

Components of Environment

SEMESTER I

The four major components of environment include lithosphere, hydrosphere, atmosphere and biosphere, corresponding to rocks, water, air and life respectively.

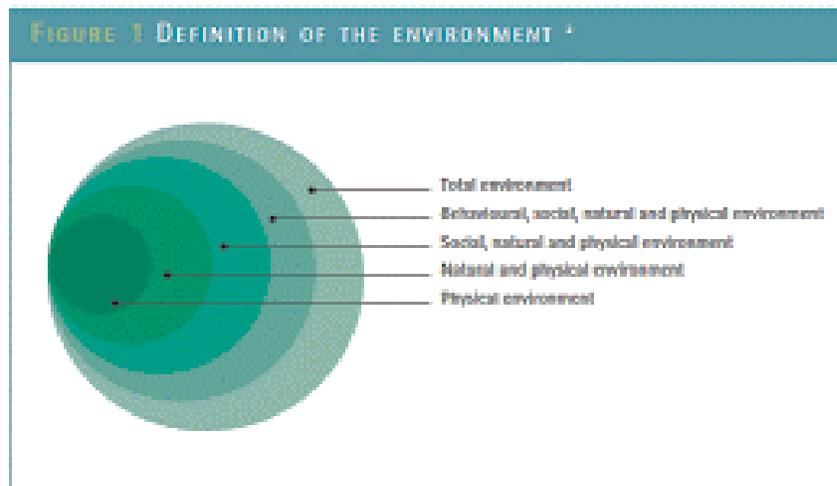
- **Lithosphere** is derived from the word "sphere," combined with the Greek word "lithos" which means rock. The lithosphere is the solid outer section of Earth which includes Earth's crust (the "skin" of rock on the outer layer of planet Earth), as well as the underlying cool, dense, and fairly rigid upper part of the upper mantle. The lithosphere extends from the surface of Earth to a depth of about 44-62 mi (70-100 km). The main component of lithosphere is earth's tectonic plates.
- **Hydrosphere** comprises of all forms of water bodies on earth including marine (oceans, seas) freshwater (rivers, lakes, ponds, streams) and groundwater resources etc. It covers 71% of earth's surface. 97% of water found on Earth is in the oceans in the form of salt water. Only 3 % of water on Earth is freshwater. Out of this, 30.8% is available as groundwater and 68.9% is in frozen forms as in glaciers. Amount of 0.3% is available in rivers, reservoirs and lakes and is easily accessible to man.
- **Atmosphere** is gaseous layer enveloping the Earth. The atmosphere with oxygen in abundance is unique to Earth and sustains life. It mainly comprises 78.08% nitrogen, 20.95% oxygen, 0.93% argon, 0.039% carbon dioxide, and traces of hydrogen, helium, and noble gases. The amount of water vapor present is variable (0-3%). Earth's atmosphere has a series of layers, each with its own specific traits. Moving upward from ground level, these layers are named the troposphere, stratosphere, mesosphere, thermosphere and exosphere. The troposphere is the lowest layer of our atmosphere. Starting at ground level, it extends upward to about 11 km (about 33,000 feet) above sea level. The next layer up is called the stratosphere. The stratosphere extends from the top of the troposphere to about 52 km (32 miles) above the ground. The infamous ozone layer is found within the stratosphere. Ozone molecules in this layer absorb high-energy ultraviolet (UV) light from the Sun, converting the UV energy into heat. Above the stratosphere is the mesosphere. It extends upward to a height of about 85 km (53 miles) above our planet. Most meteors burn up in the mesosphere. The layer of very rare air above the mesosphere is called the thermosphere. High-energy X-rays and UV radiation from the Sun are absorbed in the thermosphere, raising its temperature to hundreds or at times thousands of degrees. At the top of the thermosphere

temperatures can be found anywhere between 500 and 1,000 km (311 to 621 miles) above the ground. Temperatures in the upper thermosphere can range from about 500° C (932° F) to 2,000° C (3,632° F) or higher.

- **Biosphere** refers to all the regions on Earth where life exists. The ecosystems that support life could be in soil, air, water or land. The term **Biosphere** was coined by **Geologist Edward Suess** who used this term for place on Earth where life can be found. Biosphere refers to the sum total of all living matter, the biomass or biota. It extends from the polar ice caps to the equator, with each region harboring some life form suitable to the conditions there.

SEMESTER I**CONCEPT OF ENVIRONMENT**

- Term Environment – In English discourse, *Environment* borrowed from old French word *Environner* (1603 AD)
- *Environner* means to encircle or to surround
- *Environment* means the surrounding things and conditions affecting the plants and animals by Thomas Carlyle (1828)
- The emergence of the modern concept of environment started from **Thomas Carlyle's** translation of **Goethe's** work in 1828.
- **Environment:** is defined as sum total of all conditions that surround a particular organism at a particular point of time in space.
- Or**
- **Environment:** is defined as “all the physical, chemical, biological factors external to the organisms, that governs the growth and development.
- Or**
- **Environment:** is defined as "the aggregate of all external conditions and influences affecting life and development of an organism"



¹ (Adapted from Smith, Corvalán and Ejlertsson, 1999)

Environmental Factors Affecting Living Organisms

- **Environmental Factors (Terrestrial)**

- **Abiotic factors:** non-living factors e.g. aspect: north-facing slopes are cooler and darker than south facing slopes in Northern hemisphere
 - **Biotic factors:** living factors, e.g. food availability: more food will enable more organisms to live
 - **Climatic factors:** effects of weather, e.g. rain: more rain means more water, which supports more life
 - **Edaphic factors:** effects of soil, e.g. soil pH: pH affects growth of particular plants as pH affects enzyme action. Most plants grow at soil pH of 6.5 to 8.5
- **Environmental Factors (Aquatic)** Aquatic habitats have unique problems in comparison to terrestrial habitats. These problems include:
- **Light penetration** e.g. plankton grows better in the upper layers of water due to higher light intensity.
 - **Currents** transport organisms. Plants and animals subsequently get washed away unless they attach themselves to objects (e.g. limpets and many seaweeds).
 - **Wave action** moves and damages organisms
 - **Salt content** results in organisms adapting to freshwater or saltwater. This causes issues with water moving in or out of organisms and their cells.
 - **Tides** e.g. the amount of time organisms are exposed or submerged. Shore plants lose water at low tide. Organisms on shore have shells or mucilage to retain water
- **Temperature:** influences most plant processes, including photosynthesis, transpiration, respiration, germination, and flowering. As temperature increases (up to a point), photosynthesis, transpiration, and respiration increase. When combined with day-length, temperature also affects the change from vegetative (leafy) to reproductive (flowering) growth.
- **Water and Humidity:** Most growing plants contain about 90 percent water. Water plays many roles in plants. It is:
- A primary component in photosynthesis and respiration
 - Responsible for turgor pressure in cells (Like air in an inflated balloon, water is responsible for the fullness and firmness of plant tissue.

- A solvent for minerals and carbohydrates moving through the plant
- Responsible for cooling leaves as it evaporates from leaf tissue during transpiration
- A regulator of stomatal opening and closing, thus controlling transpiration and, to some degree, photosynthesis
- The source of pressure to move roots through the soil
- The medium in which most biochemical reactions take place

TYPES OF ENVIRONMENT

- **Bio-physical environment:** It is essential life-supporting environment. The bio-physical environment includes land, air, water, plants and animals, buildings and other infrastructure, and all of the natural resources that provide our basic needs and opportunities for social and economic development. A clean, healthy environment is important for people's physical and emotional wellbeing. At a fundamental level, factors such as clean air and good quality drinking water are vital for people's physical health.
- **Social environment:** social environments includes the immediate social relationships, and cultural settings within which defined groups of people function and interact. Components of the social environment include built infrastructure; industrial and occupational structure; labor markets; social and economic processes; wealth; social, human, and health services; power relations; government; race relations; social inequality; cultural practices; the arts; religious institutions and practices; and beliefs about place and community
- **Economic environment:** The economic environment is the sum total of the economic [conditions](#) and the nature of the economy in which the people has to live and compete. The economic conditions of people also have a huge impact on their physical health, mental health and education. People with low income, don't have access to good education and health facilities
- **Psychological environment:** is the interaction of the various sources of stress in our lives and how we respond to them, both individually and as communities. The Psychological environment enables us to understand the personality of an individual.

ENVIRONMENTAL SCIENCE**SEMESTER I****➤ Definition:**

Environmental Science-an **interdisciplinary** and **multidisciplinary** subject that studies how the earth works, how we interact with the earth, and how we can deal with the environmental problems we face.

Or

Environmental science-is the systematic study of environment and human existence in it, using scientific methods and provide socially acceptable, economically viable and scientifically reliable solution to environmental problems.

➤ **Multidisciplinary:** people from different disciplines or subjects work together, each drawing on their disciplinary knowledge.

➤ **Interdisciplinary:** integrating knowledge and methods from different disciplines or subjects, using a real synthesis of approaches.

❖ **Environmental science** is also referred to as an interdisciplinary field because it incorporates information and ideas from multiple disciplines such as biology, chemistry, geology, geography, economics, mathematics, political science, philosophy and ethics.

❖ By combining subjects of the natural sciences, social sciences, and the humanities, the field of environmental science can cover more concepts and also examine problems and topics from many different points of view.

➤ Difference between **Environmental Science** and **Environmental Studies**

❖ *Environmental Science*-uses fundamental knowledge from mathematics, chemistry, biology and physics coupled with specialization in a particular area of science to provide advanced scientific understanding of environmental problems and provide solutions.

For Example-if there is an oil spill in a lake caused by an equipment failure

Environmental science asks questions such as:

- How much oil was spilled?
- How will it impact physical, chemical and biological systems?
- What are the risks to humans, animals and habitats?
- What are long-term outcome of oil spill and how can we prevent this from happening in future from scientific point of view

❖ ***Environmental studies***-is the subject that provides an integrated understanding of social, political and historical aspects of our environmental issues with focus on policy, law and sociality aspects of these issues.

For Example-if there is an oil spill in a lake caused by an equipment failure

Environmental Studies asks questions such as:

- What are the economic and social impacts of oil spill?
- What policies, law and regulations are in place that were/were not followed in this situation? if there aren't any policies, regulations or law in place, how can we work with local governments to improve this situation.
- How can we educate common people about the effects of oil spill?
- How can we prevent this from happening in future?

SEMESTER I**IMPORTANCE OF ENVIRONMENTAL SCIENCE**

- Since **industrial revolution** (1760-1840)-the world has changed at a very rapid pace, some changes were beneficial (eradicating previously incurable disease, reducing infant mortality, providing security from invasion, reducing poverty, and securing resources such as water, energy, and minerals), but many of the changes were causing damage to our environment. Due to this increase in industrialization and the human population, there has also been an increase in pressure on the natural resources and ecosystem services that we rely on for survival.
- It was the **fossil fuel coal** that initiated the Industrial Revolution, forever changing the way people would live and utilize energy. While this pushed human progress to extraordinary levels, it came at extraordinary costs to our environment, and ultimately to the health of all living things.
- In the recent past- several environmental problems—such as pollution, global warming, ozone layer depletion, acid rain, deforestation, and desertification—have remained a major focus of scientists, policy makers, and common public across the world.
- These problems are perceived as the major threats to the life-supporting environment of the earth, thus making our survival on the planet increasingly unsafe.
- In order to tackle these challenges, holistic knowledge about working of our life-supporting environment and thorough understanding of the dynamics of these problems become imperative.
- Since no other academic discipline covers the above two knowledge requirements completely, environmental science evolved as an academic discipline to fill in this gap.
- The field of environmental science is a valuable resource for learning more about these changes and how they affect the world we live in.
- **Importance of environmental science.**
 - It aware us how our developmental and day-to-day activities affect environment and how we are affected by changes in the environmental conditions.
 - It encourages us to create a pollution-free environment (that is, clean air, water, land, and food) by adopting different methods of preventing and controlling pollution.
 - It guides us to utilize our natural resources such as water, forest, minerals, and fossil fuels in a judicious manner

- To adopt eco-friendly lifestyle by preventing and controlling pollution, and utilizing the resources efficiently in day-to-day activities
- Industries to adopt an eco-friendly mode by adopting clean and efficient technologies and installing pollution control systems.
- To solve complex global environmental problems such as climate change, ozone-layer depletion, desertification, and energy crisis by using different interdisciplinary tools and approaches.
- To adopt sustainable development strategy.