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Topic covered:

- Unit-1-

The Multidisciplinary Nature of Environmental Studies

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Unit 1

The Multidisciplinary Nature of Environmental Studies

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Reference books were considered for preparing the study materials:

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2. *World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press, USA.*
3. *Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y., and Berg, L.R. (2015). Environment, 9th Edition. Wiley Publishing, USA*
4. *Singh, J.S., Singh, S.P., and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.*
5. *Kaushik, Anubha and Kaushik, C.P. (2018)Perspectives in Environmental Studies*
6. *Bharucha, Erach Textbook of Environmental Studies for Undergraduate Courses(2018)*
7. *Sharma, P.D. Environment and Ecology (2018)*
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NOTE: ***The prepared study materials are indicative only. For complete coverage, please refer to the mentioned textbooks or the basic books like "Textbook for Environmental Studies" by Erach Bharucha"***

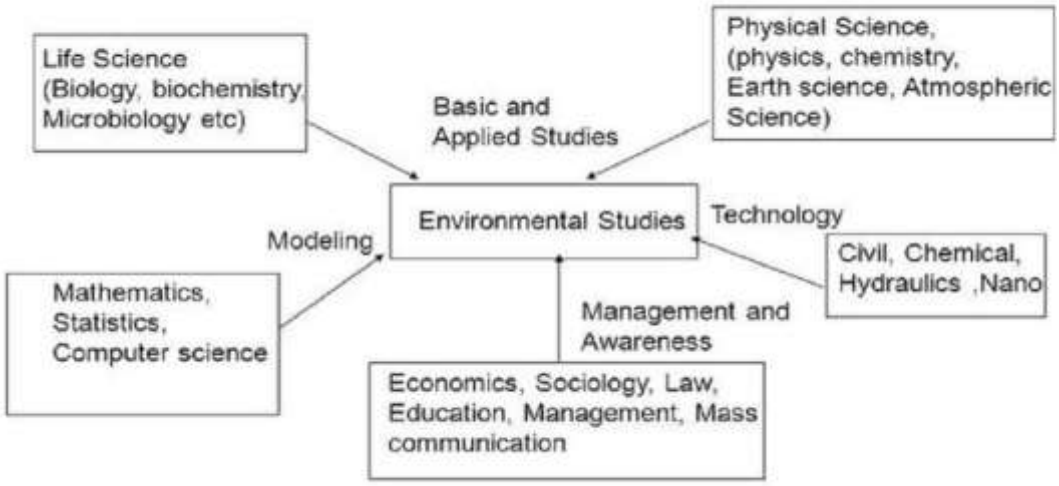
The Multidisciplinary Nature of Environmental Studies

1.1 DEFINITION, SCOPE AND IMPORTANCE

1.1.1 Definition

Environmental studies deals with every issue that affects an organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impacts on its integrity. It is an applied science as its seeks practical answers to making human civilization sustainable on the earth's finite resources.

Its components include biology, geology, chemistry, physics, engineering, sociology, health, anthropology, economics, statistics, computers and philosophy.



1.1.2 Scope

As we look around at the area in which we live, we see that our surroundings were originally a natural landscape such as a forest, a river, a mountain, a desert, or a combination of these elements. Most of us live in landscapes that have been heavily modified by human beings, in villages, towns or cities. But even those of us who live in cities get our food supply from surrounding villages and these in turn are dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder, and fish. Thus our daily lives are linked with our surroundings and inevitably affects them. We use water to drink and for other day-to-day activities. We breathe air, we use resources from which food is made and we depend on the community of living plants and animals which form a web of life, of which we are also a part. Everything around us forms our environment and our lives depend on keeping its vital systems as intact as possible.

Our dependence on nature is so great that we cannot continue to live without protecting the earth's environmental resources. Thus most traditions refer to our environment as 'Mother

Nature' and most traditional societies have learned that respecting nature is vital for their livelihoods. This has led to many cultural practices that helped traditional societies protect and preserve their natural resources. Respect for nature and all living creatures is not new to India. All our traditions are based on these values. Emperor Ashoka's edict proclaimed that all forms of life are important for our well being in Fourth Century BC.

Over the past 200 years however, modern societies began to believe that easy answers to the question of producing more resources could be provided by means of technological innovations. For example, though growing more food by using fertilizers and pesticides, developing better strains of domestic animals and crops, irrigating farmland through mega dams and developing industry, led to rapid economic growth, the ill effects of this type of development, led to environmental degradation.

The industrial development and intensive agriculture that provides the goods for our increasingly consumer oriented society uses up large amounts of **natural resources** such as water, minerals, petroleum products, wood, etc. **Non renewabl**e resources, such as minerals and oil are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations. **Renewable** resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as regrowth or rainfall. But these too will be depleted if we continue to use them faster than nature can replace them. For example, if the removal of timber and firewood from a forest is faster than the regrowth and regeneration of trees, it cannot replenish the supply. And loss of forest cover not only depletes the forest of its resources, such as timber and other non-wood products, but affect our water resources because an intact natural forest acts like a sponge which holds water and releases it slowly. Deforestation leads to floods in the monsoon and dry rivers once the rains are over. Such multiple effects on the environment resulting from routine human activities must be appreciated by each one of us, if it is to provide us with the resources we need in the long-term. Our natural resources can be compared with money in a bank. If we use it rapidly, the capital will be reduced to zero. On the other hand, if we use only the interest, it can sustain us over the longer term. This is called **sustainable utilisation or development.**

1.1.3 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. Thus the scope of environmental studies is extremely wide and covers some aspects of nearly every major discipline.

We live in a world in which natural resources are limited. Water, air, soil, minerals, oil, the products we get from forests, grasslands, oceans and from agriculture and livestock, are all a part of our life support systems. Without them, life itself would be impossible. As we keep increasing in numbers and the quantity of resources each of us uses also increases, the earth's resource base must inevitably shrink. The earth cannot be expected to sustain this expanding level of utilization of resources. Added to this is misuse of resources. We waste

or pollute large amounts of nature's clean water; we create more and more material like plastic that we discard after a single use; and we waste colossal amounts of food, which is discarded as garbage. Manufacturing processes create solid waste byproducts that are discarded, as well as chemicals that flow out as liquid waste and pollute water, and gases that pollute the air. Increasing amounts of waste cannot be managed by natural processes. These accumulate in our environment, leading to a variety of diseases and other adverse environmental impacts now seriously affecting all our lives. Air pollution leads to respiratory diseases, water pollution to gastro-intestinal diseases, and many pollutants are known to cause cancer.

Improving this situation will only happen if each of us begins to take actions in our daily lives that will help preserve our environmental resources. We cannot expect Governments alone to manage the safeguarding of the environment, nor can we expect other people to prevent environmental damage. We need to do it ourselves. It is a responsibility that each of us must take on as one's own.

Productive value of nature:

As scientists make new advances in fields such as biotechnology we begin to understand that the world's species contain an incredible and uncountable number of complex chemicals. These are the raw materials that are used for developing new medicines and industrial products and are a storehouse from which to develop thousands of new products in the future. The flowering plants and insects that form the most species rich groups of living organisms are thus vital for the future development of man. If we degrade their habitat these species will become extinct. If one sees being sold or used, a product that comes from an illegally killed wild species, if we do not inform the authorities, we become party to its extinction. Once they are lost, man cannot bring them back. When we permit the destruction of a forest, wetland or other natural area and do not protest about it, future generations are being denied the use of these valuable resources and will blame us for these rash and negligent actions towards the environment. Thus the urgent need to protect all living species is a concept that we need to understand and act upon. While individually, we perhaps cannot directly prevent the extinction of a species, creating a strong public opinion to protect the National Parks and Wildlife Sanctuaries in which wild species live is an importance aspect of sustainable living. There is a close link between agriculture and the forest, which illustrates its productive value. For crops to be successful, the flowers of fruit trees and vegetables must be pollinated by insects, bats and birds. Their life cycles however frequently require intact forests.

Aesthetic/Recreational value of nature: The aesthetic and recreational values that nature possesses enlivens our existence on earth. This is created by developing National Parks and Wildlife Sanctuaries in relatively undisturbed areas. A true wilderness experience has not only recreational value but is an incredible learning experience. It brings about an understanding of the oneness of nature and the fact that we are entirely dependent upon the intricate functioning of ecosystems.

The beauty of nature encompasses every aspect of the living and non-living part of our earth. One can appreciate the magnificence of a mountain, the power of the sea, the beauty of a forest, and the vast expanse of the desert. It is these natural vistas and their incredible diversity of plant and animal life that has led to the development of several philosophies of life. It has also inspired artists to develop visual arts and writers and poets to create their works that vitalize our lives.

A wilderness experience has exceptional recreational value. This has been described as nature tourism, or wildlife tourism, and is also one aspect of adventure tourism. These recreational facilities not only provide a pleasurable experience but are intended to create a deep respect and love for nature. They are also key tools in educating people about the fragility of the environment and the need for sustainable lifestyles.

In an urban setting, green spaces and gardens are vital to the pschycological and physical health of city dwellers. It provides not only an aesthetic and visual appeal but the ability to ensure that each individual is able to access a certain amount of peace and tranquillity. Thus urban environmental planners must ensure that these facilities are created in growing urban complexes. Another important conservation education facility in urban settings includes the need to set up well designed and properly managed zoological parks and aquariums. These have got great value in sensitizing school students to wildlife. Many young people who frequented zoos as young children grow up to love wildlife and become conservationists.

In the absence of access to a Protected Area, a botanical garden or a zoo, one concept that can be developed is to create small nature awareness areas with interpretation facilities at district and taluka levels. These areas can be developed to mimic natural ecosystems even though they could be relatively small in size. Such nature trails are invaluable assets for creating conservation education and awareness. They can be developed in a small woodlot, a patch of grassland, a pond ecosystem, or be situated along an undisturbed river or coastal area. This would bring home to the visitor the importance of protecting our dwindling wilderness areas.

The option values of nature: While we utilise several goods and services of nature and enjoy its benefits, we must recognize that every activity that we do in our daily lives has an adverse impact on nature's integrity. Thus if we use up all our resources, kill off and let species of plants and animals become extinct on earth, pollute our air and water, degrade land, and create enormous quantities of waste, we as a generation will leave nothing for future generations. Our present generation has developed its economies and lifestyles on unsustainable patterns of life. however, nature provides us with various options on how we utilize its goods and services. This is its option value. We can use up goods and services greedily and destroy its integrity and long term values, or we can use its resources sustainably and reduce our impacts on the environment. The option value allows us to use its resources sustainably and preserve its goods and services for the future.

1.2 NEED FOR PUBLIC AWARENESS

As the earth's natural resources are dwindling and our environment is being increasingly degraded by human activities, it is evident that something needs to be done. We often feel

that managing all this is something that the Government should do. But if we go on endangering our environment, there is no way in which the Government can perform all these clean-up functions. It is the prevention of environment degradation in which we must all take part that must become a part of all our lives. Just as for any disease, prevention is better than cure. To prevent ill-effects on our environment by our actions, is economically more viable than cleaning up the environment once it is damaged. Individually we can play a major role in environment management. We can reduce wasting natural resources and we can act as watchdogs that inform the Government about sources that lead to pollution and degradation of our environment.

This can only be made possible through mass public awareness. Mass media such as newspapers, radio, television, strongly influence public opinion. However, someone has to bring this about. If each of us feels strongly about the environment, the press and media will add to our efforts. Politicians in a democracy always respond positively to a strong publicly supported movement. Thus if you join an NGO that supports conservation, politicians will make green policies. We are living on spaceship earth with a limited supply of resources. Each of us is responsible for spreading this message to as many people as possible.

Suggested further activities for concerned students:

• Join a group to study nature, such as WWFI or BNHS, or another environmental group.

• Begin reading newspaper articles and periodicals such as 'Down to Earth', WWF-I newsletter, BNHS Hornbill, Sanctuary magazine, etc. that will tell you more about our environment. There are also several environmental websites.

• Lobby for conserving resources by taking up the cause of environmental issues during discussions with friends and relatives. Practice and promote issues such as saving paper, saving water, reducing use of plastics, practicing the 3Rs principle of reduce, reuse, recycle, and proper waste disposal.

• Join local movements that support activities such as saving trees in your area, go on nature treks, recycle waste, buy environmentally friendly products.

• Practice and promote good civic sense such as no spitting or tobacco chewing, no throwing garbage on the road, no smoking in public places, no urinating or defecating in public places.
• Take part in events organised on World Environment Day, Wildlife Week, etc.

• Visit a National Park or Sanctuary, or spend time in whatever nature you have near your home.

1.2.1 Institutions in Environment

There have been several Government and Nongovernment organizations that have led to environmental protection in our country. They have led to a growing interest in environmental protection and conservation of nature and natural resources. The traditional conservation practices that were part of ancient India's culture have however gradually disappeared. Public awareness is thus a critical need to further environmental protection. Among the large number of institutions that deal with environmental protection and

conservation, a few well-known organizations include government organisations such as the BSI and ZSI, and NGOs such as BNHS, WWF-I, etc.

Bombay Natural History Society (BNHS), Mumbai: the BNHS began as a small society of six members in 1883. It grew from a group of shikaris and people from all walks of life into a major research organisation that substantially influenced conservation policy in the country. The influence on wildlife policy building, research, popular publications and peoples action have been unique features of the multifaceted society. Undoubtedly its major contribution has been in the field of wildlife research. It is India's oldest conservation research based NGO and one that has acted at the forefront of the battle for species and ecosystems. The BNHS publishes a popular magazine called Hornbill and also an internationally well-known Journal on Natural History. Its other publications include the Salim Ali Handbook on birds, JC Daniel's book of Indian Reptiles, SH Prater's book of Indian Mammals and PV Bole's book of Indian Trees. One of its greatest scientists was Dr. Salim Ali whose ornithological work on the birds of the Indian subcontinent is world famous. The BNHS has over the years helped Government to frame wildlife related laws and has taken up battles such as the 'Save the Silent Valley' campaign.

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. The early years focused attention on wildlife education and awareness. It runs several programs including the Nature Clubs of India program for school children and works as a think tank and lobby force for environment and development issues.

Centre for Science and Environment (CSE), New Delhi: Activities of this Center include organising campaigns, holding workshops and conferences, and producing environment related publications. It published a major document on the 'State of India's Environment', the first of its kind to be produced as a Citizen's Report on the Environment. The CSE also publishes a popular magazine, 'Down to Earth', which is a Science and Environment fortnightly. It is involved in the publication of material in the form of books, posters, video films and also conducts workshops and seminars on biodiversity related issues.

CPR Environmental Education Centre, Madras: The CPR EEC was set up in 1988. It conducts a variety of programs to spread environmental awareness and creates an interest in conservation among the general public. It focussed attention on NGOs, teachers, women, youth and children to generally promote conservation of nature and natural resources. Its programs include components on wildlife and biodiversity issues. CPR EEC also produces a large number of publications.

Centre for Environment Education (CEE), Ahmedabad: The Centre for Environment Education, Ahmedabad was initiated in 1989. It has a wide range of programs on the environment and produces a variety of educational material. CEE's Training in Environment Education {TEE} program has trained many environment educators.

Bharati Vidyapeeth Institute of Environment Education and Research (BVIEER), Pune: This is part of the Bharati Vidyapeeth Deemed University. The Institute has a PhD, a Masters and Bachelors program in Environmental Sciences. It also offers an innovative

Diploma in Environment Education for in-service teachers. It implements a large outreach programme that has covered over 135 schools in which it trains teachers and conducts fortnightly Environment Education Programs. Biodiversity Conservation is a major focus of its research initiatives. It develops low cost Interpretation Centres for Natural and Architectural sites that are highly locale specific as well as a large amount of innovative environment educational material for a variety of target groups. Its unique feature is that it conducts environment education from primary school level to the postgraduate level. The BVIEER has produced several EE aids. It has developed a teacher's handbook linked to school curriculum, a textbook for UGC for its undergraduate course on environment. Its Director has developed a CD ROM on India's biodiversity published by Mapin Publishers, Ahmedabad.

Uttarkhand Seva Nidhi (UKSN), Almora: The Organisation is a Nodal Agency which supports NGOs in need of funds for their environment related activities. Its major program is organising and training school teachers to use its locale specific Environment Education Workbook Program. The main targets are linked with sustainable resource use at the village level through training school children. Its environment education program covers about 500 schools.

Kalpavriksh, Pune: This NGO, initially Delhi based, is now working from Pune and is active in several other parts of India. Kalpavriksh works on a variety of fronts: education and awareness; investigation and research; direct action and lobbying; and litigation with regard to environment and development issues. Its activities include talks and audio-visuals in schools and colleges, nature walks and outstation camps, organising student participation in ongoing campaigns including street demonstrations, pushing for consumer awareness regarding organic food, press statements, handling green alerts, and meetings with the city's administrators. It is involved with the preparation of site-specific, environmental manuals for schoolteachers. Kalpavriksh was responsible for developing India's National Biodiversity Strategy and Action Plan in 2003.

Salim Ali Center for Ornithology and Natural History (SACON), Coimbatore: This institution was Dr. Salim Ali's dream that became a reality only after his demise. He wished to support a group of committed conservation scientists on a permanent basis. Initially conceived as being a wing of the Bombay Natural History Society (BNHS) it later evolved as an independent organisation based at Coimbatore in 1990. It has instituted a variety of field programs that have added to the country's information on our threatened biodiversity.

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. Its most significant publication has been 'Planning A Wildlife Protected Area Network for India' (Rodgers and Panwar, 1988). The organisation has over the years added an enormous amount of information on India's biological wealth. It has trained a large number of Forest Department Officials and Staff as Wildlife Managers. Its M.Sc. Program has trained excellent wildlife scientists. It also has an Environment Impact Assessment (EIA) cell. It trains personnel in ecodevelopment, wildlife biology, habitat management and Nature interpretation.

Botanical Survey of India (BSI): The Botanical Survey of India (BSI) was established in 1890 at the Royal Botanic Gardens, Calcutta. However it closed down for several years after 1939 and was reopened in 1954. In 1952 plans were made to reorganise the BSI and formulate its objectives. By 1955 the BSI had its headquarters in Calcutta with Circle Offices at Coimbatore, Shillong, Pune and Dehra Dun. Between 1962 and 1979, offices were established in Allahbad, Jodhpur, Port Blair, Itanagar and Gangtok. The BSI currently has nine regional centres. It carries out surveys of plant resources in different regions.

Zoological Survey of India (ZSI): The ZSI was established in1916. Its mandate was to do a systematic survey of fauna in India. It has over the years collected 'type specimens' on the bases of which our animal life has been studied over the years. Its origins were collections based at the Indian Museum at Calcutta, which was established in 1875. Older collections of the Asiatic Society of Bengal, which were made between 1814 and 1875, as well as those of the Indian Museum made between 1875 and 1916 were then transferred to the ZSI. Today it has over a million specimens! This makes it one of the largest collections in Asia. It has done an enormous amount of work on taxonomy and ecology. It currently operates from 16 regional centres.

1.2.2 People in Environment

There are several internationally known environmental thinkers. Among those who have made landmarks, the names that are usually mentioned are Charles Darwin, Ralph Emerson, Henry Thoreau, John Muir, Aldo Leopald, Rachel Carson and EO Wilson. Each of these thinkers looked at the environment from a completely different perspective. **Charles Darwin** wrote the 'Origin of Species', which brought to light the close relationship between habitats and species. It brought about a new thinking of man's relationship with other species that was based on evolution. Alfred Wallace came to the same conclusions during his work. Ralph Emerson spoke of the dangers of commerce to our environment way back in the 1840s. **HenryThoreau** in the 1860s wrote that the wilderness should be preserved after he lived in the wild for a year. He felt that most people did not care for nature and would sell it off for a small sum of money. **John Muir** is remembered as having saved the great ancient sequoia trees in California'a forests. In the 1890s he formed the Sierra club, which is a major conservation NGO in the USA. **Aldo Leopald** was a forest official in the US in the 1920s. He designed the early policies on wilderness conservation and wildlife management. 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 wellknown book called 'Silent Spring' which eventually led to a change in Government policy and public awareness. **EO Wilson** is an entomologist who envisioned that biological diversity was a key to human survival on earth. He wrote 'Diversity of Life' in 1993, which was awarded a prize for the best book published on environmental issues. His writings brought home to the world the risks to mankind due to man made disturbances in natural ecosystems that are leading to the rapid extinction of species at the global level.

There have been a number of individuals who have been instrumental in shaping the environmental history in our country. Some of the well-known names in the last century include environmentalists, scientists, administrators, legal experts, educationists and

journalists. **Salim Ali's** name is synonymous with ornithology in India and with the Bombay Natural History Society (BNHS). He also wrote several great books including the famous 'Book of Indian Birds'. His autobiography, 'Fall of a Sparrow' should be read by every nature enthusiast. He was our country's leading conservation scientist and influenced environmental policies in our country for over 50 years. **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 PAs grew from 65 to 298! The Wildlife Protection Act was formulated during the period when she was PM and the Indian Board for Wildlife was extremely active as she personally chaired all its meetings. India gained a name for itself by being a major player in CITES and other International Environmental Treaties and Accords during her tenure. BNHS frequently used her good will to get conservation action initiated by the Government.

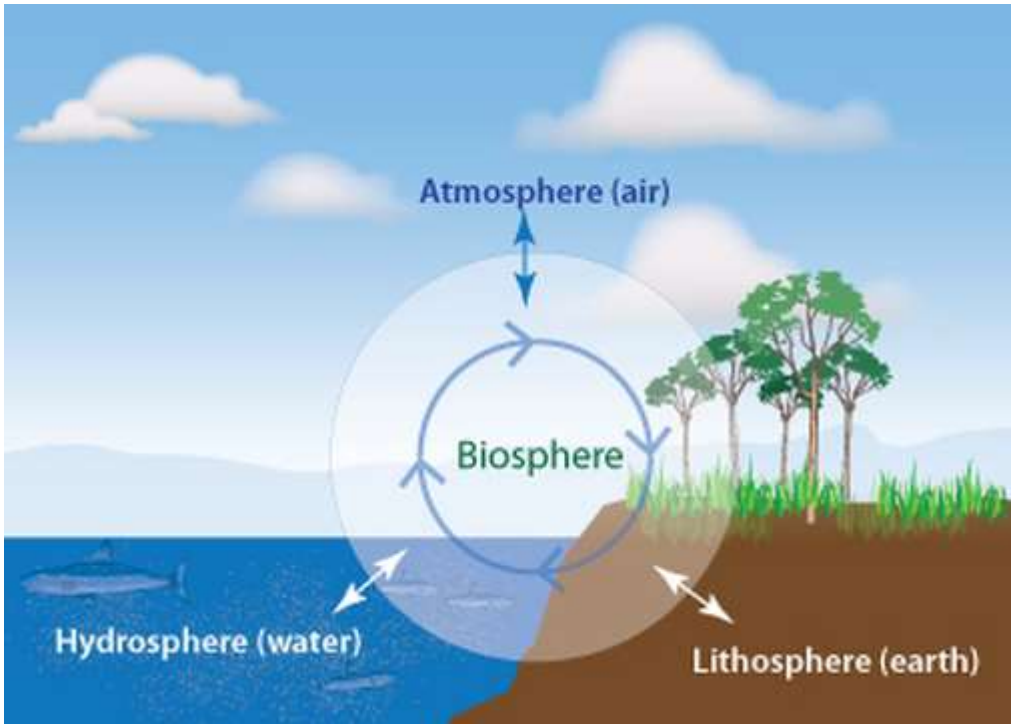
S P Godrej was one of India's greatest supporters of wildlife conservation and nature awareness programs. Between 1975 and 1999, SP Godrej received 10 awards for his conservation activities. He was awarded the Padma Bhushan in 1999. His friendship with people in power combined with his deep commitment for conservation led to his playing a major advocacy role for wildlife in India. **M S Swaminathan** is one of India's foremost agricultural scientists and has also been concerned with various aspects of biodiversity conservation both of cultivars and wild biodiversity. He has founded the MS Swaminathan Research Foundation in Chennai, which does work on the conservation of biological diversity. **Madhav Gadgil** is a well known ecologist in India. His interests range from broad ecological issues such as developing Community Biodiversity Registers and conserving sacred groves to studies on the behaviour of mammals, birds and insects. He has written several articles, published papers in journals and is the author of 6 books. **M C Mehta** is undoubtedly India's most famous environmental lawyer. Since 1984, he has filed several Public Interest Litigations for supporting the cause of environmental conservation. His most famous and long drawn battles supported by the Supreme Court include protecting the Taj Mahal, cleaning up the Ganges River, banning intensive shrimp farming on the coast, initiating Government to implement environmental education in schools and colleges, and a variety of other conservation issues. **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. Medha Patkar is known as one of India's champions who has supported the cause of downtrodden tribal people whose environment is being affected by the dams on the Narmada river. **SunderlalBahugna's** 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. His fight to prevent the construction of the Tehri Dam in a fragile earthquake prone setting is a battle that he continues to wage. The Garhwal Hills will always remember his dedication to the cause for which he has walked over 20 thousand kilometers.

Components of environment: atmosphere, hydrosphere, lithosphere, and biosphere

Environment consists of mainly four components- lithosphere, hydrosphere, biosphere and atmosphere.

The understanding of '-sphere- in this situation means 'to surround or encompass'
The following help us understand the mean of the four spheres :

- **Litho**sphere - litho referring to rocks and minerals or land
- **Hydro**sphere - hydro referring to water
- **Bio**sphere - bio referring to life
- **Atmo**sphere - atmo referring to air



1.
Lithosphere (Land)

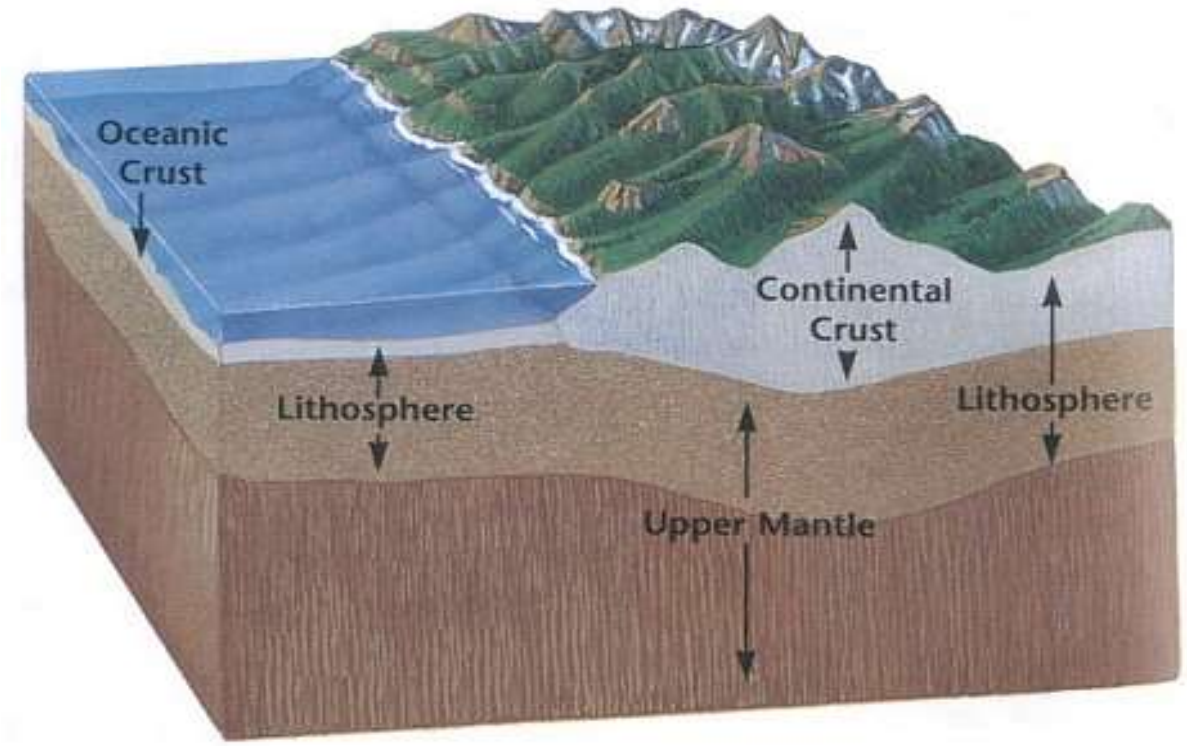
It is believed the lithosphere evolved about 4.6 billion years ago. The lithosphere refers to the solid, rocky crust that covers the entire planet. The lithosphere is made up of all the hard and solid land mass on the earth's surface, the semi-solid rocks (molten materials) underneath the earth crust, and the liquid rocks in the inner core of the earth. The surface of the lithosphere is uneven as it is characterized by various landform features. Some of the landforms include mountains like the Mount Fuji in Japan and Mount Vesuvius in Italy, deep valleys within the mountain ranges, huge plains like the ones in Texas and Brazil,

extensive plateaus like Bolivian plateau in South America and the Colorado plateau of the United States, and hills like the black hills.

The liquid, semi-solid, and solid land components of the lithosphere form layers that are chemically and physically different. This is why the lithosphere is further divided into sub-spheres namely the **crust, the mantle, the outer core, and the inner core**. The crust is made of loose soil and rocks. The mantle is made of dense rock made up of nickel and iron in the form of silicate rocks and its lower part is semi-solid (partially molten) rocks.

The outer core is made up of liquid (purely molten) rock materials. The inner core is the centre of the earth which is purely made of very hot and liquid iron and nickel. The rock materials are divided into three primary categories based on how they are formed namely igneous rocks, sedimentary rocks, and metamorphic rocks.

- Igneous rocks – igneous rocks are formed by the cooling of hot molten rock also known as magma. When the hot magma cools it begins to harden meaning once it had fully cooled it create what is known to be an igneous rock.
- Sedimentary rocks – sedimentary rocks are formed from pre-existing rocks. When rocks erode and mix with other dirt, clay and particles then settle together the mix together to form a sedimentary rock.
- Metamorphic rocks – Metamorphic rocks are formed by heat and / or pressure from pre-existing rocks.



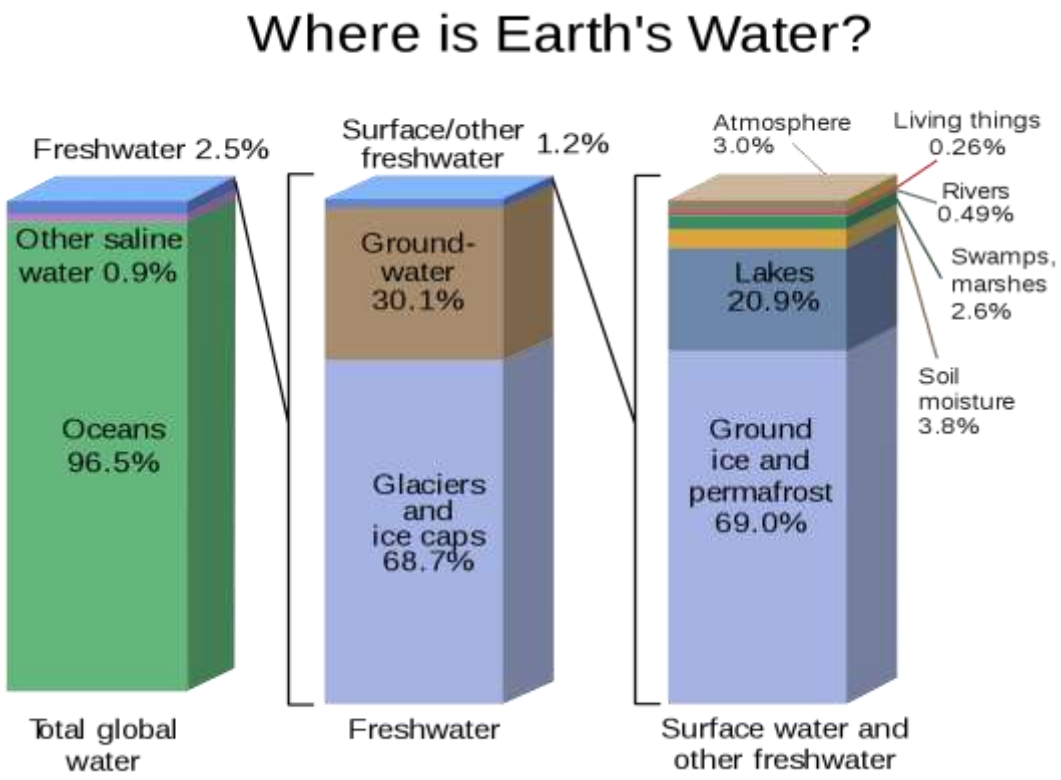
The earth's surface is composed into two types of lithospheres. There are known as the oceanic and continental lithospheres.

The oceanic lithosphere includes the uppermost layers of mantle which is topped with a thin yet heavy oceanic crust. This is where the hydrosphere and lithosphere meet. The continental lithosphere include the uppermost layers of mantle which is topped with a thick yet light continental crust. This is where the atmosphere, biosphere and hydrosphere meet the lithosphere.

2. Hydrosphere (Water)

The hydrosphere refers to the most important resource which is water. The hydrosphere includes all forms of water i.e; all the gaseous, liquid, and solid water of the planet earth. The hydrosphere stretches all the way from the Earth's surface downward numerous miles into the lithosphere and high above the crust into the atmosphere. Most of the water in the atmosphere is in gaseous form and as it rises higher into the atmosphere it condenses to form clouds which fall back on earth as precipitation.

All the water in the hydrosphere is always in motion just like the atmospheric gases. The natural earth features depicting the hydrosphere are the rivers, streams, lakes, seas, oceans and the water vapor. Glaciers, which are the slowly moving masses of ice, are also part of the hydrosphere.



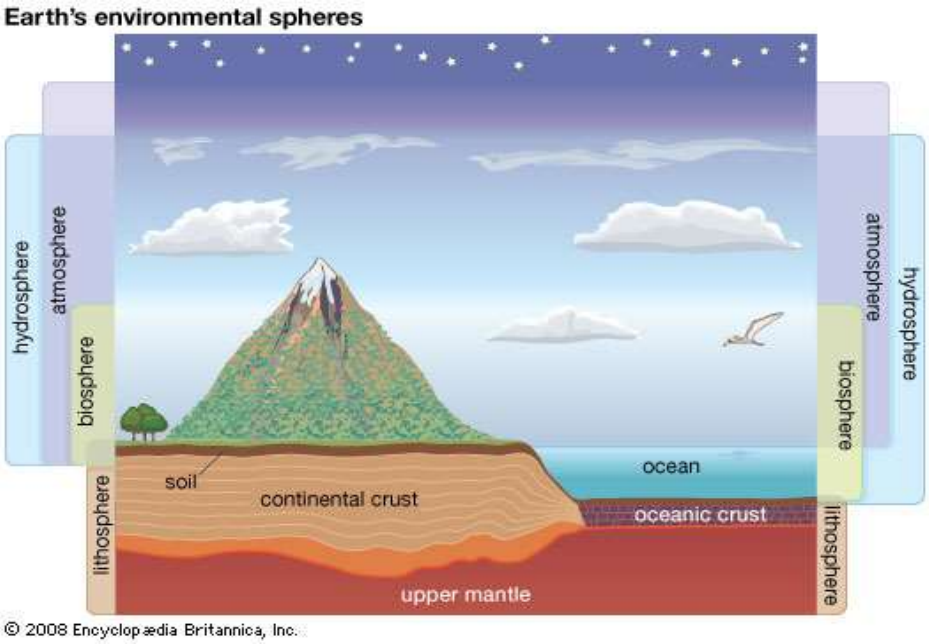
Plant and animal organisms rely on the hydrosphere for their survival as water is essential. The hydrosphere is also home to many plants and animals and it believed that the hydrosphere covers approximately 70% of the earth's surface. 97% of all earth's water is salty. Oceans carry most of the salty water while the majority of lakes and rivers carry fresh water. The earth's temperature is highly influenced by the hydrosphere.

Very low temperatures are associated with icebergs, glaciers or icecaps; low to moderate temperatures are associated with the common types of precipitation like snow, rain, drizzle, sleet or hails; and high temperatures are tied to dry and hot conditions and evaporation. The glaciers, icebergs, and icecaps are also categorically called the cryosphere.

3. Biosphere (Living Things)

All the living things in the planet are categorized under the biosphere. In this view, the biosphere includes all of the animals, plants, and microorganisms of earth. Humans as well belong to this group. Most of the living organisms are found from up to three meters below ground to thirty meters above it and also in the to 200 meters of the ocean and seas. The entire ecological communities within the physical surrounding of the earth are within the umbrella of living things (biosphere). The biosphere could not survive if it wasn't for the other spheres as all organisms need water from the hydrosphere, minerals for the lithosphere and gases from the atmosphere. These ecological communities interact together with the physical aspects of the earth including the hydrosphere, lithosphere, and the atmosphere.

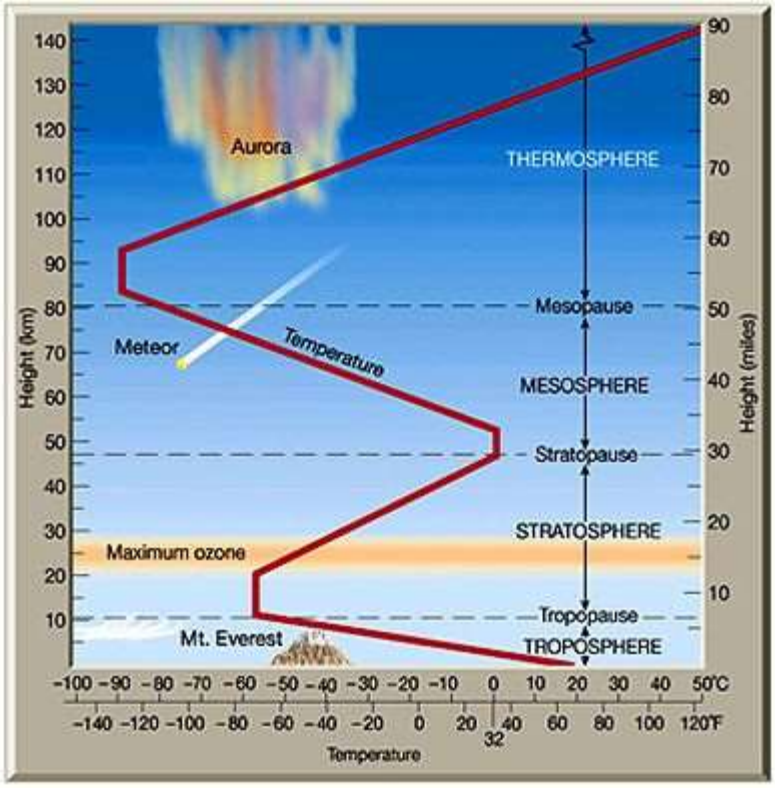
Collectively, these ecological communities are made reference to as biomes. Deserts, forests, grasslands, aquatic, tundra, and chaparral are the six main biomes that are present in the biosphere. The living things on earth interact with each other in various ways, which is well elaborated under the trophic levels of food chain – how energy is transferred in ecological systems.

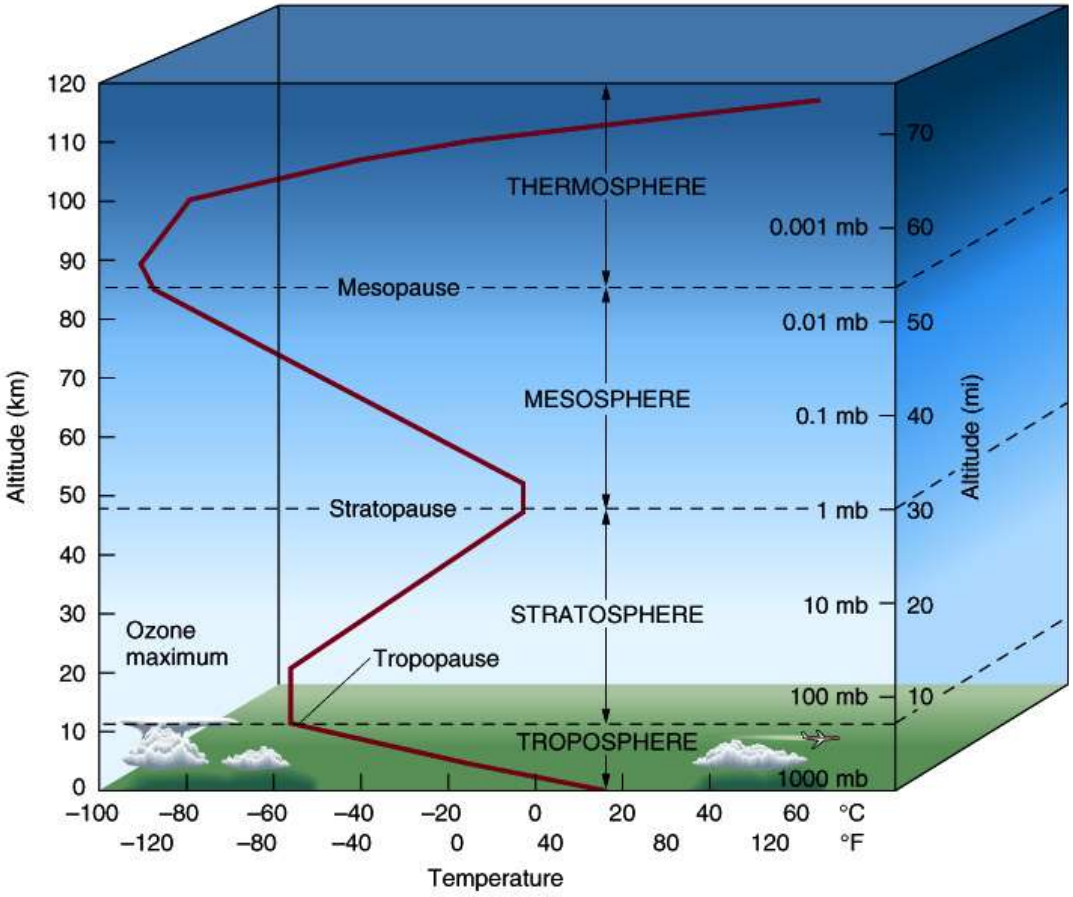


4. Atmosphere (Air)

All the air in the atmosphere makes up the atmosphere. The atmosphere is a mixture of nitrogen (about 78%), oxygen (about 21%), and other gasses (about 1%) such as carbon dioxide (0.039%), argon (0.93%) and the rest are trace gases (krypton, neon, helium , and xenon). The higher the atmosphere, the thinner it becomes and this trait gradually moves towards space. The atmosphere extends all the way from the earth's crust to more than 6200 miles (10,000 kilometers) above the earth's surface into space.

The atmosphere is divided into four layer troposphere, stratosphere, mesosphere and thermosphere. The bottom layer of the atmosphere is known as the **troposphere**. The troposphere is where the weather happens. It is the warmest near the Earth because of the heat rising from the earth's surface but it becomes colder with altitude. This layer is separated from the next by what is known as ***tropopause***. The tropopause is the point in which temperatures will begin to change due to the increase of altitude.
Above the tropopause is the **stratosphere**. The stratosphere is where there large concentration of ozone gas is found. The ozone gasses are essential as they absorb a large percent of radiant solar energy, protecting the earth from harmful ultra violet rays also known as UV. The coldest of spheres is known as the **mesosphere** this is where the water vapor often freezes to create clouds that are purely made of ice. The mesosphere is separated from the thermosphere by the ***mesopause***.
The topmost layer is known as the **thermosphere**, this is where many satellites circle the earth. Due to the thin air and proximity of the sun, the temperatures in the thermosphere tend to rapidly increase and decrease.




THERMOSPHERE
Mesopause
MESOSPHERE
Stratopause
STRATOSPHERE
Ozone maximum
Tropopause
TROPOSPHERE
0.001 mb
0.01 mb
0.1 mb
1 mb
10 mb
100 mb
1000 mb
Altitude (km)
Altitude (mi)
Temperature
°C
°F
