Unit 1: Introduction to environmental studies

Multidisciplinary nature of environmental studies

- **Definition of Environmental studies**
  - Environmental studies deal with every issue that affects an organism.
  - Environmental studies involve understanding human interactions with environment.
  - It is an applied science.
  - Its components include biology, geology, chemistry, physics, engineering, sociology, health, anthropology, economics, statistics, computers, and philosophy.
- **Scope and importance**
  - Environment is not a single subject. It is an integration of several subjects that include both Science and Social Studies.
  - To understand all the different aspects of our environment we need to understand biology, chemistry, physics, geography, resource management, economics, and population issues.
  - The scope of environmental studies is extremely wide and covers some aspects of nearly every major discipline.
  - We live in a world where natural resources such as land, water, forest, minerals, oil, grassland, and wetland are limited. We cannot continue to over-utilize these resources beyond the earth assimilative capacity. Thus, the sustainable use of resources is most importance.
- Need for public awareness:
  - As the earth's natural resources are declining and our environment is being increasingly degraded by human activities, hence it is evident that something needs to be done.
  - This can only be made possible through mass public awareness. Mass media such as newspapers, radio, television, strongly influence public opinion.
  - There are several Government and Non-Government Organizations (NGO's) working towards environmental protection in our country. They have created a growing interest in environmental protection and conservation of nature and natural resources.
  - Join a group to study nature, such as WWFI or BNHS, or another environmental group.
  - Begin reading newspaper articles such as 'Down to Earth,' WWF-I newsletter, BNHS Hornbill, Sanctuary magazine, etc. that will tell you more about our environment.
  - Join local movements that support activities such as saving trees in your area.
  - Take part in events organised on World Environment Day, Wildlife Week, etc.

Table: Environmentally significant day

Day & month	Event
02 February	World wetland day
28 February	National Science day
21 March	World forest day
22 March	Water day
18 April	World heritage day
22 April	Earth day
22 May	International biodiversity day
05 June	World environment day
11 July	World population day
16 September	World ozone day
28 September	Green consumer day
03 October	World habitat day
1-7 October	Wildlife week
04 October	Animal welfare day
02 December	Bhopal gas tragedy day

Institution in Environment

- **Bombay Natural History Society (BNHS), Mumbai**
  - The BNHS began as a small society of six members in 1883.
  - They are related with wildlife policy building, research, popular publications etc. Its major contribution has been in the field of wildlife research.
  - It is India's oldest conservation research-based NGO.

- **Botanical Survey of India (BSI):**
  - The Botanical Survey of India (BSI) was established in 1890 at the Royal Botanic Gardens, Calcutta.
  - BSI mainly encourage taxonomic research and preparation of a comprehensive list of the flora of the country, maintenance of herbaria etc.

- **Central Pollution Control Board (CPCB)**
  - It is a statutory organization which was constituted in 1974 under the Water (Prevention and Control of Pollution) Act 1974 and under air (Prevention and Control of Pollution) Act 1981.
  - CPCB is mainly focus on development of source-specific pollution control norms, setting up of ambient air and water quality criteria, monitoring of ambient air and water quality etc.

- **Centre for Science and Environment (CSE), New Delhi:**
  - Activities of this Centre include organising campaigns, holding workshops and conferences, and producing environment related publications.
  - The CSE also publishes a popular magazine, 'Down to Earth.

- **Ministry of Environment and Forest (MoEF)**
  - The MoEF is primarily concerned with the planning, promotion and coordination of the implementation of India's environmental and forestry policies and Programme.
  - The primary concern of MoEF lies in the implementation of policies and programs related to the conservation of the country natural resources including lakes and rivers, its biodiversity, forest and wildlife etc.

- **World Wide Fund for Nature (WWF-I), New Delhi**
  - The WWF-I was initiated in 1969 in Mumbai after which the headquarters were shifted to Delhi with several branch offices all over India.
  - It is mainly focused on wildlife education and conservation.

- **Wildlife Institute of India (WII), Dehradun:**
  - This Institution was established in 1982, as a major training establishment for Forest Officials and Research in Wildlife Management.
  - It has trained a large number of Forest Department Officials and Staff as Wildlife Managers.

- **Zoological Survey of India (ZSI):**
  - The ZSI was established in1916. Its mandate was to do a systematic survey of fauna in India.

People in Environment

There are several internationally known environmental thinkers.

- **Charles Darwin**
  - Charles Darwin wrote the 'Origin of Species', which brought to light the close relationship between habitats and species.

- **Rachel Carson**
  - In the 1960s Rachel Carson published several articles that caused immediate worldwide concern on the effects of pesticides on nature and mankind.
  - She wrote a well-known book called 'Silent Spring' which eventually led to a change in Government policy and public awareness.

- **Wangari Maathai**
  - Kenyan environmentalist, human rights activist, and feminist. The founder of the Green Belt Movement, which has planted 30 million trees.

- **Salim Ali's**
  - He is known as bird man of India.
  - He also wrote several great books including the famous 'Book of Indian Birds.'

- **Indira Gandhi**
  - Indira Gandhi as PM has played a highly significant role in the preservation of India's wildlife.
  - It was during her period as PM, that the network of protection area grew from 65 to 298. The Wildlife Protection Act was formulated during the period when she was PM

- **M S Swaminathan**
  - He is known as Father of green revolution in India.
  - M S Swaminathan is one of India's foremost agricultural scientists and has also been concerned with various aspects of biodiversity conservation.
  - He has founded the MS Swaminathan Research Foundation in Chennai, which does work on the conservation of biological diversity.

- **M C Mehta**
  - M C Mehta is India's most famous environmental lawyer. Since 1984. He has filed several Public Interest Litigations for supporting the cause of environmental conservation.

- **Anil Agarwal**
  - Anil Agarwal was a journalist who wrote the first report on the 'State of India's Environment' in 1982.
  - He founded the Centre for Science and Environment which is an active NGO that supports various environmental issues.

- **Sunderlal Bahuguna's**
  - He is related to Chipko Movement.
  - Chipko Movement has become an internationally well-known example of a highly successful conservation action program through the efforts of local people for guarding their forest resources.

Components of environment

- **Atmosphere:**
  - The major components of the atmosphere are nitrogen and oxygen while the minor components are argon, carbon dioxide and some trace gases.
  - The components may be expressed as per cent by volume.
    - Nitrogen: 78.0%
    - Oxygen: 20.9%
    - Argon: 0.93%
    - Carbon dioxide: 0.03%

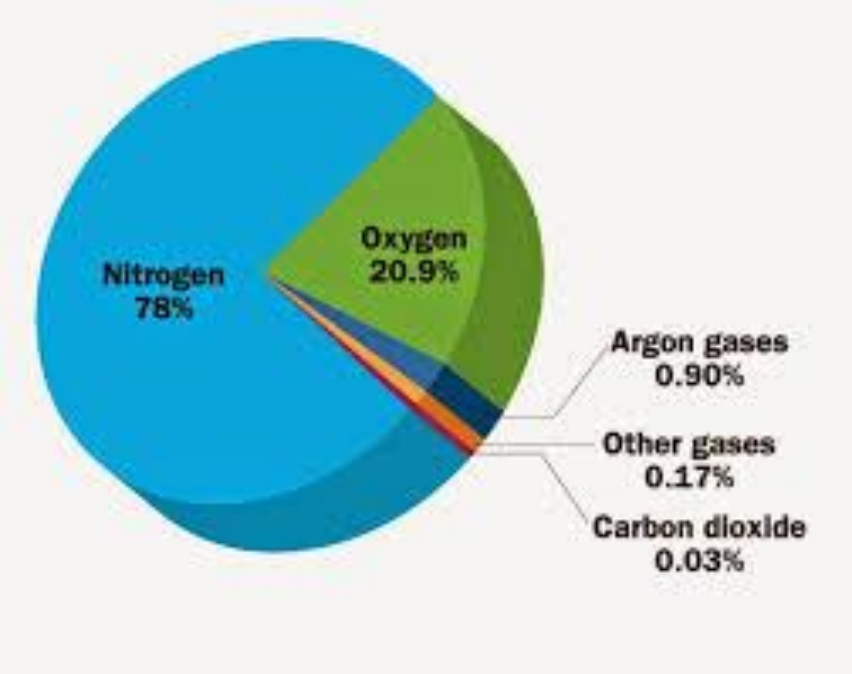

Fig. Composition of atmosphere

- # Atmospheric structure:

The atmosphere is broadly dived into four regions:

✓ Troposphere

- It is extended from 0 to 11 km from the earth surface.
- It contains 70% of the atmosphere.
- The temperature of the troposphere falls off uniformly with increasing altitude.
- The air near the ground level is heated by radiation from the earth.
- The cold layer at the top of the troposphere is called as tropopause.

✓ Stratosphere

- It is extended from 11 to 50 km from the earth surface.
- Stratosphere contains ozone layer which absorbs ultraviolet radiation (UV) of sun.
- Stratosphere acts as a positive shield for life on the earth due to the presence of ozone layer.
- The temperature increases with increasing altitude in this region because Ozone in this region absorbers UV radiation and rises the temperature.

✓ Mesosphere:

- It is extended from 50 to 85 km from the earth surface.
- Temperature falls with increasing altitude in this region. This is due to low level of ultraviolet-absorbing species, particularly ozone.

✓ Thermosphere:

- It is situated above the mesosphere and extended from 85 to 500 km from the surface of earth.
- Here temperature rises with increasing altitude in this region. Here, atmospheric gases particularly oxygen and nitric oxide split into atoms and also undergo ionization after absorption of solar radiation.
- The atmosphere plays an important role in maintaining the heat balance of the earth through absorption of infra-red radiation emitted by the sun and re-emitted from the earth.

- Man has polluted the atmosphere by dumping harmful waste aerosols, gases and fumes into it. This has affected the world climate and the future of mankind

✓ Hydrosphere:

- The hydrosphere consists of all types of water resources—oceans, seas, rivers, lakes, streams, reservoirs, glaciers, polar ice caps and ground water.
- About 97% of the earths water present in the oceans, which is unfit for human consumptions and other uses because of its high salt content. And out of the remaining 3%, 2% is locked in the polar ice caps and remaining 1% is available as fresh water in rivers, lakes, streams, reservoir, and ground water which is suitable for human consumption.
- The mass balance of annual rainfall shows that about 70% of rainfall is lost by direct evaporation and transpiration by plants, while the remaining 30% goes into the stream flow.
- Irrigation for agriculture purpose and hydro-electric power generating are the major consumers of water.
- The major importance of the hydrosphere is that water sustains various life forms and plays an important role in ecosystems and regulating the atmosphere.
- Oxygen and hydrogen are the most abundant elements in Earth's hydrosphere
- Rainwater is the primary source of water. The water cycle is a series of events that include evaporation, condensation, and precipitation with rainfall as the final product.
- Water pollution, river damming, climate change and irrigation have all changed the hydrosphere.
- Hydrosphere provides a place for many plants and animals to live in. Many gasses like CO_2, O_2, nutrients like ammonium and nitrite(NO^-_2) as well as other ions are dissolved in water

✓ Lithosphere

- The earth's crust is known as the lithosphere.
- It includes the soil which covers the rock's crust in many places.
- Soil is suitable for the growth of plants—after death and decay, plant debris returns to soil. The mineral component of soil comes from the parent rocks by weathering processes while the organic component is due to plant biomass as well as populations of bacteria, fungi and insects (earthworms).

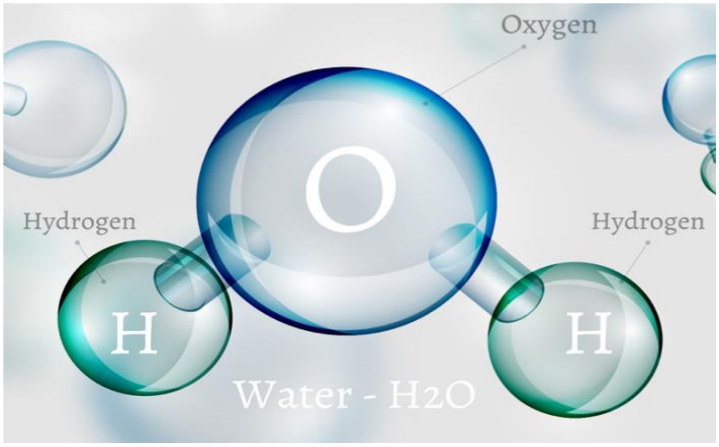

Fig. Structure of water

- Soil has an important role as it produces food for us and animals.
- Soil is an important component of natural cycles.
- Due to human activities soil becomes the dumping ground for many pollutants including pesticides, fertilizers, industrial effluents, and particulate matter from smoke chimneys of factories, etc.
- In general, soil has a loose structure consisting of solid mineral and organic matter and air spaces.
- The top layer, up to several inches thick, is known as the topsoil which is an index of the soil quality. This is the layer of maximum biological productivity, and it contains bulk of the organic matter. Hence it is very important for vegetation cover and agricultural crops.
- loss of topsoil is known as soil erosion, which also means loss of agricultural production. The underlying layer is the sub-soil which receives organic matter, salts and clay particles leached from the topsoil.
- The third layer (zone) consists of weathered parent rocks from which the soil was formed.

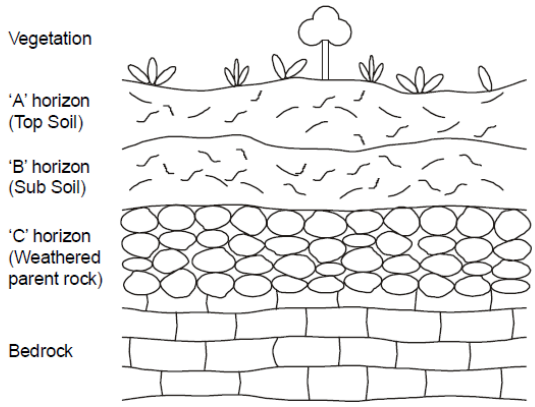

Fig. 2.1 Soil profile showing soil horizons

- Soil, however, receives large quantities of waste products—domestic, human, animal and industrial. Fertilizers and pesticides applied to crops are retained by the soil and spread into the environment, namely, water bodies by leaching.
- Pesticide residues in crops and food get into the human food chain causing long-time health hazards.
- The Soil is essentially silicate minerals, 74.3% of which consists of silicon and oxygen.
- The common elements of soil are oxygen 46.6%, silicon 27.7%, aluminum 8.1%, iron 5%, calcium 3.6% etc.
- There is various type of soil such as

(a) Sandy soil:

- Sandy Soil is light, warm, dry and tends to be acidic and low in nutrients.
- Sandy soils are one of the poorest types of soil for growing plants because it has very low nutrients and poor water holding capacity, which makes it hard for the plant's roots to absorb water.
- Sandy soils are largely observed in arid and semi-arid regions of north-western plains and along the coastline.
- Sandy soil is good for growing vegetables because it has excellent drainage.

(b) Silt soil:

- Silt Soil is a light and moisture retentive soil type with a high fertility rating.
- Silt is easily transported by moving currents and it is mainly found near the river, lakes and other water bodies.
- Silt soil is more fertile compared to the sandy soil. Therefore, it is also used in agricultural practices to improve soil fertility.
- At least 35-40% of India has silty soil.
- Shrubs, climbers, grasses etc like silty soil.

(c) Clay soil:

- Clay soil is soil that is comprised of very fine mineral particles.
- Clay is commonly present near freshwater lakes, ponds or rivers.
- Clay soils are very sticky They can hold more total water than other soil types.
- Clay soils offer plants two major advantages over other soil types: they hold water well, minimizing drought stress, and are abundant in nutrients essential for plant growth.
- Clay soil retains most nutrients very well, so clays usually are very fertile.

(d) Loam soil:

- Loam is soil made with a balance of the three main types of soil: sand, silt, and clay soil.
- It contains more moisture, nutrients and humus compared to sandy soil and better drainage compared to clay and silt soil.
- Loams are the best soils for growing plants.
- Loamy soil is ideal for most garden plants because it holds plenty of moisture but also drains well so that sufficient air can reach the roots.
- Loamy soil is ideal for growing several crops such as wheat, sugarcane, cotton, pulses etc.

Biosphere:

- Biosphere consists of the earth's crust, hydrosphere, atmosphere, and various living species (microorganisms to man) which exist in the zone 600 meters above earth's surface and 10,000 meters below sea level.

- The two components of the biosphere are called the abiotic and the biotic. The abiotic, or non-living, portion of each ecosystem includes the flow of energy, nutrients, water, and gases and the concentrations of organic and inorganic substances in the environment.
- Both biosphere and environment have close interactions with each other. Thus, oxygen and carbon dioxide levels of the atmosphere depend entirely on the plant world.
- The biosphere helps in recycling nutrients, like oxygen and nitrogen, to sustain life on Earth.
- Green plants are responsible for the accumulations of oxygen in the atmosphere through photosynthesis
- Biomass/glucose break down in the presence of oxygen and produce Carbon di oxide (aerobic respiration).
- Acts like deforestation and burning of fossil fuels have negative environmental impacts which directly affect the biosphere.

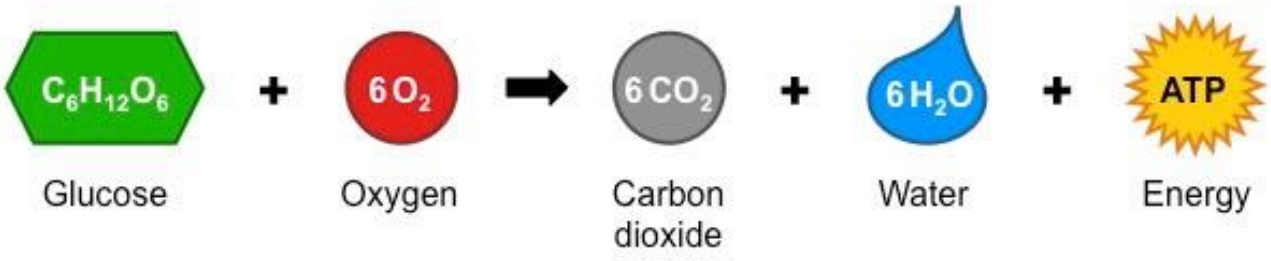

Fig. Aerobic respiration equation

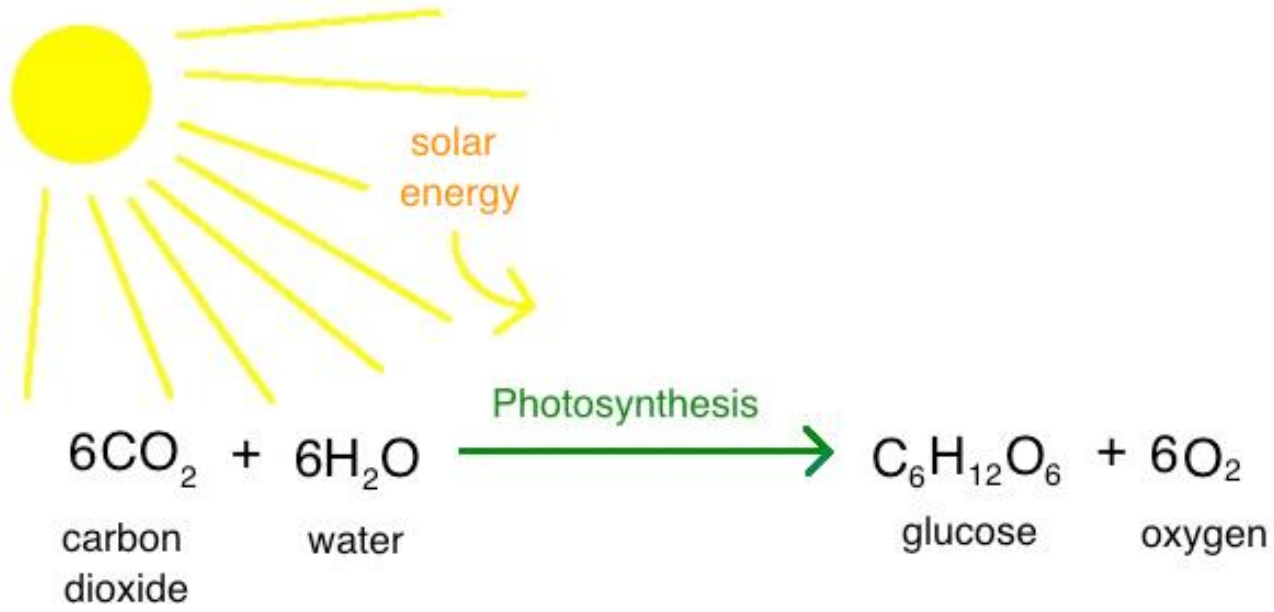

Fig. Photosynthesis equation

Concept of sustainability and sustainable development:

- Sustainability consists of fulfilling the needs of current generations without compromising the needs of future generations, while ensuring a balance between economic growth, environmental care, and social well-being.

- Sustainable development is defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs. This definition was given by the Norwegian Prime Minister, G.H. Brundtland, who was also the Director of World Health Organisation (WHO).
- Sustainable development is the path of development, which is environmentally sound, ecologically viable, and socially acceptable.
- Discussion on sustainable development emerged on an international level in 1992, in the UN Conference on Environment and development (UNCED), popularly known as The Earth Summit, held at Rio de Janeiro, Brazil.
- Agenda 21 is an action plan of the United Nation related with Sustainable development.
- The Sustainable Development Goals (SDGs) aim to transform our world. They are a call to action to end poverty and inequality, protect the planet, and ensure that all people enjoy health, justice, and prosperity.
- Many of the challenges facing humankind, such as climate change, water scarcity, inequality, and hunger, can only be resolved at a global level and by promoting sustainable development: a commitment to social progress, environmental balance and economic growth.
- Hence sustainable development has 3 main aims i.e., Securing economic development, social equity and justice, and environmental protection.
- Eenvironmental message in 2022, **"Only One Earth"** is the campaign slogan, with the focus on "Living Sustainably in Harmony with Nature".

Measures for Sustainable Development:

Some of the important measures for sustainable development are as follows:

(1) Using appropriate technology:

- It is one which is locally adaptable, eco-friendly, resource-efficient, and culturally suitable.
- It mostly involves local resources and local labour.

(2) Reduce, Reuse, Recycle approach (3R approach):

- The 3-R approach advocating minimization of resource use, using them again and again instead of passing it on to the waste stream and recycling the materials goes a long way in achieving the goals of sustainability.
- It reduces pressure on our resources as well as reduces waste generation and pollution.

(3) Prompting environmental education and awareness:

- Making environmental education the centre of all learning process will greatly help in changing the thinking and attitude of people towards our earth and the environment.

(4) Resource utilization as per carrying capacity:

- Any system can sustain a limited number of organisms on a long-term basis which is known as its carrying capacity.
- Sustainability of a system depends largely upon the carrying capacity of the system. If the carrying capacity of a system is crossed (say, by over exploitation of a resource) then environmental degradation starts.

Brief history of the Environmental Movements in India

- **Bishnoi Movement**
  - This movement was started by sage Sombaji around 1700 AD against deforestation.
  - After that Amrita Devi forwarded the movement.
  - The 363 people from the Bishnoi community were killed in the protest. When the king of this region came to know the protest and killing then he rushed to the village and apologized and declared the region as protected area.
- **Chipko Movement**
  - It was launched from Gopeshwar in Chamoli district, Uttarakhand in 1973.
  - The movement was to prevent illegal cutting of trees in the Himalayan region (Uttarakhand).
  - Sunder Lal Bahuguna and Chandi Prasad Bhatt were the leaders of this movement.
- **Appiko Movement**
  - In 1983, on the lines of Chipko Movement, Pandurang Hegde launched a movement which is come to known as Appiko Movement in Karnataka.
  - Its main objectives were afforestation as well as development, conservation and proper utilization of forests in the best manner.

- **Silent Valley Movement**
  - It is an area of tropical evergreen forests in Kerala. It is very rich in biodiversity.
  - The environmentalists and the local people strongly objected to the hydel power project being set up here in 1973. Under pressure, the government had to declare it the national reserve forests in 1985.
- **Narmada Bachao Movement**
  - The environmentalists and the local people started protest against the building of Dams on the Narmada for the production of hydroelectricity since 1985 which was popularly known as Narmada Bachao Aandolan.
  - Medha Patkar has been the leader of this aandolan.
- **Tehri Dam Conflict**
  - This movement was started by the local people around 1980s and 1990s because the dam project would construct in the seismic sensitive region and people think that it causes submergence of forest areas along with Tehri town. Sunder Lal Bahuguna is related with Tehri Dam Conflict