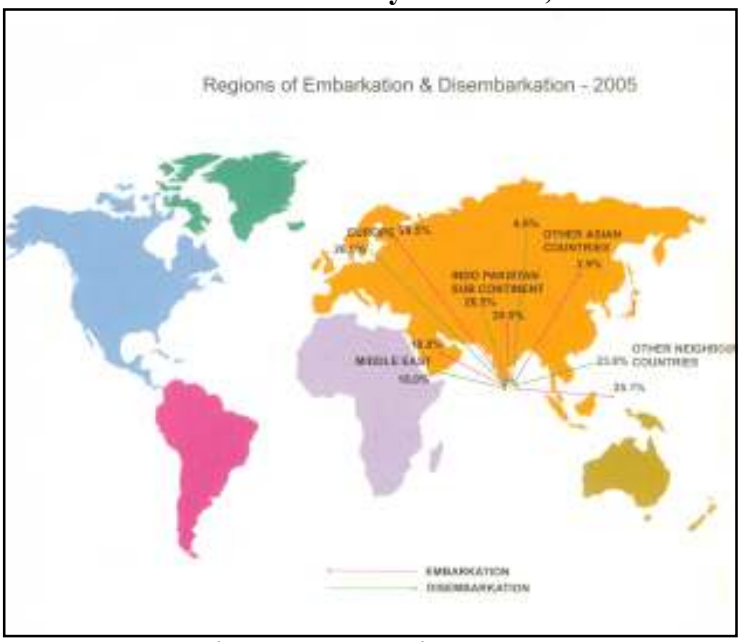
- Although Sri Lanka is a small island, its diverse relief and climatic characteristics, and natural and man-made constructs which can be reached within one day have attracted tourists.
- The tourists who come to see and experience the natural beauty expect Sun, Sea, Sand and Service.
- The tourists coming to Sri Lanka focus their attention on various aspects of tourism such as eco-tourism which includes beaches, forests, mountain landscapes, wild animals and natural parks, cultural tourism which covers historic ruins, religious places and museums and heritage tourism which includes *Sinharaja* and Galle Fort.
- Tourists arrive in Sri Lanka in two ways:
  - arriving as a member of a group package organized by tourism representatives
  - individual tourists

Fig.11.1.2
Reasons for tourists to visit Sri Lanka



Source: *Sri Lanka Tourist Board*, 2005.

Fig.11.1.3
Arrivals of Tourists by Countries, 2005



Source: *Sri Lanka Tourist Board*, 2005.

- In tourism industry there are two sectors, namely local and international.
- The local tourism sector comprises the following tourism objectives:

Table 11.1.1

Local tourism by objectives, 1993

Objective	Percentage of the total number of tourists
Pilgrims	40.0
Holidaying with family	22.0
Holidaying in groups	21.0
Educational tours and sightseeing	14.0
Other	3.0

Source: *Tourism Master Plan*, 1993.

- the important places that attract local tourists are Anuradhapura, Kataragama, Nuwara Eliya, Kandy, Adams Peak, Polonnaruwa, Sigiriya and Dambulla
- With the end of terrorism in the country tourists are visiting places in the North and East
- Not only the arrival of tourists but also the length of their stay in the country also is important

Table 11.1.2

The duration of stay of tourists, 2002

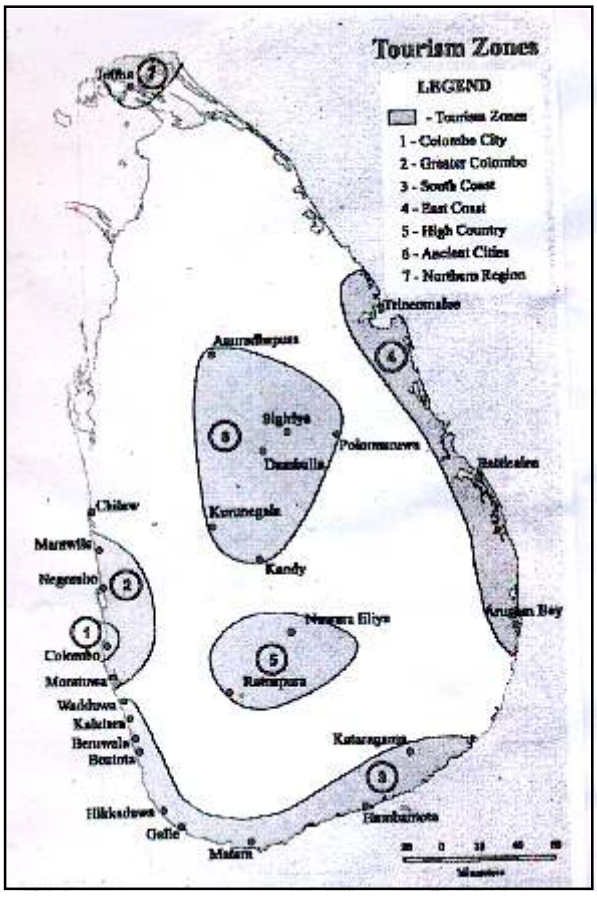
Duration	Per cent of total tourists
1 - 3 nights	22.6
4 - 7 nights	27.0
8 - 14 nights	34.7
15 - 21 nights	12.1
22 - 30 nights	2.6
31 or more nights	1.0

Source: *Tourism Master Plan*, 1993

- The Sri Lanka Tourist Board has named seven (7) major tourism zones in Sri Lanka as follows:
    1. Colombo City
    2. Greater Colombo
    3. Southern Coast
    4. East Coast
    5. Central Highlands
    6. Ancient Cities, and
    7. Northern Region

Fig. 11.1.4

Major Tourism Zones of Sri Lanka



Source: *National Atlas of Sri Lanka*, 2007

Development plans for tourism industry

- Development activities in tourism industry dates back to 1937 in which year the Tourism Bureau was established
- Establishment of Sri Lanka Tourist Bureau under the Tourism Act of No. 10 of 1966
- Preparation of Ten Year Promotion Plan 1968 - 1978 and declaration of five (5) major tourism centres
- Establishment of Sri Lanka Hotel School in 1993
- Preparation of Ten Year Plan under the auspices of UNDP/WTO

Future Expectations

Development of tourism industry under the following two sectors:

- Mass tourism with a focus on Sun, Sea and Sand (Beach)
- Alternative local tourism activities

Both sectors had been identified in the Tourism master Plan of 1993.

Impact of Tsunami

- The tourism industry in Sri Lanka was adversely affected by the tsunami disaster of 26. 12. 2004
- Many infrastructure facilities of the tourism industry was destroyed by the tsunami
- Twenty five (25) hotels along the main beaches were severely damaged and six hotels in the East coast was totally destroyed
- About 66,840 jobs were affected
- The tsunami warning in 2005 resulted in the decrease in tourists arrivals by 21.4 per cent
- The loss to the Gross Domestic Product of the country has been estimated as US $ 201 million
- Sri Lanka Tourist Board had planned to redevelop the industry in three stages:
  1. Tourist market promotion
  2. Reconstruction and rehabilitation, and
  3. Resettlement of people in the affected areas

  US$ 195 million have been set apart for these activities.

- **Impact of tourism industry**

Economic impact

- The economic impact of the tourism industry could be discussed according to the following headings:
  - Foreign exchange earnings
  - Employment
  - Regional Development
  - Increase in government income
  - Income earning and economic stimulation

Foreign exchange earnings

- The tourism industry is the sixth largest sector in the economy of Sri Lanka in terms of foreign exchange earnings
- Rs. millions 42,666 and 36,377 were earned in 2004 and 2005 respectively
- In 2006, the earnings were US$ 319.5 million.
- In 2006, the average daily expenditure of a tourist was US$ 76.7
- It is clear that the tourism industry has potential to earn foreign exchange without much difficulty

Employment

- In the world, one out of every 10 jobs is created in the tourism field. It is believed that every five tourists arrive in a third world country create one job opportunity
- Tourism creates direct and indirect employment opportunities
- Hotels, Tourist Guest Houses, Tourist Restaurants and Transport services, provide direct employment opportunities.
- The provision of supplementary services to hotels, production and marketing of handicrafts, souvenirs, gems and jewelry, tourist guiding are the indirect employment opportunities
- According to the Handbook of Tourist Statistics 2005 every 100 direct employment opportunities create another 140 indirect employment opportunities
- In 2005, the direct employment opportunities created in tourism industry were 52,085
- In 2008, according to provisional data, 51,857 and 72,599 direct and indirect employment opportunities respectively had been created in the tourism sector.

Regional development

- Development of infrastructure facilities in the tourist attracting areas. E.g. te development taken place in areas like Pinnawala, Dambulla, Kandalama, Sigiriya, Polonnaruwa, Kataragama and Hikkaduwa
- Opening of tourist hotels and restaurants and urbanization can be seen in these areas
- In 2005, there were 234 hotels registered with the Tourist Board and the number of rooms in them was 13,162.

Table 11.1.3

Regional Distribution of Room Capacity of Hotels - 2005

Region	% of Total Room Capacity
Southern Coast	33.7
Colombo City	22.3
Greater Colombo Area	18.9
Ancient Cities Area	18.4
Hill Country Area	6.7
Total	100.0

Source: *Sri Lanka Tourist Board*, 2005.

As above table shows, more lodging facilities can be seen in areas out of Colombo city region.

Increase in government income

- The Government of Sri Lanka directly and indirectly taxes the tourism industry.
  The entrance fees charged by museums, botanical gardens, national parks, institutions within the Cultural Triangle and other institutions are examples. In 2005, the government earned Rs. million 1,880.3 from the sale of entry tickets.
- The Embarkation Tax and Customs fees are other examples.

Economic stimulation

- The level of living of the people in a particular area increases when tourists visit that area. Examples for such places are Kandy, Hikkaduwa, Bentota, Unawatuna, Pinnawala, Kandalama and Dambulla.

Adverse economic impacts

- The uncertainty of tourist arrivals results in fluctuations in economic returns.
- The seasonal nature of tourism industry exerts and adverse effect on employment and institutions involved.
- Sometimes, in areas where tourists arrive in large numbers the local people face problems; sometimes the prices of local products tend to increase.
- Sometimes, in order to satisfy tourists' demand food and other necessities may have to be imported; in such case foreign exchange has to be spent.
- the influence of multi-national corporations; the tourist arrivals are decided by these multinational companies.

Cultural and Social effects

- The Sri Lankan cultural events become known world over
- Sri Lankan art and creations become known in other countries
- Opening up of new income sources for artists
- The money earned from sale of tickets could be used for conservation of ruins and relics of archaeological value
- the revival of handicraft industries associated with souvenir production etc.

Social returns

- opening up of pathways to world peace through knowing of other nationalities
- Spread of Sri Lankan culture through mix of various cultures
- The tendency in Sri Lankan youth to learn foreign languages
- Tendency to learn some favorable foreign cultural values

Adverse cultural effects

- The cultural value and characteristics of festivals, art and souvenirs being overshadowed by commercial objectives
- Sending out of products with religious and physical value to overseas countries
- Some very few tourists do not observe order at places of religious significance

Adverse Social effects

- Tendency to follow foreign values uncritically
- Deterioration of the family institution
- Deterioration in ethics
- Spread of vernal diseases
- Increase in child abuse
- Increase in drug addiction

Environmental impact

- Increasing tendency to protect environment as environment is the basis of tourism; e.g. drawing attention to eco-tourism (Kandalama is an example).
- Receipt of foreign aid for conservation of environment
- Receipt of foreign aid for protecting vanishing and endangered species (e.g. conservation of turtles)
- The income earned through selling of entrance tickets being used to maintain sanctuaries, botanical gardens, zoological gardens, etc.

Adverse environmental impact

- Damage caused to aesthetic value of attractive places by constructing hotel and tourist guest houses
- Coastal erosion
- Pollution in western and southern coastal areas where tourists are found in large numbers
- Destruction of coral reefs
- Pollution of water streams adjoining tourist resorts
- Tourist purchasing of products made of parts of vanishing or endangered animals leading to disappearance of such species; e.g. turtles and porcupines
- Destruction caused to bio-environmental systems and their functions by intolerable influx of tourists and vehicles to some attractive tourist areas and sanctuaries
- Destruction of biological system due to accumulation of non-degradable waste such as plastics and glass bottles
- Threat to some areas of aesthetic vale due to the illegal collection of souvenirs by tourists, e.g. Knucles Protected Area and Sinharaja
- Taking away of parts of flora and fauna by tourists illegally

- **Measures for the Development of Tourism Industry**

  Special attention should be paid to the following areas in order to promote tourism industry.

- Promotion of tourist attractiveness
  - The physical and human environment of Sri Lanka can easily be utilized to attract tourists. Sri Lanka is a small island where more leisure time could be spent with little cost and this has to be advertised widely world over.
  - An awareness program must be launched about the specific advantages that Sri Lanka enjoys relative to other countries; e.g. the proposed 8th Wonder of the World: Sigiriya.
  - Pinnawala: the Elephant Orphanage plus Elephant Reproductive Centre, Sinharaja Forest, Knuckels Protected Area, Limestone Caves at Wavulpane and places like Ritigala are very rare tourist attractions
  - Sri Lanka has seven World Heritage places named by the UNESCO. As such special and wide advertising program has to be launched stressing that Sri Lanka is a special case.
  - Comfortable accommodation facilities must be provided to the tourists. Also, appropriate accommodation must be provided to eco-tourists to satisfy their specific needs. Attraction of tourists largely depends on the facilities provided to tourists in accordance with international standards.
  - The eco-tourism infrastructure facilities, guesthouses, observation compartments in trains, environmental trails etc. must be developed without damaging the environment.
  - In addition to accommodation facilities, sports and other recreation facilities must be made available at destinations.
  - Air transport, road transport, railway and other access facilities must be improved.
  - The personnel needed for tourism industry must be well trained. For example, untrained guide personnel have created problems both for tourists and as well as for themselves.
  - The unfavorable attitudes toward tourism must be removed and the society must be made aware of the reality. Such measures would be of help in minimizing the problems facing tourism.
  - Since tourism is an industry with a potential of earning foreign exchange it should be given more government patronage. The Tourist Board cannot do this by itself and must be helped by other institutions.
  - In the construction of hotels attention must be paid to its impact on environment.

References

- Survey Department of Sri Lanka (2007), *The National Atlas of Sri Lanka*.

Teaching and Learning Activities

Activity - 1

Identify special environmental and cultural locations in Sri Lanka attractive to tourists and prepare an information sheet of them

Activity - 2

Prepare a wall paper containing information on a comparative study of the favorable and unfavorable economic, social, environmental and cultural effects of tourism in Sri Lanka.

N.B. These activities must be done individually and in groups. Opportunities must be provided for presentation of student investigations, description and evaluation.

Competency - 12

Analyze the nature of globalization comparatively and presents examples that Sri Lanka could follow

Competency level 12.1: Examines information technology as a factor affecting globalization (10 periods)

Learning Outcomes

- Gains a basic understanding about the concept of globalization
- Describes what is information technology
- Discusses the influence of information technology on the globalization process
- Comparatively analyzes the process of globalization and identify the lessons that Sri Lanka could learn
- Comparatively studies the nature of globalization and construct attitudes on the lessons that could be learnt

Introduction

The main factor that has influenced globalization is the rapid development in information technology.

Globalization is a topic that has been a subject of wide discussion in world mass media in recent years. It is important to have a clear idea about it since the creation of a world without borders and all sectors of human activity largely depend on it. It would also be correct to identify globalization as an interactive process in political, economic, social and cultural domains of the people living in different places. In the process of creating a borderless world, the significance of traditional social value systems at national levels has been on the decline.

The concept of global village implies that the world is shrinking or becoming smaller. R. Robertson (1992) in terms of space and time, an eminent sociologist, has shown that it is in terms of space and time that the shrinking of the world is taking place. Due to the progress in technology the significance of these variables are decreasing. Although some 'geographers' are of the view that due to the globalization the discipline of geography will lose it significance, the globalization does unravel regional differences of much geographic significance.

At present, globalization is in action in expanding the markets which is being discussed in various fields. The integration of national markets into the global market through liberalization of economies, global market forces, change of production methods and environmental (global warming), social and cultural (emergence of new consumption patterns and new social classes) changes are among

these fields. In the process, through competition, monopoly and technological revolutions the economic, political, social and cultural profiles of a state will change.

As such, the tremendous progress that has been achieved by information technology within the scientific world today can be identified as a very influencing factor in the globalization process.

A Helping hand to comprehend the subject matter

- What is information technology?

  - The information technology which has its roots in the distant past has caught renewed attention due to its impact on globalization
  - Information is what is transmitted to the recipient through a text, voice or visual media
  - Communication is sending a message to an individual or a group and knowing that it has received by that individual or group.
  - This process was known at the beginning as Information technology (IT) but later was changed into Information Communication Technology (ICT).
  - At the beginning of the 2oth century capital was considered as the essential factor in economic growth but later it was replaced by the information technology.
  - In the decade of 1950 the computer came into existence. Later, the progress in technology industries along with digitization and integration of telephones and satellites into the system there has been a revolutionary growth in information technology. This means that information technology has emerged as a combined result of the computer technology and communication technology.
  - Technological knowledge has been of great help not only in increasing the onomic production but also the quality of products as well.
  - Technologies used in electronic processing, storing and distribution of information belong to information communication technology. In this event many apparatus such as computers, computer networks, computer accessories, telephones, facsimiles, satellites and various electronic equipment are used.

Fig. 12.1.1

The Process of Information Communication Technology

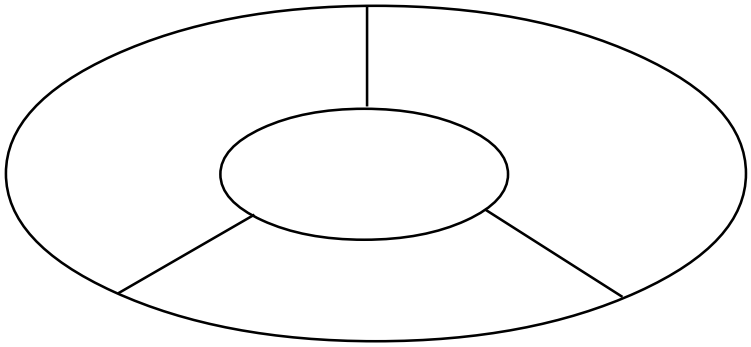
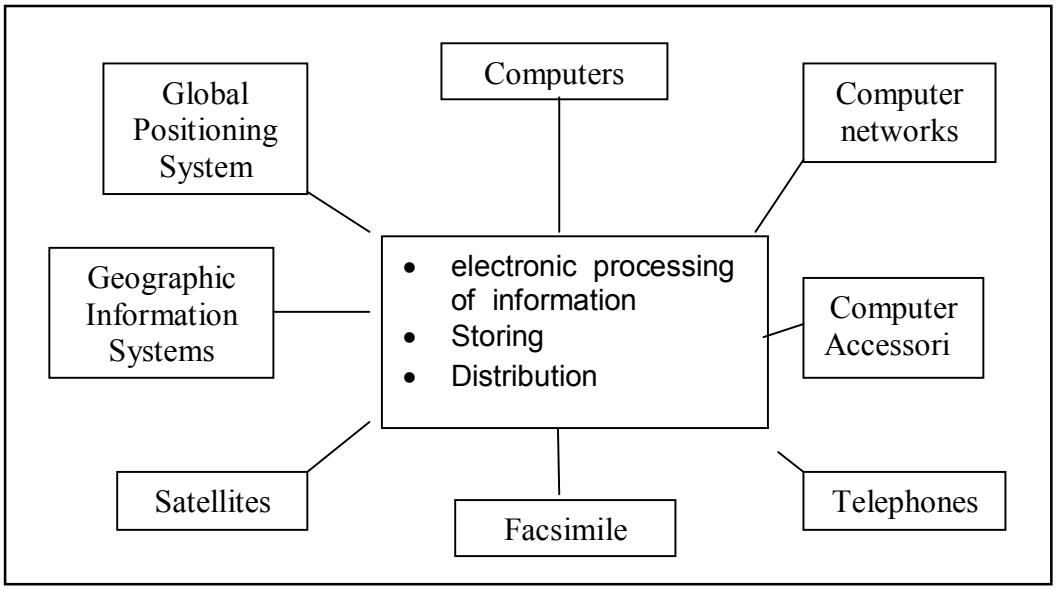


Fig. 12.1.2

Components of Information Technology



- As social globalization takes place with continuous quantitative and qualitative growth in science and technology the reciprocal human relationships grow further. Its cost has been decreasing and in relation to that the number of beneficiaries is on the increase. For example, in 1950, a telephone conversation of 3 minute-duration from New York to London cost US$ 300 whereas today it will cost only US$ 0.08. At the same time, it has been possible to translate one language into several languages through the Internet.
- Although the information technology has been able to spread the results of globalization to the four corners of the world there still remains disparities among nations in required skill in terms of their flexibility, accessibility and usage.

International Information Provision Network (Internet) as a medium of Information Technology

- The wide use of the Internet has been able to make a revolution in the computer information technology
- The internet provides information on any topic and this information comes from various countries. The Internet has been identified as the world's largest computer network. When computers work together it is called a computer network system.
- The internet has grown gradually and has been modernized to suit the needs of a large number of people within a short time span.
- It is a medium that increases the knowledge within a short period of time. It provides a large number of texts, voices, video, pictures etc. to mass media.
- A large number of people of various walks of life are using the Internet to increase their knowledge. For example, the university undergraduates, school children, institutes of higher education like universities and research institutions, state institutions and other organizations, businessmen, and others including fun-seekers use the Internet for various purposes.
- Among the other uses that Internet provides:
  1. Intranet: A system that gather and exchange the information stored in the computers within an institution
  2. Extranet: A system that connects a number of institutions and exchange their information stored in computers.
  3 E-commerce: The transactions carried out using the internet is called e-commerce which makes it possible to get work done with a minimum cost and without hardcopy documents.
  4. E-mail: A communication method that enables delivering and receiving written information in a moment.
  5. Virtual campus: A method of disseminating education electronically. This enables to provide educational facilities to large number of people with least amount of physical resources.
  6. E-banking: In this system, it is possible to engage in banking at any time of the day by using the Internet, telephone or the Electronic Teller Machines. The use of credit cards is also a popular method in electronic banking.
  7. E-medicine: It is possible to receive medical services through the Internet and therefore the Internet has expanded the opportunities for receiving medical services.

- **Globalization is…**

Globalization has been interpreted from different perspectives by various people depending on their different subject areas.

- According to sociologists globalization is a recent practical process connected to information and communication technology.
- According to Robert Gilpin, a political scientist, globalization is the growth of interdependence of national economies associated with trade, finance and micro-economic policies.
- David Harvey (1989), a geographer and another political scientist, James Middleton (1996) show that globalization shrinks the world in terms of time and space.

- According to Anthony Giddens (1991), globalization is a process that exchanges communication, knowledge and culture together. It builds connections between social phenomena and the intermediary in the process is information technology.
- Globalization builds a global culture, according to sociologist Roberson (1992). It is created by two components, namely, spatio-temporal shrinking and global perception.
- Globalization is a process that makes goods, services, money, people, information and culture flow across boundaries and according to economists it is mainly an economic process.

However, according to some intellectuals, globalization exerts positive as well as negative impacts.

- According to Samir Amin (1994) and James Pettras (1997) globalization is a capitalist global system that exploits the countries in the third world for the benefit of the capitalist countries.
- De Silva is of the view that although the global culture destroys the local cultures the very fact could be an inducement to generate a feeling about the regions.
- According to all these interpretations it is clear that globalization is a process that integrates local markets into the international market economy by removing the obstacles to foreign trade through the maximum use of technology. Also, it is a process that minimizes the gap between time and space.
- Due to the minimizing gap between time and space, the distance among the people of the world is decreasing. At the same time, in the recent past, people have been building a global perspective on the global level hazards, risks and problems
  (e.g. global warming, rising levels of oceans, climate change etc.).

A few special characteristics could be identified in the globalization process:

- Unlike in the case of colonialism or industrialization there is no decided end to globalization. It is a very complex process.
- Since it is also a cultural process it displays a cultural identity that extends beyond national borders.

- **The Impact of information technology on globalization**

The impact of information technology on globalization could be seen from the contribution of the Internet. The wide use of the Internet has made a tremendous change. In association with the changes taking place in the economic, social, cultural and political trends in the society it has been modernized within a very short period of time to suit the needs of the majority of people.

Anyone who has computer literacy can use the Internet for following purposes:

- For educational purposes, it is possible to access the websites of the universities world over and obtain their services
- It is possible to obtain information on any field of relevance; published books, research, research papers, magazines and journals, newspapers, encyclopedia, and library facilities are among them.
- Possibility of obtaining facilities like free and charged software, advice, computer encyclopedia.
- Possibility of selling goods and services, advertizing commercials and prepare market research programs
- Possibility of facilitating management and administrative affairs in order to arrive at correct decisions
- The use of information technology in state affairs will make it possible to channel more benefits to the people.
- Possibility of enjoying programs like movies, cartoons, friends' clubs etc.
- In addition to the Internet, it is possible to obtain and disseminate information through Geographic Infformation Systems (GIS) and Global Positioning System (GPS).

Information technology has been utilized to sustain and improve the global economic, social and cultural processes in the following ways:

Economic globalization

- With the introduction of the liberal economic system many changes have taken place. Exchange of capital, movement of production of goods, share markets and labor markets beyond national levels, the disappearing of the single country ownership of the production of goods and services, emergence of component assembly industries (for example. in computer industry, USA produces one component while others are being made in countries like Japan and Malaysia) are some of these changes.
- The emergence of a borderless financial system

Political globalization

- Since information communication media unravel the political problems within a country world over in a moment, it has been possible for the international community to influence that country. In that way it is possible to protect human and fundamental rights of the people.

Environmental globalization

At present, a global perspective on environmental problems has been formed. On one hand, a global understanding has been created about the damage done to the environment by the developed nations (e.g. climate change). On the other hand, the technology needed to mitigate the effects of such disasters could be exchanged thanks to the information technology, e.g. when a country is struck by a Tsunami others countries could be warned to take necessary measures in a moment.

Problems involved with Information technology

Although it has been made possible to centralize the world around a particular location, this has created problems to both developed and developing countries alike.

- Damages occurring to coordinating systems due computer viruses
- Program piracy and illegal entry to confidential websites
- Financial frauds taking place through the Internet
- Dissemination and retrieval of phonographic publications, advertisements, photographs, movies through the Internet
- Something that is legal and ethical in one country may be unacceptable in another country although the Internet disseminate them
- Although information technology is a media owned by the commons it has been dominated by the powerful nations. Since they manipulate it according to their needs, the preparation of news, use of language etc. have paved way to social anomalies.
- Since the dissemination of information so quick due to spatio-temporal shrinking of the world even an incorrect information will be spread in no time.
- The information technology has been widely used for terrorist activities.

Teaching and Learning Activities

Activity - 1

Critically examine the how the information technology has affected the globalization.

Activity - 2

- This is a group activity.
- Conduct a class discussion on the impact of information technology on globalization based on the following lines:
  - economic aspects
  - political aspects
  - social and cultural aspects, and
  - environmental aspects

Competency - 13

Examines the contribution of the information technology to socio-economic transformation of Sri Lanka

Competency Level 13.1 **comparatively analyzes the impact of information technology on the social and economic transformation of Sri Lanka** (10 periods)

Learning Outcomes

- explains the need of information technology for socio-economic transformation in Sri Lanka
- Comparatively shows the appropriateness of information technology in the formulation of political policies
- Analyzes the significance of information technology in agriculture in the economic development process of Sri Lanka
- Explains the contribution of information technology in meeting the challenges of industrial development in Sri Lanka
- Analyze how information technology could be used to maintain a productive service sector in Sri Lanka

Introduction

In the 21st century the world was introduced to a new era by the information technology. In the face of globalization no country can act alone. New knowledge is exploding every moment and disseminates world over. As such, it has become imperative that countries are paying attention to information technology in their development attempts. In this unit, the contribution of information technology to the economic and social development in Sri Lanka and problems faced will be discussed from a geographical perspective.

A Helping hand to comprehend the subject matter

- In the 21st century the information technology has directed world to a new path.
- In combination, the telephone, computer and other information communication media have transformed the world into a global village.

- Many technologically developed countries have realized their objectives efficiently and productively by utilizing information technology in their production, marketing and service sectors.
- It is important to know the current need as well as the associated problems in using the information technology in the socio-economic transformation of Sri Lanka

The impact of information technology in the socio-economic transformation of Sri Lanka could be summarized under following sectors:

The economic sector and information technology

Although there is a great potential to use information technology in agricultural development in Sri Lanka the present level of application is minimal.

- deriving knowledge through the internet for cultivation of various crops
- Exchange of knowledge between farmers, businessmen and service providers; e.g., market prices, research findings, new discoveries etc.
- derive weather and climate data relevant to agriculture
- Use of Geographical Information Systems (GIS) by various institutions both public and private related to agriculture for conservation and management of agricultural resources; in addition, in addition, the use of Global Positioning System (GPS), an important instrument in the information communication technology.
- Especially, the companies that produce fertilizer, pesticides and other agricultural inputs have extensively used information communication technology. Also, in the production of seeds, agricultural chemicals, disease- free crops and testing of seeds inside laboratories according to international standards, in the conservation of veterinary resources, production agricultural machinery and dissemination of agricultural information the information technology communication technology is used (in the case of Sri Lanka, the companies like Baur, Haleys and Browns are in the forefront)

The industrial sector in Sri Lanka relative to other sectors is in the forefront in the use of information communication technology.

- The state and private sectors in the production of agro-based industrial raw materials widely use information technology. Tire and Tube and Sugar production are examples.
- The apparel industry, a widely dispersed industry in Sri Lanka uses information communication technology at a larger scale to derive information on latest styles and fashions, modern technology and equipment, raw materials, new markets and pricing.

It is also indicated that the use of information communication technology in the industrial sector of Sri Lanka has been increasing.

In the **service sector**, too, a similar situation could be observed.

- Banks: in monetary transactions, money changing, cheque exchange, calculation of interest rates etc.
- Industries: in planning, production, quality control and packaging etc.
- Printing: in planning and printing
- It has been possible to do planning and maintenance correctly in the service sector by using information communication.
- However, compared to other countries Sri Lanka has used information communication technology for social transformation only limitedly.
- Many of the technologically developed countries in the present world have connected the field information with the technical components for the benefit of the service providers.
- Now, it is not necessary to meet service providers and service recipients in person but connecting themselves into computer networks the recipients could realize their requirements from any region or country at any time.

Following are some examples:
- Banking services: Money transactions
- Education: through the Internet it is possible to follow various study programs, sit examinations etc.
- Health: through telemedicine diagnosis and treatment have become possible
- Transport: the networking of air, sea and land transport systems can be done easily.

Politics and Information technology
- A policy framework has been formulated to implement the information technology within Sri Lanka. It is known as E-Sri Lanka. The main objective is to centralize the global knowledge in order to implement the national development programs successfully.
- In Sri Lanka, various public and private departments use information technology to prepare, implement and evaluate the administrative affairs.
- Information technology has been widely used in national security also. For example, the Global Positioning System has been utilized to prepare accurate maps of war areas and to derive information from those areas immediately.
- The politicians are utilizing information technology to publicize their election programs through the Internet. Information technology is being used by the political parties to make people aware of their programs, of other parties and of the political situation of the country.

Use of Information technology in cultural and social sectors

- It is the social and cultural sector that has been affected mostly by the information technology
- The higher level of use of information technology in urban areas compared to rural areas has contributed their higher levels. Relative to rural areas the use of computer networks, mobile phones and other components in urban areas has increased.
- Religious activities, language, leisure and recreation, sports, aesthetic activities, architecture, astrology, clothing, food and beverages and social etiquettes have been subject to various changes due to information technology.
- Languages have been broadened, new words and usages have been added and various software and websites containing encyclopedias, dictionaries and short messages have been made available.
- Television programs, computer games, movies and documentaries have been produced for leisure and recreation. These programs exert a tremendous effect on the social life.
- In the aesthetic field, a range of audio visual equipment has been produced and a progress can be observed in the field of performing arts, too.
- Software for study programs in the websites on clothing and fashions have been produced. A range of new equipment is being used in this field.
- The technologies used for making people aware of natural and other disasters and to disseminate and make available the facilities to derive such information on them quickly have been developing steadily.
- Also, with the use of information communication technology the society has modernized in many ways. It has also been possible to obtain more benefits with least amount of time, labor and cost.
- At present, information communication technology is being widely used to build inter-personal connections and create a broader understanding among the people on cultural and social heritages.
- The television and the Internet have been responsible for making salient changes in the Sri Lankan social environment and they have directly contributed to the progress as well as deterioration of the society.
- The information communication technology has directly contributed to the deterioration of Sri Lankan cultural values and therefore in the application of ICT in the cultural sector special care has to be observed by all parties involved.

Teaching and Learning Activities

Activity - 1

Analyze comparatively under following headings how information communication technology has affected the social and economic transformation in Sri Lanka.

- Economic sector
- Political sector
- Cultural and social sectors

Competency - 14

Contributes to strengthen the national economy by examining the role of multinational corporations in international trade

Competency Level 14.1: **Comparatively examines the impact of multinational corporations on international trade** (10 periods).

Learning Outcomes

- describes what is international trade
- describes what are multinational corporations and presents facts on them
- describes how multinational corporations participate in international trade
- Clarifies how important role is played by multinational corporations and international trade in the investment of capital, transfer of technology, resource use and management process.

Introduction

The trade transactions taking place between countries is known as international trade. The international trade occupies an important place in the world economic process.

The large scale companies that operate their business activities through branches or affiliated institutions located in one or more foreign countries are known as multinational corporations.

At present, the multinational corporations account for over 50 per cent of the value of international trade. As such, multinational corporations have the ability to control the world economy. They play an important role in the world economy in the areas like investment of capital, manipulation of technology, resource extraction and management.

To engage in an analytical study of international trade, its functions, the role played by multinational corporations and their activities in international trade are the objectives of teaching this unit.

A Helping hand to comprehend the subject matter

International trade and its functions

- Every country in the world is somehow connected with international trade. The reason behind it is that countries need to exchange their products.
- International trade is operated not only between nations but also between various organizations and institutions.
- Earlier, international trade took place as a bi-lateral activity.
- By the decade of 1970 multinational corporations acquired the position of a dominant decision-maker in international trade.
- In the post-1980 period, the participation of various sectors in the international trade could be observed. In this regard the regional organizations trade organization are important.
- There are instances that international trade is being used as a weapon to solve political issues between countries and different political groups. The imposition of trade embargoes is an example.
- International trade exerts an influence on the development process of the countries in the world and it shows the development disparities in various countries.
- About 70 per cent of the international trade is concentrated in the developed world.

Multinational corporations

- During the decade 1950-1960, the large companies in the United States of America established their business activities in the European countries. Later, the companies in Europe and Japan followed the United States and started locating their business activities in other countries. This could be considered as the beginning of the spread of multinational corporations.
- At present, about 600 multinational corporations are operating in the world. Of them, nearly 300 are in the United States of America. About 160 belong to Japan and another 60 is owned by the companies in the United Kingdom. The remaining companies belong tot the companies in other developed countries (Encarta Encyclopedia, 2008).
- These companies make investments in other countries directly, a system known as Foreign Direct Investments (FDI).
- The impact of multinational corporations on local entrepreneurs is considerable.
- The local entrepreneurs find it difficult to compete with the advertising network and various strategies adopted by the multinational corporations. This results in weakening of the local business.
- Monsanto (USA), Unilever (UK) Merck (UK) Glaxo (UK) ICI (UK), Mitsui (Japan) Bayer (Germany), Shell (UK/Netherlands) Cargills (USA) are some of the laeading multinational corporations of the world.

Capital Investment

- The developing countries lack capital for investment due to their low incomes. This situation could be attributed to the unfavorable terms of trade which in turn could be attributed to the dependence of their economies on exports of primary products and to the fact that international trade is controlled by multinational corporations.
- As such, the developing countries are relying on foreign investments for economic development.
- Since the cost of production is low in developing countries the multinational corporations tend to invest in those countries.
- Developing countries are adopting various measures like opening or liberalizing their economies, relaxation of labor laws, relaxation of tax policies and provision of infrastructure facilities with a view to widen the opportunities for foreign investments.
- However, the direct returns of foreign investments are enjoyed by the companies that invest. Nevertheless, the developing countries due to the financial problems they encounter have been forced to rely on foreign investments in their economic developing process.
- At present, multinational corporations have invested their capital largely in China, and countries in Southeast Asia like Malaysia, Singapore, Thailand, South Korea and Taiwan and in Latin American countries like Brazil and Mexico.
- A recent trend in multinational corporations has been that countries like China and Malaysia while trying to attract foreign investments to their countries they themselves invest in other countries.
- The returns that enjoy by the countries that attract foreign investments include the creation of employment opportunities, receipt of training opportunities and development of infrastructure facilities.
- China, Malaysia and Singapore are among the countries that developed their economies through widening of foreign investments in their countries.
- The foreign capital investments have largely contributed to make China a major producer of computers and Malaysia a major producer of radios in the world.

Transfer of technology

- Technological knowledge and technical skills play a major role in the development of a country. Lack of advanced technology is a problem similar to lack of capital.
- One of the objectives in attracting foreign capital investments into a country has been the development of technological skills through transfer of technology.
- However, it is doubtful that capital investments by multinational corporations alone would make technology transfers.
- In many manufacturing industries the technology transfer takes place only limitedly due to labor specialization approaches adopted. As such, there wouldn't be full improvement in labor skills as expected.

- Due to labor specialization a full transfer of technology will not take place implying that there are limitations to technology transfer.
- Nevertheless, there are instances that multinational corporations providing training workshops, overseas scholarships and management training opportunities for their employees.
- An added advantage is the possibility of obtaining technical equipment and production techniques that are not available in the country.

Extraction of Resources

- The harnessing of natural resources of the earth for the use of humankind is known as extraction of resources.
- The developing countries lack money and technology to invest in most resource extraction activities. As such they have been compelled to turn to developed countries is resource extraction activities.
- There are multinational corporations that engage only in resource extraction activities. The companies that engage in the extraction of copper and gold in African countries are examples. Taking away of these extracted resources instead of using them for local productions is a problem.
- In the extraction of resources no attention is paid to their sustainability and, in some instances, they are over-extracted.
- Some countries extract resources of developing countries as a strategy of preserving their resources at home for future consumption.
- The extraction of non-renewable resources and resources that takes a long time for regeneration has become a problem.
- The multinational corporations using the resources of developing countries subsequently obtain patent rights for them. This has become a problem for developing countries because it has precluded them using those resources for their own production purposes at a later stage.
- The piracy of bio-resources is a problem associated with resource extraction.

Management

- Management is a significant factor in international trade; in areas like markets, trade policies, resources, labor and finance management play an important role.
- One management strategy is the setting up of trade organizations at international or regional levels.
- Training of managers to suit the global economy and the establishment management schools for training have been very important.
- Having a management system to identify various aspects of development is also important.

- Policy management in areas like opening of the economy and its control is another important aspect.
- Management training has been significant in the adjustment of national policies to facilitate working with multinational corporations.

References

Encarta Encyclopedia (2008).

Teaching and Learning Activities

Activity - 1

Instruct to prepare a file containing information on the following themes:

introduction to international trade, its initial nature, participants, role of multinational corporations in international trade.

Activity - 2

Provide instructions for an individual assignment under the theme 'activities of multinational corporations and the developing countries'

Competency - 15

Examining the role of regional organizations tends to regional cooperation

Competency level 15.1: Examines the functions of selected regional organizations

(10 periods)

Learning outcomes

- states the names of the member countries of selected regional organizations
- map the member countries of selected regional organizations
- identifies the functions of various organizations
- examining the functions of various regional organizations create attitudes about their identities

Introduction

The states of the world maintain relations with other organizations for their various needs and they are known as international relations. At the same time, every country in the world are particular about the freedom, sovereignty and security of their countries. Also, the political and socio-economic policies implemented by one country may not be compatible with that of another country. Nevertheless, no country can function in isolation. The cooperation of nations for various objectives can be viewed as a highest level of international relations. In the meantime, international organizations have been established to maintain the interdependence of the countries of the world in a more protective manner.

The institutions comprising two or more member countries operating with a view to facilitating their reciprocal cooperation and social, economic and cultural affairs are known as international organizations.

These organizations have been established at global level as well as in accordance with geographical regions. United Nations is world's prime international organization that operates at global level.

A characteristic of a regional organization is that it has been based on a particular geographic region. In some instances, however, even the countries outside that geographic region are members of that organization. At present, regional organizations have been established representing all geographic regions of the world.

The objective of this unit is to study some of the regional organizations, namely, South Asian Association for Regional Cooperation (SAARC), Association of Southeast Asian Nations (ASEAN), European Union (EU), the North American Free Trade Agreement (NAFTA) and Economic Commission for Africa (ECA)..

A Helping hand to comprehend the subject matter

South Asian Association for Regional Cooperation (SAARC)

- The idea of establishing an organization for regional cooperation was first mooted by Late Zia Ur Rahman, the then President of Bangladesh.
- In July 1983, the foreign secretaries of the region who met in New Delhi declared a plan that contained nine areas that were agreed for mutual for cooperation. This is known as the Delhi Declaration.
- Agriculture, rural development, communication, meteorology, health and population activities, transport, postal affairs, science and technology, sports, art an culture were those nine areas.
- The South Asian Association for Regional Cooperation was officially inaugurated in Dhaka, Bangladesh on 8th December, 1985.
- The conference was attended by Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka.
- At present there are 8 member countries. They are,
    1. Afghanistan
    2. Bangladesh
    3. Bhutan
    4. India
    5. The Maldives
    6. Nepal
    7. Pakistan, an
    8. Sri Lanka

  Afghanistan joined the Association on 3rd April, 2007.

The objectives and function of SAARC

- Eradication of poverty of the people of South Asia through improvement welfare and living standards.
- Establishment of a SAARC agricultural centre and food stock in Bangladesh to maintain food security
- Agreement among leaders of the member states on prevention of terrorism and implementation of such agreements.
- Ensure cooperation and disburse financial and material aid through Japan SAARC Overseas Fund and South Asian Development Fund with a view to promote economic development and solve health problems.
- Minimize problems associated with trade and in order to promote trade among the member countries to adopt following measures:
  - implementation of South Asian Preferential Trade Agreement (SAFTA)
  - establishment of South Asian Free Trade Area (SAFTA)
- SAFTA is implemented along four basic lines:
  1. Making concessions to each member country taking account of their economic and industrial standard, tax structure and the pattern of foreign trade.
  2. To take necessary steps based on the monitoring of the stage by stage implementation of the agreement
  3. Agreement on preferential methods to deal with the needs of the member countries with very low level of development
  4. Making the agreement applicable to all raw material, finished products and semi-finished products of the member countries
- The most significant aspect of this agreement is the provision of tax concessions in the marketing of products of the member countries.
- SAFTA will, to some extent, be of help in meeting the challenges encountered by the South Asian countries in trade.

The Association of South East Asian Nations (ASEAN)

- ASEAN was established on 8th August, 1967 in Bangkok, Thailand with the participation five countries.
- Indonesia, Malaysia, the Philippines, Singapore and Thailand were pioneer member countries of this organization.
- Later, Brunei, Vietnam, Laos, Miyanmar and Cambodia joined the organization. Now, the total number of member countries is 10.

Objectives and functions of ASEAN

- ensure peace and stability in the region
- implement an integrated economic system based on cooperation in the member countries
- development of collaborative research with mutual participation
- while engaging in trading activities among member countries develop ways and means to face the problems encountered in international trade
- obtain aid from New Zealand for animal husbandry and forestry projects to build food security
- obtain aid from Canada for development of fisheries
- establishment of disaster communication centres in selected Southeast Asian countries to face natural disasters
- establishment of ASEAN science and technology committees
- implementation of concessionary tax policies to meet the challenges in trade

European Union

- European Union is an economic and political institution with 27 member countries.
- European Union was established under an agreement known as Maastricht Treaty on 1st November, 1993.
- There were 6 founding members of the Union. They were, Belgium, France, former West Germany, Italy, Luxemburg and the Netherlands.
- At present, there are 27 members. They are,

Austria	Germany	the Netherlands
Belgium	Greece	Poland
Bulgaria	Hungary	Portugal
Cyprus	Ireland	Romania
Czech Republic	Italy	Slovakia
Denmark	Latvia	Slovenia
Estonia	Lithuania	Spain
Finland	Luxemburg	Sweden
France	Malta	United Kingdom

- The administration system within the European Union is a hybrid of supra nationalism and inter-governmentalism.

Objectives and functions of the European Union

- the primary objective was to bring all people of the member countries under a unitary goods and services and capital market.
- Accordingly, the trade, agriculture, fisheries, regional development etc function under common policies.
- introduction of a single currency, i.e. Euro, to member countries of the Union
- At present, 16 countries of the Union use Euro and they together are known as the Euro Zone

In the introduction of Euro there were four basic objectives:

- Make the exchange of goods between countries of the Union easy and elimination of losses that occur in exchanging individual currencies between the member countries
- elimination of currency risks of the member countries and thereby encourage investments
- prepare background for an united Europe and an united European economy
- introduction of a strong alternative currency to the American Dollar and stabilize the Euro in place of dollar
- Make population mobility within the Union easy and thereby provide opportunities for labor migration
- intervention to avoid financial problems in the developing countries
- act to secure human rights

United Nations Economic Commission for Africa (ECA)

- The United Nations Economic Commission for Africa was established in 1958 as one of the five regional economic commissions of the United Nations Economic and Social Council (ECOSOC)
- Assistance to economic and social development of member countries, improvement of inter-regional unity and development of international cooperation in order to develop African countries were the basic objectives of establishing ECA.
- In order to realize its objectives and targets the ECA has made plans to implement its action plan under two mutually inclusive themes:
  - enhance the vision and priorities of ECA through regional inter-cooperation
  - identify the special needs of African countries and global challenges emerging from them
- In order to realize its objectives along the above mentioned two basic themes the ECA has adopted few measures.
- One of them is to take necessary steps to improve regional interrelationships on trade and infrastructure facilities
- Another one is to use of information communication technology and science and technology for development.
- Take necessary steps to improve good governance in each country and promote mutual cooperation is another.

- Another measure is to take steps to eradicate poverty in member countries and promote sustainability.
- With a view to implementing these measures more effectively ECA has established 5 regional offices.
- ECA has taken steps to extend a few modernized services under following lines for the development of member countries:
    - Policy analysis and advisory services
    - Participatory development
    - Technical assistance
    - Communication and exchange of knowledge
    - assist in regional activities
    - establishment of regional economic associations

Member countries of ECA

Botswana	Mauritania	Sierra Leone
Cameroon	Gambia	Morocco
Egypt	Gambia	Democratic Republic of
Eritrea	Algeria	Congo
Ethiopia	Angola	Guinea Bissau
Ghana	Benin	Senegal
Kenya	Burkina Faso	Chad
Gabon	Burundi	Togo
Libya	Cape Verde	Lesotho
Malawi	Comoros	Liberia
Mauritius	Zimbabwe	Madagascar
Sao Tome and Principe	Guinea	Mozambique
Uganda	Equatorial Guinea	Zambia
Namibia	Tanzania	Tunisia
Nigeria	Rwanda	Central African Republic
Seychelles	Mali	Swaziland
Somalia	Republic of Congo	Sudan
Côte d'Ivoire	South Africa	

North American Free Trade Agreement (NAFTA)

- The North American Free Trade Agreement is an agreement signed by the governments of the United States of America, Canada and Mexico creating a trilateral trade bloc in North America.
- This trade agreement came into force on January 1, 1994
- It superseded the Canada-United States Free Trade Agreement between the United States and Canada.

- The North American Free Trade Agreement has two supplements, namely, the North American Agreement on Environmental Cooperation (NAAEC) and the North American Agreement on Labor Cooperation (NAALC).
- The main objective of NAFTA was to eliminate barriers of trade and investment between the United States, Canada and Mexico.
- In 1994, with the implementation of NAFTA tariffs on imports from Mexico to United States were eliminated by one-half and the tariffs on exports to Mexico from US were eliminated by one-third.
- Steps have been taken to eliminate all US-Mexico tariffs within ten years except for some U.S. agricultural exports to Mexico
- Most US-Canada trade takes place duty free.

References

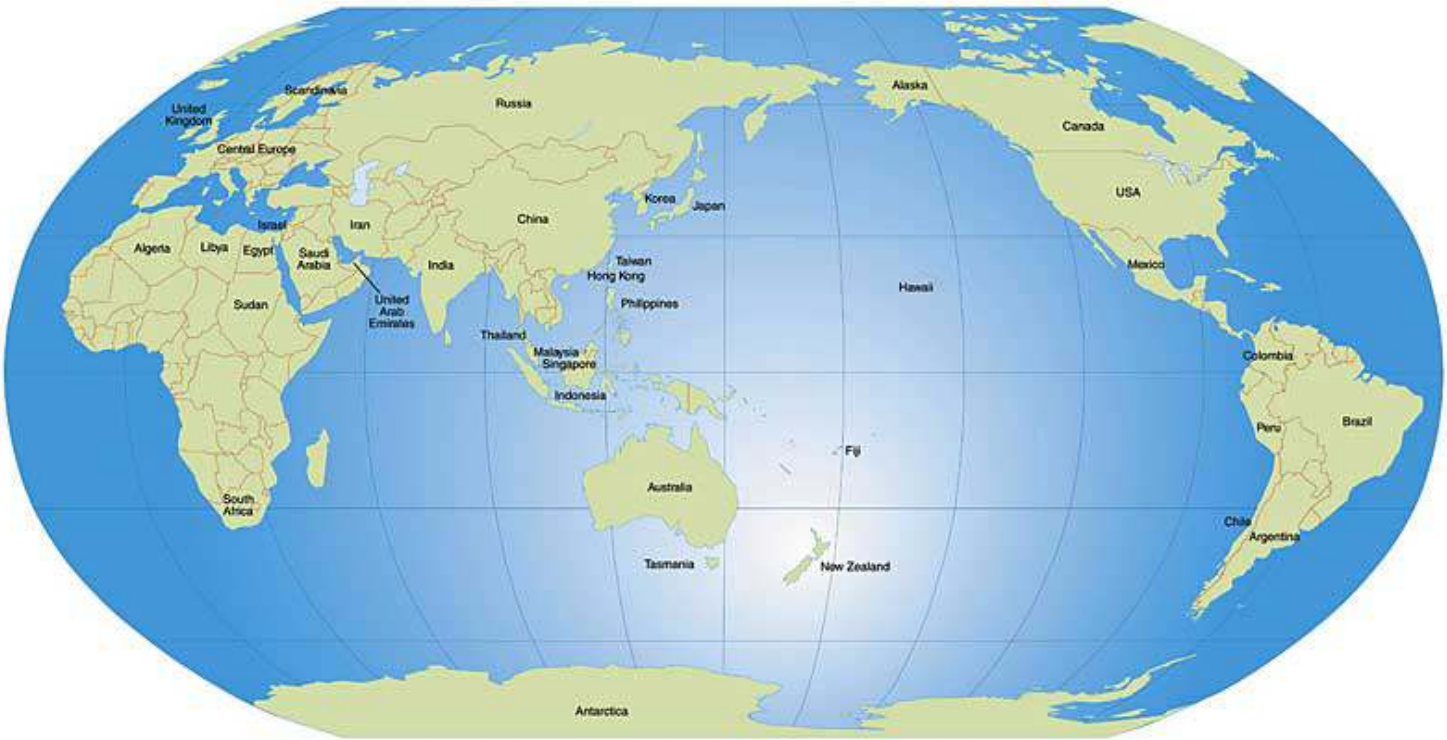
- http://www. en.wikipedia.org
- Encarta Encyclopedia, 2008.

Teaching and Learning Activities

Activity - 1

- Creation of a wall paper with information on selected regional organizations as a group assignment
- Group all students in the class in an appropriate way. Assigning 5 organizations to 5 groups would make the activity easy.
- Assign the five regional organization to five groups in a suitable manner.
- Instruct groups to include following details of the given organizations in the preparation of the wall paper:
    - Name of organization
    - Official sign and motto
    - Official flag, if any
    - Date of establishment and headquarters
    - Member countries and Map showing the headquarters
    - Structure of the organization
    - Objectives of the organization
    - Details on Conferences
    - Other information
- Provide guidance and advice.
- Conduct an outcome-based evaluation.

Geography III
Practical Geography



Competency - 04
Uses statistics and Graphical Methods in analyzing, Interpreting and presenting data and Information

(Number of Periods 10)

Competency Level 4.1 Examines data sources

Learning outcomes

- Defines data
- Explains Spatial Characteristics of data
- Classifies data
- Explains the importance of data generation and tabulation
- Identifies and explains different methods of data storing
- Identifies different methods of presentation of data

Introduction

It is clear that in Geography statistical data are used to present different Information. Information is of different forms such as temperature, rainfall, water capacity, population, agriculture, production etc. With the help of these, geographical conclusions are drawn about the man and the environment after regeneration of different data. In particular, data that are used in Geography represent special and timely distribution.

With modern technological development, many sorts of novel methods of data collection and storing have been discovered. Moreover, the use of computer has facilitated and rapidly developed tasks of data storing, tabulation and classification.

This section focuses on identifying various types of data used in Geography and different methods of presenting the identified data.

A guide to identify with the subject matter

Identification of data

Definition

- A collection of quantitative or qualitative information is called "data".
- When information is statistically presented, they are called statistical/numerical data.
- With the development of technology, use of data in various fields is rapidly spreading.

Special characteristics of data

- Data are qualitative or quantitative.
- Data can be analyzed.
- Data can be easily stored.
- These stored data can be easily received.
- Tendencies can be presented using timely data
- Prominent fact about the data used in geography is their special and timely distribution.

Types of data

Data can be categorized differently.

- Qualitative data.
- Quantitative data.
- Primary and secondary data.
- Organized and disorganized data.
- Grouped and ungrouped data.
- Continuous and discrete data.

Data bank

- Data can be stored.
- Data can be easily received in need.
- Mediums of data storing;

  Compact discs
  Internet
  Computers
  Books

Data generation

- Introduction to data generation
- Need of data generation
- Methods of data generation

Classification and tabulation of data

- Collection of gathered data does not provide a meaningful idea.
- Conclusions can be drawn after analyzing properly organizing data.
- Data are tabulated in order to organize them properly.
- Data are classified in different ways according to the necessity.

Presentation of data

- Various methods can be used to understand the facts revealed by data easily.
- For that, maps, figures, graphs etc, can be used.

Learning Teaching Activities

Activity - 1

- Collect appropriate statistical/ numerical data, which make identification of following types of data possible.
    1) Quantitative data
       Qualitative data
    2) Primary data
       Secondary data
    3) Organized data
       Disorganized data
    4) Grouped data
       Ungroup data
    5) Continuous data
       Discrete data

- Present these in a poster to understand easily.

- This can be done as an individual or group mark.

- Given below are the sources that can be used to obtain statistical data.
    1. Central bank reports.
    2. Data of the Department of Census and Statistics.
    3. Data of the Department of Meteorology.
    4. Geography textbooks.
    5. Academic articles published in newspapers, magazines etc.
    6. The internet.

Competency level 4.2 Examines methods of collecting data.

Learning outcomes

- Describes the need of collecting data in various studies.
- Explains the importance of selecting population or sample in data collecting.
- Identifies various methods of collecting data.
- Explains advantageous and disadvantageous of different methods of collecting data.
- Achieves the ability to use the most appropriate methods to collect data according to the study undertaken.

Introduction

When a geographer identifies the research problem of his/her study, s/he then moves to data collecting. In accordance with the objectives of the selected research, methods of collecting data may vary.

If the selected population for the study is large, data collecting can be expensive and difficult. In such circumstances, a sample is chosen.

In data collection, one or more methods such as measurements, discussions, questionnaires, library/computerized sources, maps, Ariel photographs, satellite images etc, can appropriately be used in the study. Here the advantageous and disadvantageous of the selected method/s should be taken in to consideration.

This section concentrates on studying the various methods of collecting data, their advantageous/disadvantageous, and the possible ways of using these methods of collecting data.

A guide to identify with the subject matter

Methods of collecting data

What is meant by a sample?

- The whole of the desired research is called 'population'.
- If population is large, 'samples' are selected to gather information.

- A sample is a finite part of a statistical population whose properties are studied to gain information about the whole.

  E.g. population.
  All the family units, which obtain "Samurdi" within a divisional secretariat.

  E.g. sample
  A selected fraction out of all the family units.

- In order to confirm that the sample represents the population aptly, sampling should be done according to a proper and scientific method.

- There are several methods of sampling.

  1. Random sample - selection of a sample randomly.

  2. Cluster sample - selection of a sample by clustering the population.

  3. Systematic sample - selection is done in a system order using records.

  4. Judgment sample - selection of the sample, which is judged as the most appropriate for the study by the researcher.

- Other than these 04 methods some other means are used at present
  E.g. quota sample used in present marketing surveys.

Observation

- Observation means the collecting data by observing information relevant to the study.

- Direct observation: information is gathered by close observation. E.g. finding the traffic patterns of a city.

- Participative observation: researcher him/herself enters the research field to gather & observe information. E.g. while gathering information about beggars; researcher him/herself acts like a beggar.

Measurements

- Measuring is used to gather certain data.

- Especially, information on whether and climate, which are very useful in Geography are obtain through measuring. E.g. temperature, rainfall, humidity etc.

- In some occasions, scales are used to gather information through questionnaires, discussions etc.

Discussions

- Data collecting is done through meeting and interviewing participants of the population/ sample.

- Here, questions should be planned beforehand to acquire correct information during the interview and selection of right people for interviewing is important.

Questionnaires

- Questionnaire survey means collecting of data through a prepared questionnaire relevant to the research.

- Questionnaires are distributed among participants and answers are obtained.

- There are two methods of distributing questionnaires among participants such as sending them and receiving answers by post or obtaining help of research assistants.

Library sources

- This method is used to collect data in published or unpublished records.

- Library sources are newspapers, magazines, records etc.

- References should be included.

Computerized sources

- This is one of the popular methods of collecting of secondary data at present.

- This facilitates the speedy obtaining of novel data.

- There is the facility to obtain and distribute data within a wide range.

- One of the most important computerized sources is the internet. Internet search engines are used to search data in the internet.

Maps, Ariel photographs, satellite images, pictures and photographs

- Above-mentioned sources are important in collecting data.

- Data regarding land use, quantity of forests, information on whether and climate, physical features etc., can be obtained by above sources.

- Information of this kind is very important to a geographer.

Learning Teaching Activities

Activity - 1

- This can be done as a group activity

- Select a topic in relation to your area to carry out a study.

- It is advised to select a simple topic on which information can easily be gathered.

- Given below are examples for some of the topics.
    1. A study on borrowing a bank loan from a rural bank.
    2. A study on problems confronted by small-scale businesspersons in a particular region.
    3. Land use for cultivation in a particular region.
    4. Daily attendance of school students.
    5. Different transportation methods used by school students.

    - Select a methods/different methods for collecting data.

    - Take necessary steps for data collecting.

    - Draw conclusions by regenerating data.

    - Prepare a record including conclusions.

Competency level 4.3 Analyses and interprets data

Learning outcomes

- Explains how a meaningful idea can be presented through organized data.
- Identifies simple means of organizing and tabulation of data.
- Uses dispersion and central tendency to interpret data.
- Expresses the importance of using graphs and diagrams to present data.
- Practices to select the most appropriate cartographic methods to present data according to their nature.

Introduction

To present geographical information, statistical/numerical data are frequently used. Generally, statistical data are presented through tables. Yet, most common problem in data tables is that it is difficult understand them very easily or instantly. In order to comprehend presented information, data tables have to be referred several times. Diverse methods can be used to express information presented in a numeric table in a clear and uncomplicated manner. A variety of graphs and diagrams are used for this. It has become popular to present data, which are revealed by statistics though visual media, attractively. However, it is important to consider several facts when data are presented in various methods. What should be specially concentrated here is the identification of features represented in numeric tables and selection of the most suitable graphic/ diagrammatic techniques to highlight them. As well, its accuracy and pleasantness should be taken into consideration.

The objective of this section is to educate students on the use of simple statistical techniques to comprehend data and use of graphs and diagrams for presentation of data.

A guide to identify with the subject matter

- **Data analyzing and interpretation**

Organizing data

- Row data or collection of unorganized data does not convey a meaningful idea.
- Well-organized and collection of scientifically arranged data conveys a meaningful idea. As well, an analysis can be carried out using well-organized data.
- To organize data precisely different types of data tables can be prepared.

Preparation of data tables

- Frequency distribution

Prior to discuss frequency distribution, it is useful to know about data distribution and a data array. A set of some data is known as data distribution (table 4.3.1)

E.g. Given below is the weight (kg) of 30 students in grade 12 of a school. Here, there is a collection of statistical data.

47	48	46	51	52	49
53	45	52	54	47	52
50	54	50	49	58	50
49	56	56	51	58	48
51	60	50	59	50	53

Table 4.3.1

By arranging these data on ascending or dissenting order, a data array can be prepared (table 4.3.2).

45	46	47	47	48	48	49	49	49	50
50	50	50	50	51	51	51	52	52	52
53	53	54	54	56	56	58	58	59	60

Table 4.3.2

Frequency distribution is to see the frequency or count of the occurrence of data arranged in descending / ascending order. Depending on their distribution, these data can be categorized into two groups, such as grouped or ungrouped data.

Ungrouped frequency distribution

The table that contains the count of the occurrence of data within a data collection is called the ungrouped frequency distribution of that particular collection of data.

When the weights of the grade 12 students are arranged according to ungrouped frequency distribution, it can be tabulated as follows (table 4.3.3).

Variable (x)	Frequency (f)
45	1
46	1
47	2
48	2
49	3
50	5
51	3
52	3
53	2
54	2
56	2
58	2
59	1
60	1
Total	30

Table 4.3.3

Grouped frequency distribution

When there is a large number of data in an ungrouped frequency distribution, those data are sorted into class intervals and the frequency data belonging to each class interval is recorded in a frequency table (table 4.3.4).

Class intervals Weight (kg)	Tally	Frequency (f)
45-47	𝍸	04
48-50	𝍸 𝍸	10
51-53	𝍸 111	08
54-56	1111	04
57-59	111	03
60-62	1	01
	Total	30

Table 4.3.4

Cumulative frequency distribution

Cumulative frequency distribution is obtained by adding the frequency of a class interval and the frequencies of the preceding intervals up to that class interval. This is explained in the table 4.3.5

Class intervals	Frequency (f)	Cumulative frequency
45-47	04	04
48-50	10	14
51-53	08	22
54-56	04	26
57-59	03	29
60-62	01	30

Table 4.3.5

Central tendency

- Central tendency is values that show a summarized idea of a data array.

- Central tendency is measured using;
    - Mode
    - Mean
    - Medium

Mode

- The mode is the value that occurs most frequently in a data set.

- It is easy to find the mode in grouped data. Here, the mid-value of the class interval, which shows the maximum frequency in the frequency distribution, is considered the mode.

- In some data distributions, there can be several modes.

- In such cases, the mode is considered a weaker measure to indicate the central tendency.

Mean

- This is considered the most apt method to find the central tendency.

- This is also known as the average in common discourse.

- For a data set, the mean is the sum of the values divided by the number of values.

- The simplest formula used to calculate mean is given below.

$$\bar{x} = \frac{\Sigma x}{n}$$

$\bar{x}$ = Mean

Σx = Sum of the values (data)

n = Number of values

- As it is difficult to calculate the mean of an ungrouped data set, those data are organized into a group to measure the mean.

- There are two formulas to measure the mean in this way.

$$\bar{x} = \frac{\Sigma fx}{n}$$

$\bar{x}$ = Mean

f = Frequency

x = Value obtained through mid- point of the class intervals multiplied by the number of frequencies

n = Number of values

- A simple formula can be used to calculate the mean.

$$\bar{x} = x_o + \frac{(\Sigma fd)c}{n}$$

$\bar{x}$ = Mean

c = Class interval

x_o = Sum of the values obtained through deviation multiplied by the frequency

Σfd = Numbers of values

- Among the above given formulas to calculate the mean,

  - The 1st formula can be used when there are a little number of values (data) and,
  - When there are a large number of values 2nd and 3rd formulas can be used.

Median

- A median is described as the numeric value separating the higher half of a data array from the lower half. Then median of a finite list of numbers can be found by arranging all the values from lowest to highest, and picking the middle one.
- If the number of values is an odd number, there is a middle value. If the number of values is an even number, the average of the middle two numbers should be measured to find the median.

The importance of mode, mean and median

- The mean represents all the data in a data set. A change in single data can results in change in the mean.

- When the mean is multiplied by the number of values, the total can be obtained. Thus, the mean gives an idea about the total.

- Even though the mean depicts the central tendency, it does not indicate any idea about the distribution of values.

- Even if the median divides the values into two halves such as higher and lower, it does not indicate any idea about the remoteness of these values.

- Even though the mode is important to get an idea about the value which occurs most frequently in a data set, its weakness is that there can be several modes in a data array.

Learning Teaching Activities

Activity -1

Given bellow are data of rainfall over 25 years from 1964-1988. These data are obtained from the Meteorological Data Center at the governmental farmhouse in Ambalangoda (Rainfall is in mm).

Year	Rainfall (mm)	Year	Rainfall (mm)
1964	737	1976	468
1965	1445	1977	781
1966	1182	1978	1059
1967	1043	1979	997
1968	885	1980	1030
1969	1454	1981	638
1970	1104	1982	1389
1971	960	1983	569
1972	990	1984	870
1973	1276	1985	955
1974	579	1986	859
1975	1452	1988	566

1. Find the mean value of the rainfall over these 25 years (For this, use the formula-1).

2. Prepare a table to find the mean value of these data using formula 2 and 3. The headings of the table should be as follows.

   - Class intervals - C
   - Mid point value - X_o
   - Frequency - f
   - Deviation - d
   - Frequency deviation - fd

3. Make suggestions while comparing the mean values of all the three formulas.

4. Find the median of these data on rainfall.

5. Find mode according to frequency.

Dispersion

The need for dispersion measurements

- Measurements of central tendency do not present any idea about the spread of data.
- As well, they do not present extreme values.
- Thus, it is important to use dispersion measurements with the mean.
- An idea about variance can be constructed though this.
- Among these, range and deviation are important.

Range

- A simple measure of dispersion.
- The variance between the highest and lowest values is the range.

Quartiles

- Distribution of data can be divided into four.
- Lower quartile Q_1 - 25%
- The second quartile Q_2 - 50% (mean)
- The third quartile Q_3 - 75%
  (Higher quartile)

Inter quartile range

- The difference between Q_3 and Q_1.
- When quartile range varies, the dispersion of data also varies.

Mean deviation

- The mean deviation is also known as the absolute deviation.
- When mean deviation has a high value, the dispersion is also high.

Standard deviation

- This is a logical measurement about dispersion.
- This is the square root of the square of deviations from the mean.
- This reveals a lot of information about a numerical mean data.

Many of the data used by a geographer are of spatial distribution. The principal objectives of geographical studies are to present variances of spatial distribution and the causes for them. As well, one of the foremost tasks of a geographer is to analyze data using various methods before presenting them.

Learning Teaching Activities

Activity - 2

- Use the record of rainfall in Ambalanthota for this activity (page number 206).

- Calculate the following in relation to that record.
    1. Range
    2. The first quartile
    3. The third quartile
    4. Inter quartile range
    5. Standard deviation

Presentation of data

- Graphs and diagrams are commonly used for presentation of data.

- The various statistical data, which are important in Geography, are presented in the above-mentioned methods.

  Climatic data: temperature, rainfall, depression, humidity

  Economic data: agriculture, industry, export, import

  Social data: population, nutrition, health, immigration, and emigration

- The advantages of presenting data by graphs and diagrams
  - A large number of data can be presented briefly.
  - Ability to present data meaningfully.
  - Ability to present the relationship between two variables easily.
  - Ability to use the most appropriate method to highlight the important ideas.

- A number of facts should be considered when data are presented through visual methods.
  - Scale
  - Indicator / index
  - Title
  - Use of colours
  - Frame
  - Data source

Histogram

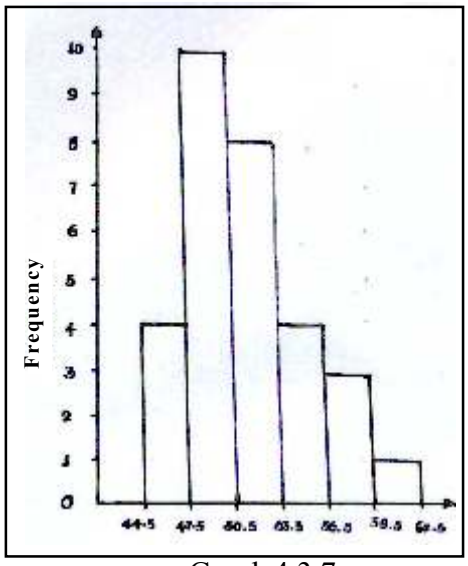
A histogram presents a distribution of grouped data through a graph. A visual analysis, which cannot be identified through a grouped frequency distribution, can easily be identified through a histogram.

- It is important to follow the following facts while drawing a histogram.
  - Frequency should be presented in the vertical axis of the graph and the variables of the class intervals of frequency distribution should be presented in the horizontal axis.

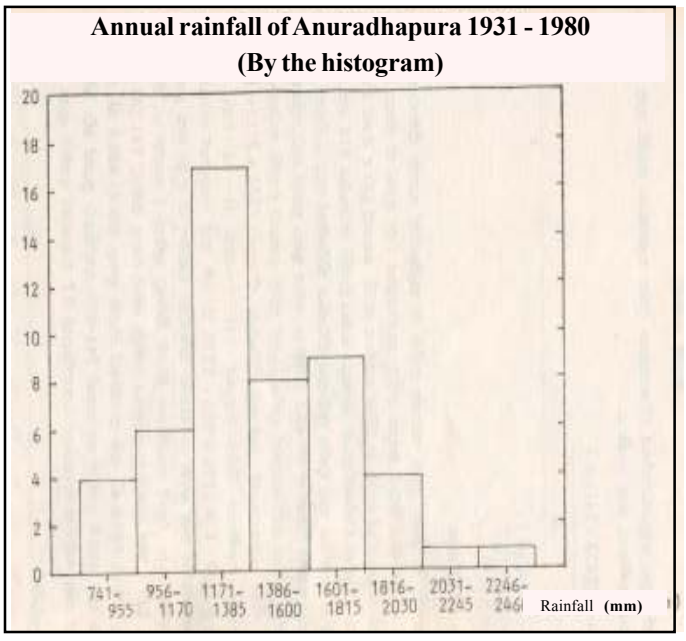
  - Determination of the lower and higher limits of the class intervals is important.
    E.g. Table 4.3.6 is prepared using grouped frequency distribution presented in the table 4.3.5 to draw the histogram.

Class intervals	Class limits	Frequency
45 - 47	44.5 - 47.5	04
48 - 50	4705 - 50.5	10
51 - 53	50.5 - 53.5	08
54 - 56	53.5 - 56.5	04
57 - 59	56.5 - 59.5	03
60 - 62	59.5 - 62.5	01

Table 4.3.6



Graph 4.3.7

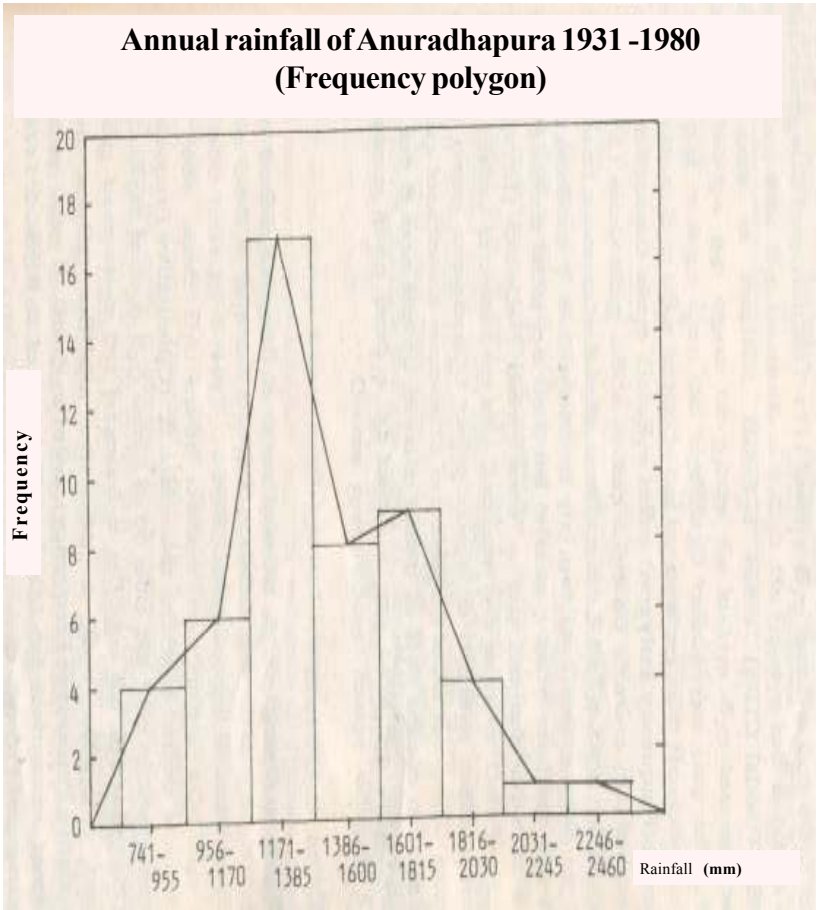


Graph 4.3.8

- The vertical axis of the histogram depicts the frequency while the horizontal axis presents data related to rainfall by class intervals.
- The histogram assists to recognize the timely variables of rainfall.

Frequency polygon

- The lines, which are drawn connecting the midpoints of the histogram, are known as the frequency polygon.
- Frequency polygon is a linear graph, which shows frequency distribution.
- Distinctive features
    - When the frequency polygon is drawn, its beginning as well as ending should be connected in horizontal angles.
    - Before the starting class and after the ending class, a half of a class should be included to this chart (interpolation).
    - The foremost use of this is the ability to compare.
- Given below is a frequency polygon drawn on the histogram, which presents the annual rainfall of Anuradhapura from 1931 -1980.



Cumulative frequency

- See the diagram about cumulative frequency, which is prepared in accordance with the grouped frequency distribution of table 4.3.5 (The frequency distribution depicting the weights of 30 students of grade 12).

Class intervals(*X*)	Frequency (*f*)	Cumulative (C*f*)	Cumulative percentage(*Cf*%)
45 - 47	04	04	13.3
48 - 50	10	14	46.6
51 - 53	08	22	73.3
54 - 56	04	26	86.6
57 - 59	03	29	96.6
60 - 62	01	30	100.0

Table 4.3.10

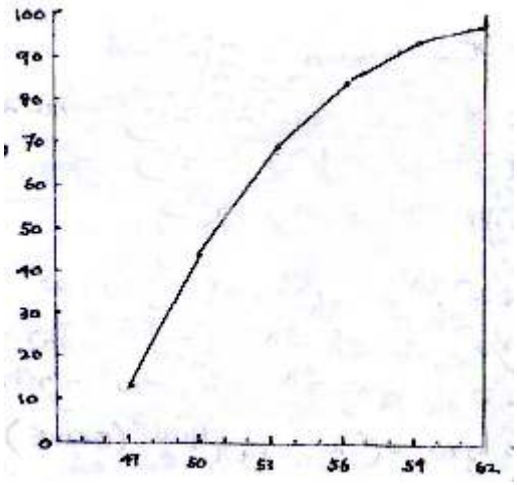
Column 01 - Class intervals
Column 02 - Number of students in each interval
Column 03 - Sum of each frequency
Column 04 - Percentage of cumulative frequency

- Thus, the cumulative frequency means the sum of each class interval. The total of its last interval is the total number of students, which is 30.

Percentage cumulative frequency

- Cumulative frequency can be stated as a percentage (4^{th} column of the table 4.3.10)
- Percentage cumulative frequency can be presented in a graph.
- This is known as the Ogive /cumulative frequency curve.
- Here, the vertical axis presents percentage cumulative frequency while the horizontal axis depicts class intervals.
- To draw the graph, points are marked vertical to the higher limits of class intervals (see the diagram).
- The most important characteristic of this graph is that the number of percentages of any value in the data range can be calculated graphically.

The Ogive of the weight of 30 students
Percentage cumulative frequency



Graph 4.3.11

Diagrams

- The graphs and diagrams used in Geography for presentation of data can simply be divided in to two as one-dimensional and two-dimensional diagrams.
- Graphs, diagrams, and maps are very important in the field of Geography.
- When distribution of statistical data is presented through a visual, the subject matter is easily understood.
- As this method is used to depict a large amount of subject matter briefly, it is easy to comprehend the subject matter.
- Ability to analyze and forecast the behavior of the variables.

Bar charts

- This is a method used to present particular collection of statistical/numerical data, by means of bars.
- There are many types of bar charts, which can be used according to the diversity of statistical facts.
- Simple, double, comparative, compound and pyramid bar charts are prominent among them.

Simple bar charts

- The vertical and horizontal axes should be established in rectangular forms.
- The width of a bar should be in appropriate size for easy understanding.
- The gaps between bars should be less in size than the bars.
- Simple bar charts can contain vertical or horizontal bars (see the graphs 4.3.12 and 4.3.13).
- To present numerical data with periods (E.g. annual rainfall) simple vertical bar charts are used.

- To present numerical data without periods (E.g. rice production in relation to districts) simple horizontal bar charts are used.

- Combining bar charts with linear graphs, one can comment comparatively about various numerical data. E.g. Joint graphs of vertical bars together with lines depicting monthly rainfall and the temperature distribution of a particular city.

Double bar charts

- Pairs of conjunctive bars are used (graphs 4.3.14).

- Data on pair base are meaningfully presented here.

  E.g. Export and import, male-female, rice production in major -minor seasons

Multi comparison bar chart

- Several joint bars are used.

- These are used to present data on cluster basis comparatively.
  E.g. Statistical data on paddy, coconut, tea and rubber production in Sri Lanka during several years.

Compound bar charts

- These are used to present compound data.

- Here, vertical or horizontal bars are drawn in accordance with integers and according to the composition of these integers, each bar is divided into blocks.

- For instance, when tea, rubber, coconut, and rice production in Sri Lanka during several years is depicted, each is shown in separate blocks of each bar (see the graph 4.3.15 and 4.3.16).

- The percentage bar chart is a category of compound bar charts.

- This is used to indicate the composition of a particular variable as a percentage (see the graph 4.3.17).

Pyramids

- These are used to illustrate the age structure and gender ratio of population of a country

- The graph takes the shape of a pyramid as population of a country decreases when it moves from younger age group to adult age group.

- These graphs are important as they illustrate a clear picture of the particular population of a country.

Learning Teaching Activities

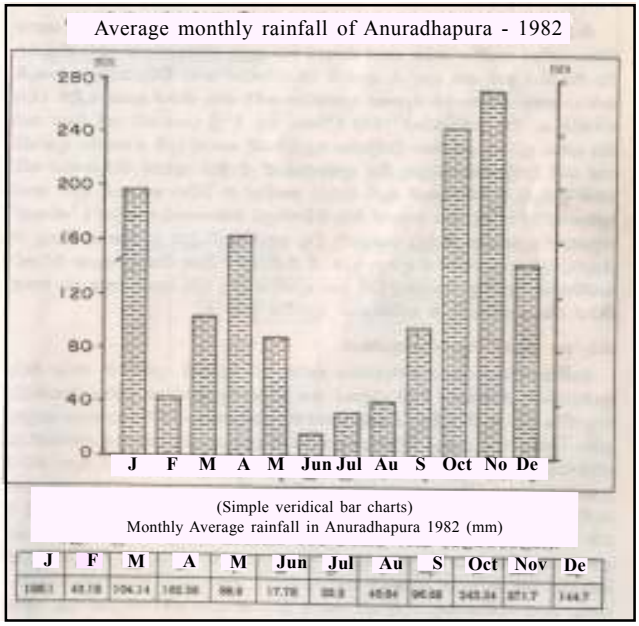
Activity - 3

Metrological Center	1997		1998		1999	
	Rainfall (mm)	Rainy days	Rainfall (mm)	Rainy days	Rainfall (mm)	Rainy days
Anuratapura	1330	114	1207	89	1193	111
Bantarawela	2010	162	1198	128	1431	152
Colombo	2530	159	2388	153	2888	174
Ambantota	1377	104	885	84	933	93
Kandy	1912	170	1596	158	1898	170
Nuwara Eliya	2028	199	1784	176	1894	194
Ratnapura	4163	215	4558	227	4381	228
Trincomalee	1618	92	1129	67	1840	93

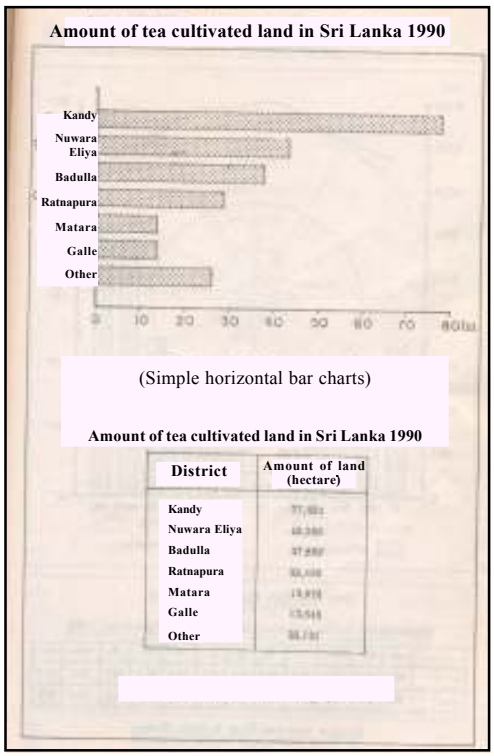
- Given above is a table, which depicts annual rainfall (mm) of some selected cities of Sri Lanka in 1997, 1998, 1999 and the number of rainy days.

- Study these numerical data and illustrate them using an appropriate graphic method.

- Prepare a record to exhibit how far the graphs that you have selected are important for presentation of data.

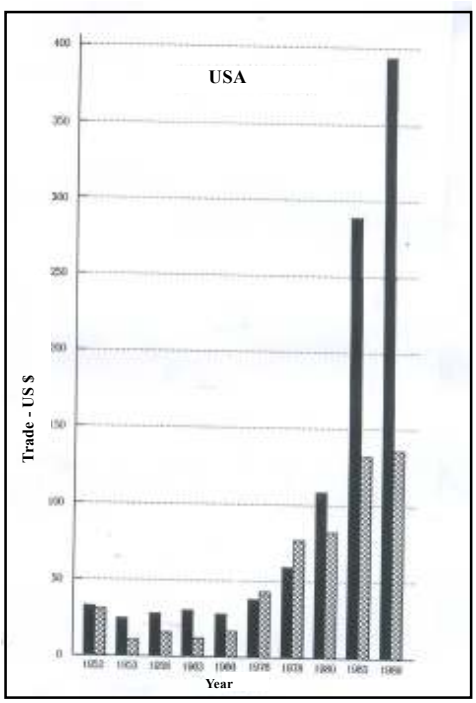


Graphs 4.3.12



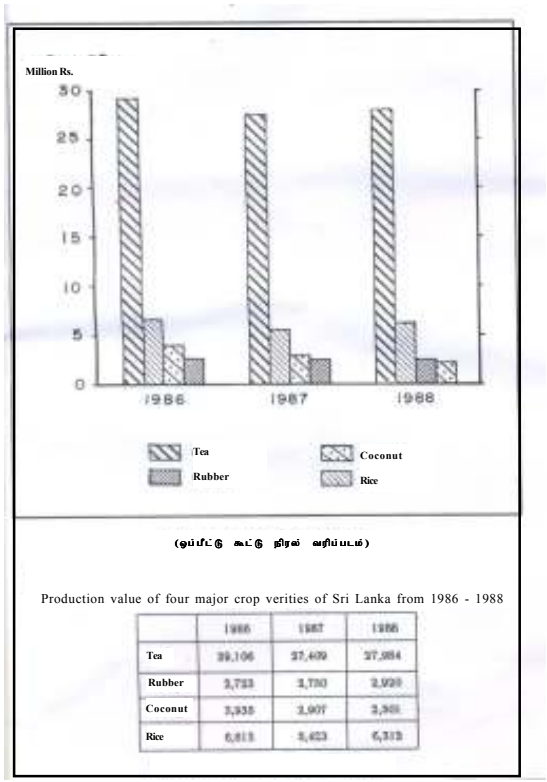
Graphs 4.3.13
Source: Central Bank Report - Sri Lanka

Foreign trade of Sri Lanka 1952-1989
(Double bar chart)



Graph 4.3.14

Production value of four major crop verities of Sri Lanka from 1986 - 1988

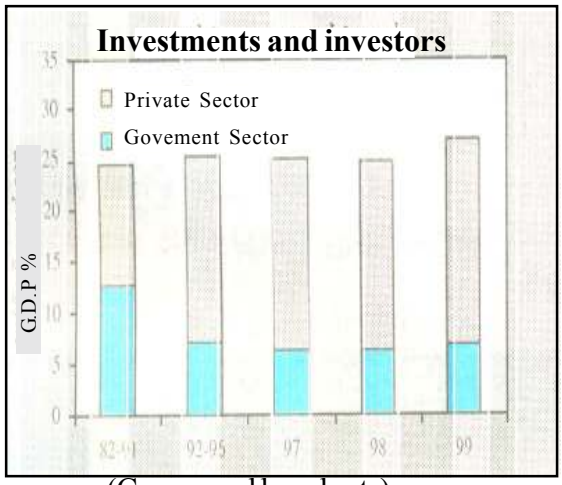


(ஒப்பீட்டு கூட்டு நிரல் வரிப்படம்)

Production value of four major crop verities of Sri Lanka from 1986 - 1988

	1986	1987	1988
Tea	39,106	27,409	27,984
Rubber	3,753	3,730	3,928
Coconut	3,935	3,907	3,901
Rice	6,813	5,423	6,313

Graphs 4.3.15

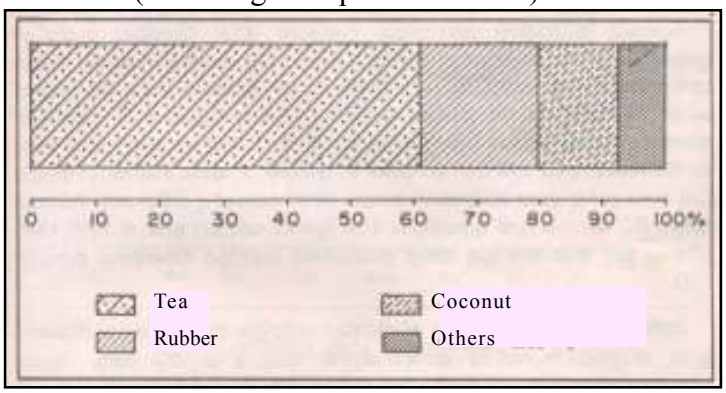


(Compound bar charts)

Graph 4.3.16

Value of agricultural exports of Sri Lanka 1989

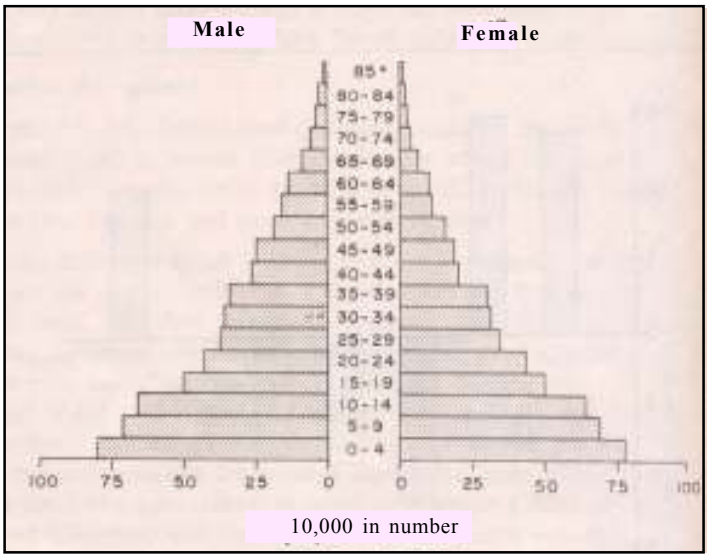
(Percentage compound bar chart)



Graph 4.3.17

Population of Sri Lanka

(Pyramid graph)



Graph 4.3.18

Wheel diagrams

- Various types of wheel diagrams can be used according to the objective of use.

- The basic type of wheel diagrams is known as pie charts (simple divided circle graphs).

Simple divided circle /pie graphs

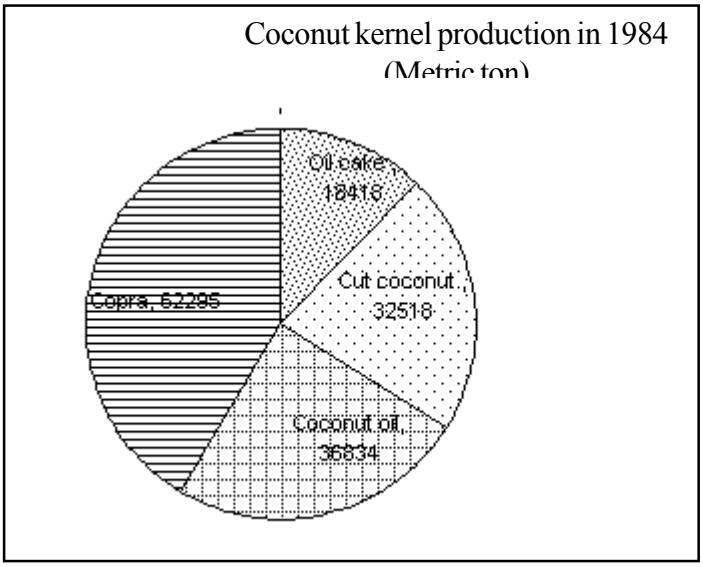
- These are used to show the composition of a numeric variable.

- These are easy to draw. The method followed here is to use a circle to show the total number and to divide it according to degrees to show the composite numbers (see the graph 4.3.19).

  E.g. To illustrate the population strata of Sri Lanka in relation to ethnicity/ religion within a particular year.

- Here, the graph should be drawn calculating the angular value of the circle according to each ethnic group and its percentage.

- Thus, several such circles can be drawn to present information of several years.



(Simple divided/ divided circles)

Linear graphs

- These are frequently used, as they are simple and easily understood.
- These are often used for simple data in Geographic Atlases.
- There are two major categories of linear graphs.
  1. Simple linear graphs
  2. Composite / multi / Comparison linear graphs

Simple linear graphs

- When this is drawn, time is shown in the horizontal scale while the vertical scale depicts values.

- The scale of the graph should be aptly chosen according to the given numbers.

- Two types of values can be shown on the two vertical axes drawn in the right and left sides of the graph. Then, it has many uses.
  E.g. indicating ^{o}C and ^{o}F in two vertical axes.

- Facts to be considered.
  1. Selection of vertical and horizontal scales
  2. Rounding off the numbers with large values into approximate numbers such as thousands, ten thousands, millions etc.
  3. If a part of the values shown in the vertical scale is to be cut off, the section between zero line and the minimum value should be constricted.
  4. Before drawing the graph, the points should be carefully placed on the graph.

Composite / multi / Comparison **linear graphs**

- These illustrate several data, which belong to a certain collection.
  E.g. monthly temperature of several places, export amount of several export crops.

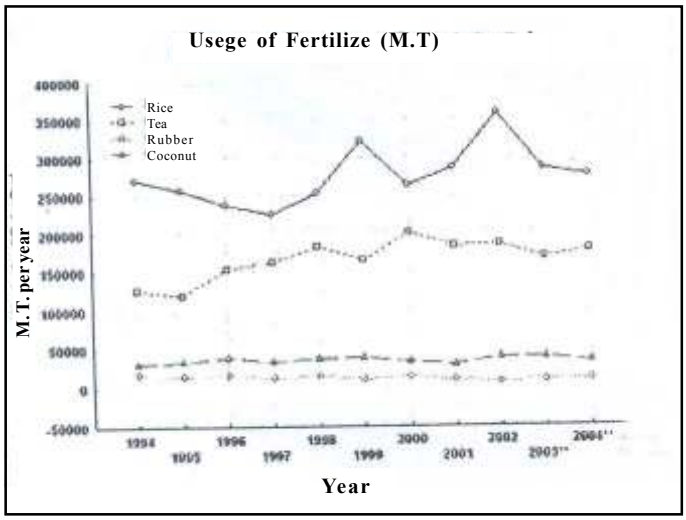
- These are drawn in the same way as the simple linear graphs (see the graph 4.3.20).

Facts to be considered.

- When scale is selected, it should agree with all the numbers/ figures.

- Different colors or symbols should be used to indicate different data.

- The number of lines included in a graph should be limited.



(Linear graph)
Graph 4.3.20

Three-dimensional diagrams

- Various three-dimensional diagrams are used to present numerical data.
- Two useful methods applied here are proportional cubes and proportional spheres.
- Principally these are presented together with maps.
- As the scale of cubes/ spheres is used for presentation of statistical data, those numbers should be organized in a geometrical order while drawing cubes/spheres
- As numbers are constricted by three-dimensional diagrams than in two-dimensional diagrams, these methods are useful to present numbers in a large range.
- Compared with two-dimensional diagrams, these are not easy to understand, calculate, or to draw.
- Above problem is minimized if entries of scale are used for accurate interpretation.
- Spheres/cubes cannot be divided into parts and drawn through telescope technique.
- Spheres are visually more attractive than cubes.

Pictorial diagrams

- Pictorial diagrams are used to illustrate the quantity of numerical data such as population, production etc.
- The foremost importance of these is that the most apt pictures can be used according to data concerned.

  E.g. pictures of human beings to represent population density, pictures of tires to represent tire production, pictures of vehicles to represent vehicles etc.

- According to the range of numbers, which are to be presented, appropriate scale should be selected.
- A part/ half of the picture is shown at the end of the pictorial diagram to indicate the definite amount of numerical data.
- This diagram method is useful in illustrating amount numerically.

Statistical maps

- These are generally used to represent numeric data of special distribution.
- Among numerical maps, isopleths maps are largely used in geographical studies.

Isopleth maps

- These maps consist of lines, which are drawn connecting the areas of equal value (graph 4.3.21).

- In many atlases, these are used to represent the distribution of physical information. E.g. contour lines, isothermal lines, isohyets, isobars, bathymetrical contours

- The following facts should be considered while drawing isopleth maps.

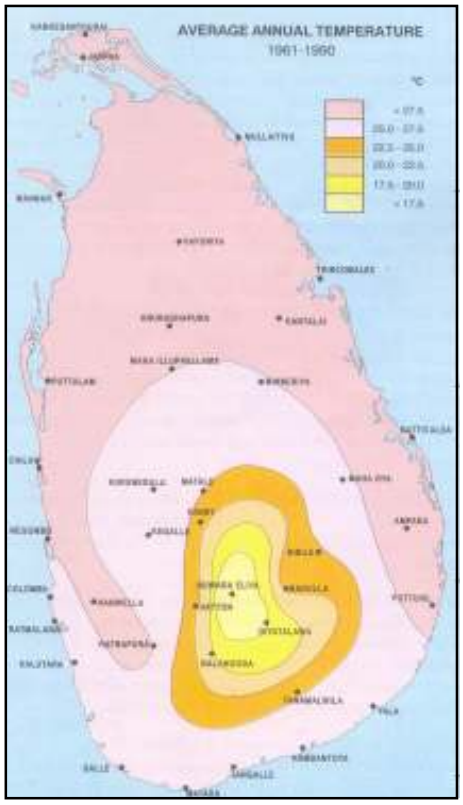
    - Isopleth lines should have equal gaps. The number of lines to be drawn should be decided depending on the range of statistical data.

    - When there is a little number of lines, interpretation is weaker, and use of a large number of lines can make the map complex.

    - Each line has a specific value. The value of the line should be depicted on it in the same colour as of the line.

    - Instead of that, the areas in between the lines can be presented in different shades of the same colour. Thus, a key should be presented.

The isopleth map



Graph 4.3.21

Leaning Teaching Activities

Activity - 4

The Zone and districts	Production		
	Main season (Maha) 1998 - 1998	Minor season (Yala)1999	Total
Wet Zone			
Colombo	14349	6825	21174
Gampaha	27842	9071	36913
Kalutara	43454	28619	72073
Galle	40443	27972	68415
Matara	46447	45409	91856
Kegalle	31823	25343	57166
Ratnapura	38791	29516	68307
Kandy	37501	29797	67298
Nuwara Eliya	11970	3650	15620
Badulla	66773	29877	96650
Dry Zone			
Kurunegala	211575	144079	355654
Puttalam	36115	18598	54713
Matale	44719	21171	65890
Monaragala	48242	19890	68132
Jaffna	14092	-	14092
Kilinochchi	4749	-	4749
Mannar	17973	1808	19781
Mullaidivu	18185	4260	22445
Vavuniya	19160	3649	22809
Anuratapura	182652	60053	244905
Polonnaruwa	231378	172694	347933
Ampara	175239	212545	443923
Batticlo	85978	46058	132036
Trincomalee	65229	42992	108221
Hambantota	83915	66490	150405

- The above given table presents the paddy production in Sri Lanka in minor and major seasons from 1998- 1999 in relation to districts.

- Prepare a brief account on presentation of these data using appropriate graphic and diagram methods.

Competency - 5

Shows correctly the spatial distribution of the physical and human components of the world

Competency level 5.1 Marks location and distribution on outline maps of the world and name them.

Leaning outcomes

- Marks the places and regions of geographical importance on outline maps of the world and names them.
- Marks and names the latitudes and longitudes shown on a model Earth Globe on an outline maps of the world.
- Marks and names major topography and climate zones of the Earth, on an outline map of the world
- Marks and names information about human activities and demography on an outline map of the world.
- Marks and names cities, rivers and oceans of ancient value on an outline map of the world.

Introduction

Human beings have made use of the physical environment in various quantities for existence, and this has occurred regionally, nationally or internationally. Geography concentrates on studying how human beings have utilized the physical environment in various ways and the consequent changes occurred in the environment.

Under the physical environment, fields such as physical features, climate, soil, vegetation, and physical resources etc., are focused while the fields such as agriculture, industry, technology, and global relationships etc., are discussed under human environment.

Further, to carry out abovementioned studies, the knowledge and awareness of their global location as well as ability to name them are very important. Owing to this kind of ability and knowledge, students are able to answer the questions at examinations using diagrams and graphs and it also helps students to achieve advanced skills. As well, knowledge about the map of the world is a timely need in their daily lives as well as in the classroom context.

Thus, it is very important that students are able mark the map of the world scientifically and this section directs students to achieve that skill. The most appropriate method to follow is to mark and name all the relevant project maps presented in these units during each learning situation. Accordingly, this section aims the development of student skills regarding map marking.

A guide to be familiar with the subject matter

When world maps are marked, places of human as well as physical activities should be marked. To minimize the complexity of such a task, the following order can be used.

Pleases of timely importance

- Regions and places prone to natural phenomena such as earthquakes, floods, and land slide.

- Regions and places where international and local summits, sports, conventions, political conflicts etc., have been occurred.

Facts related to the graticule of the model earth globe

- Important longitudes and latitudes
- International date line

Topography of the earth

- Mountains and mountain ranges, river valleys, plateaus, continents, countries, ocean abysmal, slopes, basins, coastal characteristics, interior reservoirs, currents, deserts etc.

Climate zones

- Climate zone of Keoppen's climate classification
- Natural vegetation zones

Human activities

- Regions of commercial crop cultivation
- Regions of commercial animal husbandry
- Natural resource distribution
- Regions of production industry
- Cities
- Harbour

Information related to demography

- Over populated regions
- Depopulated regions/ deserts
- Million cities

Information related to global relationships

- Zonal
- International

Principles of map marking and activities

Given below are some common principles of map marking that can be used to prevent the use of different methods.

1. Marking places
   - Cities - Specific location (coasts, in relation to rivers)
   - Islands - Apt symbols
   - Mountain tops - Apt colours - red/ black/ brown

2. Marking the expansion
   - Mountain ranges - Place of origin
   - Rivers - Place of ending
   - Currents - Direction of currents
   - Traffic roads - The pattern,
     Colours and symbols
     Characters according to the scale of
     Deployment of characters

3. Marking distribution
   - Relief zones - Regions spread
   - Climate zones - Apt colours and symbols
   - Crop distribution - Size of characters and deployment
   - Vegetation distribution -
   - Mineral distribution -
   - Population distribution -

4. Use of colours
   - High grounds - brown
   - Plains - green
   - Water - blue
   - Populated areas - red/ black
   - Currents (hot) - red
   - Currents (cold) - blue
   - Straits - blue

Common rules

- Above discussed principles of map marking are flexible. Thus, in some occasions they might change.
  E.g. To name a river, the most apt method is to write its name in blue along its deployment, but in a large scale map, to mark its name by arrows and then to write its name, is the most suitable method.
- When you mark the location of a city, think about in which direction it is situated to the city exactly. As there are no specific colours to mark regions of agriculture and animal husbandry, use an appropriate colour or symbol.
- It is better if you can provide a key, if the map marking is complex. Otherwise, it would be difficult to understand the map.

School Based Assessment - Introduction

Every teacher should be aware that teaching, leaning, and evaluation are very important components in education system and evaluation should be done to measure the progress of learning as well as teaching. As well, these components are interdependent and thus, the development of each is influenced by the other. According to the principles of continuous assessment, evaluation should be done during the process of learning and teaching. This can be at any occasion such as at the beginning, middle, or end of the leaning teaching process. Hence, any teacher, who expects to evaluate the progress of leaning of his / her student, should make use of a systematic plan on learning, teaching, and evaluation.

School Based Assessment is neither an examination method nor an experimental activity. This can be identified as an intervention, which is used to develop both processes of learning and teaching. This process can be used to assist students to achieve the maximum development in learning by recognizing and responding to their strengths and weaknesses appropriately.

School Based Assessment is performed with the aim of directing students into the process opened by learning teaching activities. As well, it is expected here that the teacher guide students moving around the classroom and observing the work carried out. Here, the student should be frequently evaluated while the teacher confirms that students have accomplished the expected standards.

The purpose of learning and teaching is to provide required experiences to student, to confirm that they have achieved these in exact way and to provide them with proper guidance to achieve these experiences. Teachers who evaluate students can guide students in two ways. These types of guidance are known as feedback and feed forward. Teachers' responsibility is to use feedback method to help students to minimize their learning problems when students weakness are recognized and on the other hand to use feed forward method to develop students' skills further when their strengths are recognized.

Generally, students are curious to know which lesson objectives on which levels they have fulfilled during their learning process in odder to measure the success of learning-teaching process. Thus, teachers are expected to determine students' proficiency levels, which are normally decided through evaluation. In addition, School Based Assessment method is expected to enhance communication between students and teacher. Teachers with above-mentioned objectives should make use of efficient learning teaching evaluation methods in odder to improve learning as well as teaching processes. Given below are several sorts of approaches, which can be used by both students and teachers. These methodologies are used by the Department of Examination and National Institute of Education to supply information to teachers over years. Hence, it is expected that teacher are well aware of these. They are as follows.

1. Assignments
2. Projects
3. Surveys
4. Explorations
5. Observations
6. Presentations/ Exhibitions
7. Field trips
8. Brief written tests
9. Structured essays
10. Open book tests
11. Creative exercises
12. Listening tests
13. Practical exercises
14. Oral activities
15. Individual work
16. Group activities
17. Conceptual maps
18. Dual entry journals
19. Wall magazines
20. Quiz programmes
21. Question books with answer keys
22. Debates
23. Discussion forums
24. Conferences
25. Instant speeches
26. Role plays

Not all of the learning-teaching methods introduced here are expected to be used in all the subjects and in each subject units. Teachers should be well aware and are responsible to choose an appropriate category for his/ her subject unit. In such cases, evaluation should be done basing on the apt determiners as shown in the following table. In Teachers' Guides, there is a note on teaching, learning, and evaluation categories, which can be used by teachers to assess the progress of students. Teachers should make use of these categories aptly within his\ her classroom to evaluate students' progress. Avoidance of the use of these might result in deficiencies in the development of students' academic skills.

Determiners	Marks			
	Competency level is achieved		Competency level is not achieved	
1. Selected information are relevant to the theme	4	3	2	1
2. Theme is presented satisfactorily through Information	4	3	2	1
3. Relevance of the presented information	4	3	2	1
4. Rationality and meaningfulness	4	3	2	1
5. Consists of relevant information Extent covered	4	3	2	1
Total Final marks $= \frac{\text{Total}}{2}$				

School Based Assessment

Term (i)

(1) Preparation of a project report on agricultural technology of Sri Lanka explaining its importance and problems.
Examples for the different sections of the agricultural technology of our country.

- Use of modern machines
- Use of genetic technology
- Use of fertilizer
- Use of novel water technological methods

It is important to concentrate on uses and problems of above given different sections.

Facts to be concentrated on during the preparation of the project report and gathering of information.

- Determination of specific periods
- Data gathering, analyzing and drawing conclusions
- Preparation of a brief project report
- Organizing as an individual activity

(Total 20 marks for 05 determiners)

Term (ii)

(2) Preparation of a file of outline of the world maps including brief entries about the timely incidences of geographical importance and the places of incidences.
Facts to be considered during information gathering.

- Gathering of information about timely incidences of geographical importance within a week.
  E.g. Eruption of volcanoes, floods, earthquakes, environmental summits, changes in transport section etc.
- Marking and naming the places of such incidences on a out line map/s of the world.
- Keeping an entry on each occurrence.
- Marking the absolute locations (in relation to longitudes and latitudes).
- Expansion of this work throughout 10 weeks.
- Preparation of a file of world maps, which consist of all the prepared maps during the 10 weeks.

Special focus

- Organize this as an individual activity.
- Use the standard methods in map marking.
- Continuous guidance and supervision are required.

(Total of 20 marks for 05 determiners)

(3) Surveying on a frequently occurring natural hazard in your region or nearby region.
Frequency occurring natural hazards.

i. Droughts
ii. Floods
iii. Land slides
iv. Lighting

Different methods that can be used for information gathering.

- Observation
- Discussions
- Questionnaires
- Sources (newspapers, radio, television, internet)

Facts to be concentrated on.

- Reasons for occurring
- Impacts of the hazard
- Possible methods of hazard mitigation

Facts to be considered.

- This can be organized as an individual or group activity.
- A record including all the acquired information should be prepared and presented after the survey.
- That record may consists of diagrams, tables, photographs etc.

(Total of 20 marks for 05 determiners)

(4) Organization of a field trip to a selected industry/ factory in the region for information gathering.
For this, traditional industry or large-scale factory in your area can be chosen.

The fields to be concentrated on while data gathering.

- Impacts of the factors for location
- Special factors
- Production
- Sales
- Timely trends

Data gathering and preparing the record.

- Preparedness
- Different methods of information gathering
- Preparation of the record
- Including pictures, tables, photographs into the record
- Systematic guidance of the teacher
- Drawing conclusions

(Total of 20 marks for 05 determiners)

Term (iii)

(5) A presentation on future measures which can be taken towards the development of special sectors of tourism industry of Sri Lanka.

Examples for special sectors, which should be focused on for the future development of the tourism industry of Sri Lanka.

- Associated with coastline
- Associated with biological systems
- Associated with sanctuaries
- Associated with ancient places
- Associated with education
- Associated with culture and folk life
- Associated with adventure

Facts to be considered.

- This activity can be organized as a group work.
- Presentation can be done as a group presentation.
- Students are supposed to be creative while presenting what they have learnt.
  E.g. A map of Sri Lanka on which the areas, which can be developed as future tourist attractions are marked, can be presented during the presentation
- Use of maps, pictures, drawings during the oral presentation is important.

(Total of 20 marks for 05 determiners)

(6) Observing the prevalent patterns of the relationship between physical environment and human activities in your area.

Examples

- Spread of waterways, cultivated lands associated with lakes.
- Impacts of different physical features on agriculture, transport methods, and establishment of dwellings.
- How the resources available in the area help the development of various industries.

Facts to be considered when presenting information though an observation.

- Study should be carried out applying the knowledge acquired beforehand on the study area.
- Conclusions should be drawn on how far physical environment has influenced on determining human activities.
- Information obtained through observation should be recorded.
- This should be organized as a group activity.
- Maps, pictures, and drawings should be used in presenting information.

(Total of 20 marks for 05 determiners)