APPOLO STUDY CENTRE

Test - 4

5. BIOSPHERE

Biosphere, the fourth sphere of the Earth, is a life supporting layer that exists on the earth's surface. This layer on earth encompasses the Lithosphere, Hydrosphere and Atmosphere. It includes flora and fauna that thrive on or near the earth's surface. The vertical range of the biosphere is approximately 20 km, which is measured from the ocean floor to the troposphere. However, most plants and animals live in a very narrow section for about 1 km above and below the Mean Sea Level (MSL). Biosphere is made up of different ecosystems and biomes. All living things, large or small, are grouped Into Species. The area in which an animal, plant or micro organism lives is called its habitat. A wide variety of plants and animals live in a particular habitat known as *biodiversity.*

Ecosystem

An ecosystem is a community, where all living organisms live and interact with one another and also with their non-living environment such as land, soil, air, water etc. Ecosystems range in size from the smallest units (Eg: bark of a tree) that can sustain life to the global ecosystem or ecosphere. (Eg: Cropland, Pond ecosystem, Forest ecosystem, Desert ecosystem etc.). Biosphere harbours all ecosystems on the earth and sustains life forms including mankind.

Components of ecosystem

An ecosystem consists of three basic components, namely

a. Abiotic components
b. Biotic components and
c. Energy component

a. Abiotic Components: Abiotic components include the non-living, inorganic, physical and chemical factors in the environment. Eg. Land, Air ,Water, Calcium, Iron etc.

b. Biotic Components: Biotic components include plants, animals and micro-organisms. Biotic components can be classified into three categories:

- **Producers** are self-nourishing components of the ecosystem. Hence they are called Autotrophs. They are found both on land and water. Eg. Plants, Algae, Bacteria etc.
- **Consumers** are those that depend on producers, directly or indirectly. Hence they are called Heterotrophs. The common category of consumers are:
  - ✓ **Primary consumers** depend on producers for their food. They are exclusively herbivores. Eg. zebra, goat etc.
  - ✓ **Secondary consumers** are small carnivores i.e., they consume herbivores. Eg. lion, snake etc.
  - ✓ **Tertiary consumers** are top carnivores that prey on both herbivores and carnivores. Eg. owl, crocodile etc.
- **Decomposers** are some organisms that are incapable of preparing its own food. They live on dead and decaying plants and animals. Hence they are called Saprotrophs. Eg. fungus, mushrooms etc.

c. Energy Components: All organisms in the biosphere use energy to work and convert one form of energy into another. The Sun is the ultimate source of energy for the biosphere as a whole. The solar energy gets transformed into other forms of energy through the various components in the ecosystem. The producers, consumers and the decomposers contribute a lot to the energy flow in an ecosystem.

Functions of an ecosystem

The living organisms form an interacting set of flora and fauna which are organized into trophic levels, food chains and food webs. The functioning of an ecosystem depends on the pattern of the energy flow, as it helps in the distribution and circulation of the organic and

inorganic matter within an ecosystem. Energy flow generally takes place in a hierarchical order in an ecosystem through various levels. These levels are called trophic levels. The chain of transformation of energy from one group of organisms to another, through various trophic levels is called a food chain. A system of interlocking and interdependent food chains is called a food web.

Biodiversity

Biodiversity or biological diversity refers to a wide variety of living organisms (plants, animals and other micro-organisms) which live in a habitat. It is highly influenced by topography, climate as well as human activities. It represents the strength of the biological resources of a place on earth. In biodiversity, each species, no matter how big or small, has an important role to play in the ecosystem. It maintains the ecological balance and facilitates social benefits such as tourism, education, research etc. over an area.

Loss of biodiversity

The extinction of species (flora and fauna) due to human and natural influences is called loss of biodiversity. The biodiversity loss has a great impact on mankind and also affects land, water, air etc. Habitat destruction due to deforestation, population explosion, pollution and global warming are the major cause for loss of biodiversity. Sometimes, habitat loss is so severe or happens so quickly that it results in a species being eliminated from the planet. Scientists are still trying to decide what caused the mass extinction of dinosaurs. A healthy eco system provides clean water, pure water, enriched soil, food, raw materials, medicines etc. Hence stable biosphere has to be conserved.

Biomes

A biome is a geographically extensive ecosystem where all flora and fauna are found collectively. It is the total assemblage of plant and animal life interacting within the biosphere. Biomes are defined by abiotic factors like, relief, climate, soils and vegetation. They are classified into two broad categories, terrestrial biomes and aquatic biomes.

Terrestrial Biomes

Terrestrial biomes is a group of living organisms that live and interact with one another on land. They are mainly determined by temperature and rainfall. Some of the major terrestrial biomes of the world are A. Tropical Forest Biomes, B. Tropical Savanna Biomes, C. Desert Biomes, D. Temperate Grassland Biomes, E. Tundra Biomes

A. Tropical Forest Biomes

The tropical forest biome is comprised of several sub-biomes, including evergreen rainforest, seasonal deciduous forest etc. This biome extends between 10° N and 10° S of the Equator. Central and South America possess half of the world's tropical forests. The climate in these biomes shows little seasonal variation with high annual rainfall and relatively constant, high temperature. This unique weather condition favours thick vegetative cover. Tropical forests have the highest biodiversity and primary productivity of any of the terrestrial biomes.

The Amazon basin, Congo basin and Indonesian islands are the major regions of this biome. These regions have very dense forests and so have great economic importance. Human settlements are found scattered here. They sustain their livelihood through food gathering, fishing, lumbering and shifting cultivation. Due to the humid nature of this biome, the people get afflicted to tropical diseases like malaria, yellow fever etc. The chief trees found here are rubber, bamboo, ebony, etc. Bats, pheasants, jaguars, elephants, monkeys etc. are the important birds and animals found here.

B. Tropical Savanna (Grasslands) Biomes

Tropical grasslands are generally found between tropical forests and deserts. Tropical Savanna biomes are found between 10o to 20o N and S latitudes. These grasslands are generally flat and are found in the Sahel, south of Sahara in East Africa and in Australia. This biome is generally hot and dry and experiences moderate to low rainfall. So, the grass which grow here are tall and sharp. Hence the chief occupation of the people found here is herding. The primitive people living here are nomadic. The common animals found here are the lion, leopard, tiger, deer, zebra, giraffe etc. Flora such as Rhodes grass, red oats grass, lemon grass etc. are found in this biome.

C. Desert Biomes

Deserts are usually found on the western margins of the continents between 20° and 30° N and S latitudes. The annual rainfall is less than 25 cm in these regions. Due to the lack of rainfall and arid conditions, these regions do not possess any vegetation but have special vegetation type called Xerophytes. As the soil is sandy and saline, deserts remain agriculturally unproductive. Drought resistant thorny scrubs and bushes, palms are found here.

Tribal people who live here practice food gathering and hunting. They move their temporary settlements frequently in search of pastures. Transportation becomes very difficult here and is carried on by camels. Reptiles like snakes, lizards, scorpions etc., are most commonly found here.

D. Temperate Grassland Biomes

Temperate Grasslands are usually found in the interior of the continents and are characterized by large seasonal temperature variations, with warm summer and cold winter. The type of grassland in these regions strongly depends upon precipitation. Higher precipitation leads to tall and soft grass and lower precipitation leads to short and soft grass. These regions favour wheat cultivation. Extensive mechanised agriculture is practised due to lack of farm labour. Pastoral industry becomes the main occupation, thereby facilitating slaughtering of animals, packing of raw and processed meat, dairy products etc. The common birds and animals are grass hopper, wolf, bison, prairie dog etc.

E. Tundra Biomes

These vast lowlands are found where the ground remains frozen. Greenland, Arctic and Antarctic regions and Northern parts of Asia, Canada and Europe fall in this biome. These regions are also called Barren lands. This biome experiences long severe winter and short cool summer. Due to the prevailing of low temperature and short growing seasons, the net primary productivity is very low in tundra. People are nomadic. Hunting and fishing are their major occupations. The population here is extremely sparse and the harsh environment makes them change their settlement frequently. They live in igloos in winter and in tents during summer. Arctic moss, Arctic willow, lichens etc.

grow here. Fauna like the polar bear, wolverine, reindeer, snowy owl are found here.

Aquatic Biomes

Aquatic biome is a group of living organisms that live and interact with one another and its aquatic environment for nutrients and shelter. Like terrestrial biomes, aquatic biomes are influenced by a series of abiotic factors. It is broadly classified as fresh water biomes and marine biomes.

A. Fresh water Biomes: It comprises lakes, ponds, rivers, streams, wetlands etc. It is influenced by various abiotic components such as the volume of water, water flow, composition of oxygen, temperature, etc. Humans rely on freshwater biomes for drinking water, crop irrigation, sanitation and industry. Water lily, lotus, duck weeds etc. are the common plants found here. Trout, salmon, turtles, crocodiles etc. are the animals found here.

B. Marine Biomes: They are the largest aquatic biomes on earth. They are continuous bodies of salt water and provide a wide range of habitats for marine plants and animals. Coral reefs are a second kind of marine biomes within the ocean. Estuaries, coastal areas where salt water and fresh water mix, form a third unique marine biome. As water provides maximum mobility to marine organisms, nutrients are circulated more quickly and efficiently here than the terrestrial biomes.

Apart from animals, plants such as kelp, algae, phytoplankton etc. also grow in water. Aquatic biomes are not only important for plants and animals, but also for humans. Humans use aquatic biomes for water, food and leisure activities. Some of the threats and issues to aquatic biomes are overfishing, pollution and rise in sea level.

Difference between Aquatic and Terrestrial ecosystem	
Aquatic Ecosystem	**Terrestrial Ecosystem**
Aquatic ecosystem exists on water covering 71% of the earth surface.	Terrestrial ecosystem exists on land covering 29% of the earth surface.
Aquatic animals use 20% of energy to obtain oxygen.	Terrestrial animals use only 1-2% of energy to obtain oxygen.
In this ecosystem there is abundant of	In this ecosystem there is less

water with limited oxygen supply.	availability of water, greater availability of gases and temperature fluctuation.
The small drifting photo synthetic organisms of the ocean called photo phytoplankton are regarded as the major primary producer.	The primary producer is the plants that produce food through photosynthetic process.
Aquatic environment is more stable with smaller fluctuation in temperature and other variable.	Terrestrial environment is quite unstable as the land surface is affected by great risks from external impacts.

Conservation

The biosphere extends from the deep ocean trenches to lush rain forests. People play an important role in maintaining the flow of energy in the biosphere. At the same time, the primary cause of today's loss of biodiversity is habitat alteration caused by human activities. The ever increasing population results in over exploitation of biological resources. This has an adverse impact on flora and fauna on earth. There are places on earth that are both biologically rich and deeply threatened. Hence it is man's duty to conserve and care for the earth and make it a better place to live in.

Case Study-Biosphere II

Scientists have created an artificial Biosphere called Biosphere-2, to understand the Earth which is refered as Biosphere-1.

Facts and Numbers

- ✓ Biosphere-2 covers 3.15 acres and is located in Arizona, America.
- ✓ It is 91 feet at its highest point.
- ✓ It is sealed off from earth below by 500 ton welded stainless steel liner.
- ✓ A host of instruments constantly monitors the air, soil and water.
- ✓ The 25 foot ocean contains a million gallons of salt water.
- ✓ Biosphere-2 contains five biomes - a rain forest, desert, savanna, marsh and ocean.
- ✓ It has more than three thousand species of living organisms.
- ✓ The habitat is opened for public tours. (To visit biosphere-2 log on to www.biosphere2.org)

Gulf of Mannar – Marine Treasure

- ✓ **Location:** Lies between the southeastern tip of India and the west coast of Sri Lanka, in the Coromandel Coast region.
- ✓ **Marine National Park**: The gulf of Mannar Marine National Park is a protected area consisting of 21 Small Island and adjacent coral reefs in the Gulf of Mannar in the Indian Ocean.
- ✓ **History:** Gulf of Manner was declared as National park in 1986. Later deckared as a biosphere reserve in 1989.
- ✓ **Flora**: They consist of species belonging to the mangrove, Rhizophora, Avicennia, Bruguiera, Ceriops and Lumnitzera genus.
- ✓ **Fauna:** Indo – Pacific bottlenose dolphin, Common dolphin, Melon-headed whale, and critically endangered whale species.

NOTE

- ❖ The branch of science that deals about ecosystem is called *Ecology*.
- ❖ A person who studies ecology is referred to as an *Ecologist.*
- ❖ An ecological region that has lost more than 70% of its original habitat is considered a hotspot. Hotspots in India are the Himalayas, Western Ghats, Indo Burma Region and Sundaland.
- ❖ Of late, parts of the Savanna grasslands are being converted into farmlands, which pose a great threat to the wide range of fauna. For Eg. The population of the big cats like cheetah, lion etc. are dwindling drastically.
- ❖ The U.S. National Cancer Institute has identified about 70% of the plants used for treating cancer. Which are found only in rain forests. Eg. Lapacho.
- ❖ An oasis is a fertile fresh water source found in deserts and semi-arid regions. Oases are fed by springs. Crops like date palms, figs, citrus fruits, maize etc. are cultivated near these oases.
- ❖ Temperate grasslands are called differently in different parts of the world.
  - Prairies - North America
  - Steppes - Eurasia
  - Pampas - Argentina and Uruguay
  - Veld - South Africa
  - Downs - Australia and New Zealand
- ❖ A Biosphere Reserve is a special ecosystem or specialized environment with flora and fauna that require protection and nurturing. There are 18 Bioshpere Reserves in India.

6. Man and Environment

Early man depended entirely on nature for food, clothing and shelter. Man has enjoyed a dominant position over the other living organisms around him because of his erect posture, hands and intelligence. From the paleolithic period to the neolithic period, man has invented and developed the wheel, fire, tools and patterns of agriculture and housing to his comfort, which led him to improve the standard of living making himself technologically advanced. Thus, modern man modified the environment where he multiplied in numbers to increase population and has always extended his territories, leading to the exploitation of natural resources.

Classification of Environment: Environment is generally classified as

a. Natural environment
b. Human environment and
c. Man made environment

a. Natural environment: Earlier, we have learnt about the natural components of environment such as lithosphere, atmosphere, hydrosphere and biosphere. In this chapter, we will study about the human and man-made components in a detailed manner.

b. Human Environment: Human environment is defined as the interaction between man as an individual, with his family, occupation and society. It is also related to various cultural aspects such as education, religion, economics and politics.

c. Man-made environment: Man-made environment has been created by man himself for the purpose of fulfilling his needs and to make his life more convenient and easy. For example, building, transport, park, industrie, monument, etc. To bring an equilibrium between man and the environment, man has to study the distribution of population, availability of resources, development in technology, alternate means of fulfilling the increasing demand created by the growing population and other man-made features.

Population

Can you imagine a world without human beings? Humanbeings are important to develop the economy and society. The Latin word

'populus' means 'people'. Population is the total number of people living together in a particular place at the given point of time.

Population Growth

'It is easy to add but difficult to maintain'

Population is a dynamic phenomenon where the number, distribution and composition are constantly changing. Human population increases as babies are born and decreases as people die. For most of human history, births have only slightly exceeded deaths every year. As a result, human population grow slowly. About the time of Industrial Revolution, it began to increase rapidly.

Natural increase of population is the difference between the birth rate and death rate. In fact population is always increasing but only in very rare cases it may decrease through natural or man-made disasters such as famine, landslides, earthquakes, tsunami, epidemics, extreme weather conditions and war.

Population change refers to an increase or decrease in the population of an area influenced by the number of births, deaths and migration. The population of the world doubled from 500 million in 1650 to 1000 million in1850.The projected population for 2025 and 2050 is about 8 billion and 9 billion respectively.

Population growth refers to an increase in the number of people who reside in a particular area during a particular period. Population increases when there are more births and immigration. It decreases when there are more deaths and emigration. Population growth, can be calculated as Population growth = (Birth rate + Immigration) - (Death rate + Emigration).

The important features associated with the population studies in Tamil Nadu are as follows:

S. No	Term	Definition	Data for Tamil Nadu
1.	Birth Rate	Indicates the number of live births per 1000 people in a year	15.4% (2014)
2.	Population Growth	The average annual growth of population	15.6% (2011)

3.	Population Density	The average number of people per square kilometer	555/ Km2 (2011)
4.	Total Fertility Rate	The average number of children born per woman during her child bearing years (usually ages 15 to 44)	1.6 Birth Per Woman (2016)
5.	Infant Mortality	The number of deaths under one year of age for every 1000 live births in a year	17 per 1000 live births (2016)
6.	Life Expectancy at Birth	The average number of years an individual is expected to live	70.6 years (2010-14)
7.	Literacy Rate	The percentage of people in a given population who can read and write a language	80.09% (2011)
8.	Sex Ratio	The number of females for 1000 males in a given population	996:1000 (2011)

Distribution of Population

Population distribution refers to the way in which people are spread out across the earth's surface. The world population is not uniformly distributed, owing to the following factors.

A. **Physical Factors**: Physical factors include temperature, rainfall, soil, relief, water, and natural vegetation, distribution of minerals and availability of energy resources.
B. **Historical Factors**: Regions with historical importance (river valley civilizations), war and constant invasions fall under historical factors responsible for population distribution.

Density of population

Density of population refers to the number of people living per square kilometer. An area is said to be sparsely populated when it has a large area with less number of people. Similarly, smaller the area with a large number of people, it is said to be densely populated.

$$\text{Population Density} = \frac{\text{Total Population}}{\text{Total land area}}$$

The world's population density is divided into three main groups.

- Areas of high density (above 50 people per sq.km) - East Asia, South Asia, North West Europe & Eastern North America.
- Areas of moderate density (10 to 50 people per sq.km) - The sub tropical regions like Angola, Congo, Nigeria and Zambia in Africa.
- Areas of low density (less than 10 people per sq.km) - Central Africa, Western Australia, Northern Russia, Canada, etc…

Migration

Migration is defined as the permanent or semi-permanent change of home of an individual or a group of people over a significant distance from their place of origin. The causes of migration may be physical (climate, drought, flood, earthquake, volcanic eruption, epidemics etc.), social inequalities, economic opportunities, technology, education, cultural clashes, war or political issues. There are two types of migration:

1. **Internal Migration:** The movement of people within a country i.e. between states, districts, villages, etc is called as Internal migration.
2. **International Migration:** The movement of people from one country to another, across international borders is called as International migration.

Push and pull factors of migration

Push factors are those factors which force people to move to new areas to live, while pull factors are those factors that attract migrants to a new location. Given below are some of the push and pull factors of migration.

Push Factors of migration	Pull factors of migration
• Insufficient jobs and few opportunities	• Better job opportunities
• Primitive conditions	• Better living conditions
• Desertification	• Fertile land
• Slavery or forced labour	• Socio economic independence
• Poor medical care	• Better health care
• Death threats	• Security
• Pollution	• Clean environment

• Poor infrastructural facilities	• Better infrastructural facilities
• Bullying	• Education
• Natural Disasters	• Living Stability
• War	• Industry
• Lack of political or religious freedom	• Political and religious freedom

Human settlements

A settlement can be described as any temporary or permanent unit area where people live, work and lead an organized life. It may be a city, town, village or other agglomeration of buildings. During the early days, man preferred tree branches, caves, pits or even rock cuts as his shelter. As days passed by, man slowly learnt the art of domesticating animals and cultivating food crops. The evolution of farming took place along four major river basins i.e. the Nile, Indus, Hwang Ho, Euphrates - Tigris. Man built huts and mud houses. Slowly settlements came into existence. A settlement generally consisted of a cluster of houses, places of worship and a place of burial. Later, small settlements developed into villages. Several villages together formed a town. Bigger towns developed into cities. Settlements were formed in different shapes, sizes and locations.

Classification of settlements

On the basis of occupation, settlements may be classified as rural and urban settlements.

Rural Settlements

Any settlement where most of the people are engaged in primary activities like agriculture, forestry, mining and fishery is known as a rural settlement. Most of the world's settlements are rural, that are mostly stable and permanent. The most important and unique feature of rural settlements is the vast, open spaces with green, pollution-free environment.

Patterns of rural settlements:

- **Rectangular pattern:** Rectangular pattern of settlements are found in plain areas or valleys. The roads are rectangular and cut each other at right angles.
- **Linear pattern**: In a linear pattern, the houses are located along a road, railway line and along the edge of the river valley or along a levee.
- **Circular or semicircular pattern**: The pattern of settlement that is found around the lakes, ponds and sea coasts are called circular or semi circular pattern.
- **Star like pattern**: Where several metalled or unmetalled roads converge, star shaped settlements develop. In the star shaped settlements, houses are spread out along the sides of roads in all directions.
- **Triangular pattern:** Triangular patterns of rural settlement generally develop at the confluence of rivers.
- **T-Shaped, Y-Shaped, Cross-Shaped or Cruciform settlements**: T-shaped settlements develop at tri-junctions of the roads (T), while Y-shaped settlements emerge as the places where two roads converge with the third one. Cruciform settlements develop on the cross-roads which extend in all four directions.
- **Nebular pattern:** The arrangement of roads is almost circular which ends at the central location or nucleus of the settlement around the house of the main landlord of the village or around a mosque, temple or church.

Urban Settlements

Urban is the term related to cities and towns where people are primarily engaged in non-agricultural activities, such as secondary, tertiary and quaternary activities. The common characteristic feature of an urban unit is that they are compact, congested and liable to a large number of population. They comprise of mostly man-made structures that fulfill the requirements of a society's administrative, cultural, residential and religious functions. The factors responsible for

urbanization are better employment opportunities, suitable conditions for business, education, transport, etc.

Classification of Urban Settlements

Urban centres are classified as towns, cites, metropolitan cities, mega cities, conurbation, etc., depending on the size and services available and functions rendered to it.

- **Town:** A town is generally larger than a village, but smaller than a city. It has a population of less than 1 lakh. E.g.: Arakkonam near Chennai
- **City:** Cities are much larger than towns and have a greater number of economic functions. The population in cities are estimated to be more than 1 lakh. E.g.: Coimbatore
- **Metropolitan cities**: Cities accommodating population between 10 lakhs and 50 lakhs are metropolitan cities. E.g.: Madurai
- **Megacities:** Cities with more than 50 lakh population are called Megacities. E.g.: Greater Chennai
- **Conurbation:** A conurbation is a region comprising of a number of cities, large towns and other urban areas. E.g.: Delhi conurbation

Economic Activities

Economic activities are those efforts or actions that involve production, distribution and consumption of commodities and services at all levels within a region. Types of Economic Activities

Primary Activities: Primary Activities pertain to the extraction of raw materials from the earth's surface. For example: food gathering, hunting, lumbering, fishing, cattle rearing, mining and agriculture.
Secondary Activities: Secondary Activities transform raw materials into finished goods. For example: Iron and Steel industries, automobile manufacturing etc.

Tertiary Activities: Activities which by themselves do not produce goods, but support the process of production are called tertiary activities. For example: Transport, communication, banking, storage and trade.

Quaternary Activities: The activities related to Research and Development, as well as knowledge are called Quaternary activities. For e.g. Services like consultation, education and banking,

Quinary Activities: The activities that focus on the creation, rearrangement and interpretation of new and existing ideas are called quinary activities. It includes the highest levels of decision making in a society or economy. E.g.: Senior business executives, scientists and policy makers in the Government.

Environmental Issues: Environment is the basic life support system that provides air, water, food and land to all living organisms. But human beings degrade the environment through rapid industrialization.

Human life will be at risk if they don't live in harmony with the environment. Environmental problems are not limited to the local, regional and national level, but there are several global issues. Scientific and technological revolutions has given a lot of facilities to mankind, but at the same time it is responsible for the depletion of resources. Thus, several environmental problems have emerged. Some of the environmental issues that we are going to learn are:

1. Deforestation,
2. Pollution such as air, water ,noise, etc,
3. Urbanization,
4. Fracking,
5. Waste disposal

Deforestation: Deforestation is the cutting down of trees permanently by the people to clear forests in order to make the land available for other uses.

Effects of Deforestation: Deforestation results in many effects like floods and droughts, loss of soil fertility, air pollution, extinction of species, global warming, spread of deserts, depletion of water resource, melting of ice caps and glaciers, rise in sea level and depletion of ozone layer.

The United Nations Conference on Environment and Development (UNCED) by name Earth Summit Conference held at Rio de Janeiro, Brazil, on June 1992 concluded that all member countries

should reduce their emission of carbon dioxide, methane and other green house gases thought to be responsible for global warming.

Conservation of forests

i. Conservation of forests can be done through the regulation of cutting of trees.

ii. **Control over forest fire**: Through regular monitoring and controlling the movement of the people forest fire can be prevented.

iii. **Reforestation and afforestation**: Reforestation involves the replanting or regeneration of areas of forest which have previously been damaged or destroyed. Sometimes forests are able to regenerate naturally. Afforestation is the process of planting trees or sowing seeds on barren land devoid of any trees to create a forest. The term afforestation should not be confused with reforestation, which is the process of specifically planting native trees into a forest that has decreasing number of trees. While reforestation is increasing the number of trees of an existing forest, afforestation is the creation of a new forest.

iv. **Proper use of forest products**:We depend on forests for our survival from the air we breathe, to the wood we use. Besides providing habitats for animals and livelihoods for humans, forest products are one of the most essential things in our day to day life. Therefore we must use forest products properly.

v. **Sustainable forest management**: The use of forest and forest lands in a way and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill the global levels should not cause damage to other eco systems. Forest Management seeks to achieve a balance between the society's increasing demands for forest products, its benefits and the preservation of forest health and diversity too. This balance is critical to the survival of forests and to the prosperity of forest dependent communities.

Pollution

Environmental pollution occurs when pollutants contaminate the natural surroundings. Pollution disturbs the balance of our eco system affecting our normal life styles and gives rise to human illnesses and global warming. The word 'pollute' means to degrade or to make dirty. Pollution is thus, an unfavourable modification of the natural world, caused entirely or partly due to direct or indirect actions of human beings. There are many types of pollution degrading the environment. They are

1. Air pollution
2. Water pollution
3. Land pollution
4. Noise pollution
5. Light pollution

A. Air pollution

Due to some human activities or natural processes, the amount of solid wastes or concentration of gases, other than oxygen increases in air. Air thus becomes polluted and this process is called air pollution. The pollutants are generally grouped as natural and manmade. The natural pollutants are volcanic eruptions, wind erosion, pollen disposal, evaporation of organic compounds and radioactive elements etc.,

Natural air pollution does not occur in abundance and also creates a little impact on the environment. But, manmade pollutants like vehicular emission, industrial wastes, smoke from thermal power plants and refineries badly affect the environment. The main pathological effects caused by air pollutants, particularly oxides of sulphur, nitrogen and carbon-di-oxide, include respiratory disorders, jaundice, irritation of eyes and throat, headache, cancer and even death.

Ozone Depletion: Ozone layer is depleted by the pollutants like CFCs, HFCs, methyle bromide, etc. Due to the depletion of ozone layer, UV rays fall on the earth's surface, warming the earth surface and leads to impervious diseases like skin cancer, blindness, loss of plankton etc.,

Ozone layer: Ozone is a poisonous gas made up of molecules consisting of three oxygen atoms (O3). This gas is extremely rare in the atmosphere, representing just three out of every 10 million molecules. The ozone layer is not really a layer at all, but has become known as

such because most ozone particles are scattered between 19 and 30 kilometre up in the earth's atmosphere, in a region called the stratosphere. Ozone layer in the atmosphere absorbs most of the harmful ultraviolet radiation from the sun. It also screens out the deadly UV-C radiation the ozone shield is this essential to protect life.

B. Water Pollution:

Water pollution is any chemical, physical or biological change in the quality of water that has a harmful effect on any living thing that drinks or uses or lives in it. The water bodies including ponds, lakes, rivers, ground water and oceans are contaminated by the chemical wastes from industries, domestic wastes and sewage etc.

Major water pollutants

a. The disease – Causing agents; bacteria, viruses, protozoa and parasitic worms that enter sewage – systems and untreated waste.
b. Oxygen demanding bacteria: Wastes that can be decomposed by oxygen requiring bacteria.
c. Water soluble inorganic pollutants: Acids, Salt and toxic metals.
d. Organic compounds: Oil, plastics and pesticides in the water.

Our role in conserving water;

1. Do not dump in or around rivers. Clean up rivers that have a lot of trash in and around them.
2. Never dispose of cooking fats and oils by pouring them down the sink.
3. In the bathroom, take short showers and draw less water for baths. When you buy a new toilet, purchase a low flow model (1.6 gallons or less per fl ush). Check your toilet for "silent" leaks by placing a little food coloring in the tank and see if it leaks into the bowl.
4. Turn off water while brushing teeth, washing, gardening and shaving.
5. Keep a gallon of drinking water in the refrigerator, rather than running the tap for cold water. Run your washing machine with a full load of clothes. Wash with warm water instead of hot water, rinse with cold water instead of warm water.

Causes of Water Pollution: Main pathological problems caused due to water pollution include diarrhoea, liver cirrhosis, lung cancer, kidney

diseases, paralysis, chronic pain, bone deformities, cancer and even death and so on.

C. Land Pollution

Land pollution is contaminating the land surface of the earth through dumping of urban waste matter. It arises from the breakage of underground storage tanks, application of pesticides and percolation of contaminated surface water, oil and fuel dumping, leaching of wastes from landfills or direct discharge of industrial wastes to the soil.

Preventive Measures

1. Things used for domestic purposes can be reused and recycled.
2. Organic waste matter should be disposed off far away from the settlements.
3. Inorganic wastes can be separated, reclaimed and recycled.

D. Noise Pollution

Noise pollution is basically a problem of urban areas, industrial areas, transport areas due to bombardment, traffic etc. It has an impact on the habitat of animals migration and health of inhabitants. E.g. Chandipur Missile Launching Centre has created migration of sea birds. Hearing loss, hypertension, stress and mental illness are the major health hazards that human beings face.

The control measures of noise pollution

1. Development of green belt vegetation.
2. Installation of decibel meters along highways and in places of public gatherings.
3. Planting trees along the compound wall to protect houses.

E. Light pollution

Light pollution is an unwanted consequence of outdoor lighting and includes such effects as sky glow, light trespass and glare. It is caused by streetlights, parking lot lights, floodlights, signs, sports field lighting decorative and landscape lights. It affects the environment, energy resources, wildlife, humans and astronomy research.

Urbanization

Urbanization refers to the process of increase in urban population and urban areas in a country.

Problems of urbanization

As the town expands, it mounts more pressure on transport system, water supplies, sewage and profuse disposal. The overall development creates problems like air pollution, water pollution, traffic congestion and noise pollution etc., This disturbed environment affects the human beings as mental illness, heart troubles, breathing problems etc.

Fracking:

The modern technology applied to extract oil and gas while fracturing the rocks artificially with the use of pressurized liquid is called fracking. Fracking fluid is a mixture of water, sand and thickening agents. The first successful implementation of the process was done in 1950. Methane is one of the most important chemicals used in fracking process. It is estimated that four percent of methane escapes into the atmosphere during extraction. Methane is 25 times stronger than carbon di-oxide in terms of trapping heat. The spills of this gas is detrimental to the air quality of the surrounding fracking sites. Pollutants decrease the availability of clean air for workers and local residents.

Other Environmental Concerns

Fracking not only pollutes water and air but also pollutes the soil. The oil spills during fracking can harm the soil and the surrounding vegetation. The use of high pressure at the time of oil extraction and the storage of waste water on site may cause earthquakes.

Waste disposal

Things become waste when their purpose of consumption is over. Wastes can be classified into five types, which are commonly found around the house. These include liquid waste, solid rubbish, organic waste, recyclable rubbish and hazardous waste like e-waste.

How to dispose of waste:

- Do not litter your surroundings. Use a proper waste bin to store your wastes.
- People should practise to segregate degradable and non-degradable wastes and should dispose them in proper coloured bins. Wastage is generally classified into three types. They are

1. Wet Waste: Which comes from the kitchen/cooking/food, etc.
2. Dry Recyclable Waste: Such as newspapers, cardboard, packing plastics, bottles, cans, etc., should go to a different bin.
3. Rejected Waste: Which does not belong to the above two categories, including bio waste like diapers and bandages, etc..

Sewage sludge is produced by waste water treatment processes. Due to rapid urbanization, there has been an increase in municipal waste water. Common disposal practices of sewage should be send to sewage treatment plant through proper drainage pipes.

Electronic Waste (e-waste):

It can be defined as any electrical goods, devices or components that you no longer want or have already thrown away. For example, computers, televisions, mobiles and fax machines. This waste can take many years to break down, if at all and can contain toxic chemicals such as mercury, lead and lithium that leach into the ground and cause illness. Even short-term exposure to high levels of lead can result in vomiting and diarrhea. Instead of sending e-waste to the dump, components from electronics can be reused to make new products.

Sustainable Development

Humans on earth are facing many problems, such as pollution, climatic changes, poverty, war and uneven distribution of resources. These problems directly affect the survival of mankind. Therefore to sustain mankind, we have to educate people on what sustainable development is. In 1987, the Brundtland Commission cited the definition of sustainability.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generation to meet their own needs". For sustainable development to be achieved, it is

crucial to harmonize three core elements: economic growth, social aspects and environmental protection. These elements are interconnected and are crucial for the well-being of individuals and societies. To achieve true sustainability, we need to balance the economic, social and environmental factors of sustainability in equal harmony.

Social Sustainability

The ability of a social system such as a country, family or organization to function at a defined level of social well-being and harmony is called social sustainability. Problems like war, endemic poverty, widespread injustice and low education rates are symptoms of a system in socially unsustainable. The balancing capacity of a government in maintaining peaceful existence towards other countries and at the same time providing the requirements of its citizens without affecting the environment creates social sustainability.

Economic Sustainability

The people on earth consume far more than what is their fair share.

1. The economic sustainability is successfully implemented through strong Public Distribution System.
2. Economic sustainability ensures that our economic growth maintains a healthy balance with our ecosystem.

Environmental Sustainability

Environmental sustainability is the ability of the environment to support a defined level of environmental quality and natural resource extraction rates forever to mankind. Unnecessary disturbances to the environment should be avoided whenever possible.

Why is sustainability important?

The excessive usages of natural and manmade resources deplete its availability for the future generation. We need to look after our planet, our resources and our people to ensure that we can hand over our planet to our children to live in true sustainability. Hence conservation and awareness are the two important terms that can bring sustainability to our living. When we use the word sustainability to mean maintain, it means to maintain it forever. This is because our

actions have a lasting effect on the environment and we should protect it for our future generations.

How to help the value of sustainability grow among students?

1. **Lifestyle:** Your lifestyle is your choice and you can change it. For example, when you go to the grocery store, make sure you always carry a cloth bag. This way the shopkeeper does not have to give you many plastic bags.

2. **Fixing:** If your watch or a toy or a camera is broken or not working, try getting it fixed before you buy yourself a new one.

3. **Recycle:** Try and be conscious about the things around you. When you consume something, see if you can re-use it later.

4. **Needs vs Wants :** Before you buy something, ask yourself the question- do I NEED this or do I WANT it? Remember sustainability begins with you. So act locally and think globally.

Case Study

The Mangroves of Palk Bay towards Sustainable Development

The sections above have discussed environmental degradation and climate change along with the concept of sustainable development. The connection between environment protection and restoration and sustainable development has also been presented. As an example, the case of the Mangroves of Palk Bay will help demonstrate these concepts in more practical terms.

Palk Bay is the area located roughly between Kodiakkarai or Point Calimere and Rameshwaram Island in Tamil Nadu on the southeastern coast of India. Palk Bay is home to mangrove ecosystems or tidal swamps. Characterised by plants and trees that can withstand high salinity, these swamps are rich in biodiversity. The Mangrove trees themselves, offer coastal protection by checking erosion. Erosion affects not just the coastline, but also coral reefs. The tangled roots of mangrove trees help retain and trap loose soil and thereby protect coral reefs and seaweed meadows from siltation. Coral reefs are important ecosystems in maintaining healthy fish population. Mangrove forests also help fish population by providing space which

act as nurseries for juvenile fish.

In the recent decades, the mangroves of Palk Bay have been heavily degraded due to the Tsunami of 2004, land encroachment, rapid urbanisation, cattle grazing and agriculture. The degradation of mangroves resulted in the reduction of nursery space for juvenile fish, impacting fish populations in the region and as a result,the livelihood of the fishing communities of the region.

Given the scale of the problem, solutions needed to be multipronged and involve multiple stakeholders. Local communities, government and civic organisations all came together not just to conserve the remaining mangroves, but also to restore it. Saplings of native species of plants and trees are being grown, planted and cared for. Live colonies of coral from the Gulf of Mannar Biosphere Reserve are being transplanted to Palk Bay. The existing mangroves and the region are being mapped and the way land is used around the mangrove is being studied.
The local communities are actively involved in the conservation and restoration of the mangroves. Education and awareness programmes about mangrove ecosystem are being undertaken.

Along with awareness programmes, the communities are also being provided with livelihood training, so they can earn an income in more ways than just fishing. All of these efforts are on-going. The health of the mangroves are improving and as it does, the fish population will improve in quality and quantity, improving the lives of the communities. As one can see, sustainable solutions take the needs of the people into consideration and the environment because both are interconnected.

NOTE

- Environment is a set of relationships between man and nature. Man has survived through the ages, dwelling within his surrounding called the environment. The word 'environment' is derived from the French word 'environ' meaning encircled or surrounded. Environment includes both living (biotic) and non-living (abiotic) components.
- The Stockholm Conference, 1972, declared man as both a creator

and moulder of his environment. 'The Earth Summit', formally known as the United Nations Conference on Environment and Development (UNCED) was held in Rio de Janeiro in 1992.

- In ancient Greek, 'demos' means people and 'graphis' means study of measurement. So, 'Demography' is the statistical study of human population.
- The black-death is estimated to have killed 30 - 60 percent of Europe's total population during the 14th century. The dominant explanation for black-death is attributed to the outbreak of plague.
- **Census:** Census is an official enumeration of population carried out periodically. It records information about the characteristics of population such as age, sex, literacy and occupation. Different countries of the world conduct census every 5 to 10 years as recommended by the United Nations. The first known census was undertaken nearly six thousand years ago by the Babylonians in 3800 BC (BCE). Denmark was the first country in the modern world to conduct a census. In India, the first census was carried out in the year 1872. Censuses have been conducted regularly every tenth year since 1881. The Indian Census is the most comprehensive source of demographic, social and economic data. Have you ever seen a census report? Check in your library.
- The World Population Day is observed on 11th July every year. It seeks to raise awareness of global population issues. The United Nations Development Programme started celebrating this event from the year 1989.
- Over population and Under Population: Over population is a condition when a country has more people than its resources to sustain. Under Population is a condition where there are too few people to develop the economic potential of a nation fully.
- India has an official population policy implemented in 1952. India was the first country to announce such a policy. The main objective of this policy was to slow down the rate of population growth, through promotion of various birth control measures.
- **Emigration means moving out or to leave a place:** Immigration means to enter or come into a new country for the purpose of settling there.
- Damascus is widely believed to be the oldest, continuously inhabited city in the world, dating back to at least 11, 000 years.
- Tokyo is the world's largest city with the greater Tokyo area, housing about 38 million inhabitants.

- According to the Quality of Living Rankings by Consultancy Mercer, in 2016, the city offering the best quality of life was Vienna, with Zurich falling second. (Sources: United Nations, UNESCO, Mercer).
- Van Mahotsav is a weeklong festival celebrated in India. This is a festival of life and is usually celebrated between 1st July and 7 th July.
- **Green-house effect:** Global warming is caused by the increase of green house gases such as carbon dioxide, methane, water vapour and Chloro Fluoro Carbons(CFC), carbon monoxide, photo chemical oxidants and hydrocarbons, which are responsible for the heat retention ability of the atmosphere. Global warming causes climatic change, ozone layer depletion, rise in sea level and drowning of coastal inhabited land, melting of ice, etc., They are posing an even greater threat to human existence and so, man must start thinking of protecting the environment from pollution.
- **Acid Rain:** When pollutants combine with water vapour in the presence of sunlight and oxygen, they form dilute sulphuric and nitric acids in the atmosphere. When this mixture precipitates from the atmosphere, it is called acid rain. The gases that cause acid rain are sulphur-di-oxide, nitrogen oxides, carbon-di-oxide and other minute bio-products, caused by the burning of fossil fuels.
- **Smog:** A mixture of smoke, gases and chemicals causes a smoky dark atmosphere, especially over cities. It decreases visibility and creates haze throughout the area.
- Rural India has hardly any arrangement to dispose off liquid waste. Only 56.4% of the urban wards have a sewer network. According to estimates, about 80% of the sewage in India flows into rivers, lakes and ponds. This sewage is untreated and pollutes water bodies.

8. Disaster Management: Responding to Disasters

Case Study - Tsunami

Shortly before 8 am on 26 December 2004, the cicadas fell silent and the ground shook in dismay. The Moken, an isolated tribe on the Andaman Islands in the Indian Ocean, knew that the Laboon, the 'wave that eats people', had stirred from his ocean lair. The Moken also knew what was next: a towering wall of water washing over their island, cleansing it of all that was evil and impure. To heed the Laboon's warning signs, elders told their children, run to high ground. 'If the water recedes after an earthquake, run immediately to high ground' The tiny Andaman and Nicobar Islands were directly in the path of the tsunami generated by the magnitude 9.1 of earthquake off the coast of Sumatra. Final total put the islands' death toll at 1,879 alone with another 5,600 people missing. The islanders who had heard the stories about the Laboon or similar mythological figures survived the tsunami essentially unscathed.

Most of the casualties that occurred in the southern Nicobar Islands were outsiders, leaving them with no indigenous tsunami warning system to guide them to higher ground. So, humans have passed down stories through the ages that helped cultures to cope when disaster inevitably struck. These stories were fodder for anthropologists and social scientists, but in the past decade, geologists have begun to pay more attention to how indigenous people understood and prepared for disaster. These stories, which couched myth in metaphor, could ultimately help scientists prepare for cataclysms to come. In this lesson, you will learn about how to respond to certain disasters to become resilient. A disaster is "a catastrophe that causes great damage or loss of life and property".

Disaster Response

Disaster response entails restoring physical facilities, rehabilitation of affected population, restoration of lost livelihoods and reconstruction efforts to restore the infrastructure lost or damaged. The Response Phase focuses primarily on emergency relief: saving lives, providing first aid, restoring damaged systems (communications and transportation),

meeting the basic life requirements of those impacted by disaster (food, water and shelter) and providing mental health and spiritual support and care.

Who are the first responders?

No matter how large or small, local communities are expected to provide immediate disaster response. On a daily basis, police officers, firefighters, and emergency medical technicians are a community's first responders, whether during fire, flood or acts of terrorism. Mental health professionals and the community's hospitals may also be activated in those early minutes and hours after disaster. Disaster management includes Prevention, Mitigation, Preparedness, Response and Recovery.

Disaster management involves all levels of government. Non-governmental and community based organizations play a vital role in the process. Modern disaster management goes beyond post-disaster assistance. It now includes pre-disaster planning and preparedness activities, organizational planning, training, information management, public relations and many other fields. Crisis management is important, but is only a part of the responsibility of a disaster manager. The traditional approach to disaster management has a number of phased sequences of action or a continuum. These can be represented as a disaster management cycle. We mainly focus on the way how the community should respond to disasters.

Earthquake

An earthquake is a sudden vibration of the part of the earth caused by plate movements. It occurs along the plate boundaries. The place inside the earth where an earthquake originates is focus. The point on the earth's surface above the called a focus is called an epicentre. The damage caused by the earthquake is the highest near the epicentre. The earthquake is measured by an instrument called a Seismograph. It is recorded in Richter scale. Let us now see how the communities can better respond to earthquakes.

What to do during an earthquake?

Be aware that some earthquakes are actually foreshocks and a larger earthquake might occur later. Minimize your movements to a few

steps that reach a safe place nearby and stay indoors until the shaking has stopped and you are sure exiting is safe.

If indoors

DROP to the ground; take COVER by getting under a sturdy table or other piece of furniture and HOLD ON until the shaking stops. If there is no table or desk near you, cover your face and head with your arms and crouch in an inside corner of the building.
Protect yourself by staying under the lintel of an inner door, in the corner of a room, under a table or even under a bed.
Stay away from glass windows, outside doors and walls and anything that could fall (such as lighting fixtures or furniture).
Stay inside until the shaking stops and go outside.

If outdoors

Move away from buildings, trees, streetlights and utility wires.

If you are in open space, stay there until the shaking stops. The greatest danger exists directly outside buildings at exits and alongside exterior walls. Most earthquake-related casualties result due to collapsing walls, flying glass and falling objects.

If in a moving vehicle

1. Stop as quickly as safety permits. Avoid stopping near or under buildings, trees, overpasses and utility wires.
2. Proceed cautiously once the earthquake has stopped. Avoid roads, bridges or ramps that might have been damaged by the earthquake.

Tsunami

A tsunami can kill or injure people and damage or destroy buildings and infrastructure as waves come forth and recede. A tsunami is a series of enormous ocean waves caused by earthquakes, underwater landslides, volcanic eruptions or asteroids. Tsunamis can travel 700-800 km per hour, with waves 10-30 meter high. It causes flooding and disrupts transportation, power, communications, and water supply.

How to respond to Tsunami?

1. You should find out if your home, school, workplace or other frequently visited locations are in tsunami hazard areas along the sea-shore.
2. Plan evacuation routes from your home, school, workplace, or any other place you could be, where tsunamis poses a risk.
3. Use a weather radio or stay tuned to a local radio or television station to keep informed of local watches and warnings.
4. Discuss tsunamis with your family. Everyone should be aware of what to do when tsunami strikes. Discussing tsunamis ahead of time will help reduce fear and save precious time in an emergency. Review flood safety and precautionary measures with your family.

What to do after a Tsunami?

1. You should continue using a weather radio or staying tuned to a Coast Guard emergency frequency station or a local radio or television station for updated emergency information.
2. Check yourself for injuries and get first aid if necessary, before helping injured or trapped persons.
3. If someone needs to be rescued, call professionals with the right equipment to help.
4. Help people who require special assistance, like Infants, elderly people, those without transportation, large families who may need additional help in an emergency situation, people with disabilities, and the people who care for them.
5. Stay out of a building if water remains around it. Tsunami water, like floodwater, can undermine foundations, causing buildings to sink, floors to crack, or walls to collapse.
6. Check for gas leaks. If you smell gas or hear a blowing or hissing noise, open a window and get everyone outside quickly.

Riot

Though riot may seem dramatic, an angry mob can be just as dangerous and unpredictable as just about any natural disaster. Thousands of people are killed in riots all over the world each year, and these riots erupt from a number of racial, religious, economic, political, or social causes that cannot be predetermined. As per Pew Research Center analysis of 198 countries on April 11, 2015. Syria tops in riot in

the world followed by Nigeria, Iraq and India. If you've found yourself in the middle of a riot, you may not be able to run away immediately, but you can take some measures to protect yourself from harm. If you want to know how to survive a riot, just follow these steps.

Surviving a Riot

At Travel Destination: What to Do

1. Keep abreast of the current news if you are in a volatile area.
2. If you come across a demonstration, don't become inquisitive, just leave the area and find another route to your intended destination.
3. Avoid any place where police or security forces action is in progress.

If caught in a riot:

1. If you find yourself caught up in a demonstration, keep to the edge of the crowd where it is safer. At the first opportunity, break away and seek refuge in a nearby building or find a suitable doorway or alley and stay there until the crowd passes.
2. When leaving the fringe of the demonstration, just walk away – don't run as this will draw attention to you.
3. In the event that you are arrested by the police/military, do not resist. Go along peacefully and contact your law advisor to help you resolve your predicament.
4. If you are caught up in the crowd, stay clear of glass shop fronts, moreover, move with the flow.
5. If shooting breaks out, drop to the ground and cover your head and neck, and lie as flat as you can.

Fire

1. Wildfires occur when vegetated areas are set alight and are particularly common during hot and dry periods. They can occur in forests, grasslands, bush and deserts, and with blowing wind, can spread rapidly.
2. Fires can lead to the destruction of buildings, wooden bridges and poles, power, transmission and telecommunication lines, warehouses containing oil products and other fuel. It causes injury to people and animals.

3. The most common causes of fires are lightning strikes, sparks during arid conditions, eruption of volcanoes and man-made fires arising from deliberate arson or accidents.
4. A side-effect of wildfires which also threatens inhabited areas is smoke. Fires create large quantities of smoke, which can be spread far by wind and poses a respiratory hazard.
5. On an average, in India, every year, about 25,000 persons die due to fires and related causes. Female accounts for about 66% of those killed in fire accidents. It is estimated that about 42 females and 21 males die every day in India due to fire.

Fire Safety Do's and Don'ts

1. Know your building's evacuation plan.
2. Evacuate calmly and quickly, whenever a fire alarm or carbon monoxide alarm sounds.
3. Before opening a door, feel it with the back of your hand. If the door is hot, do not open it.
4. If you encounter smoke during your evacuation, stay low to the floor.
5. Know the outside rally point for your building.
6. Know the locations of fire extinguishers, fire alarm pull stations and exits.

What you should do during a fire:

1. Stay calm.
2. Pull the nearest fire alarm or call 112.
3. Give your name and location of the fire. Do not hang up until the police dispatcher tells you to do so.
4. Leave the building immediately.
5. Inform others as you pass them to leave the building immediately.
6. Walk—don't run—to the nearest exit.
7. Never use elevators—an elevator may become a trap.

NOTE

- Japan is in a very active seismic area and it has the densest seismic network in the world.
- Which country actually has the most number of earthquakes? Indonesia is in a very active seismic zone also, but because it is

larger than Japan, it has more earthquakes.

- Which country has the most earthquakes per unit area? This would probably be Tonga, Fiji or Indonesia, since they are all in extremely active seismic areas along subduction zones.