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① Multidisciplinary Nature

- Studying environment requires studying other domains
- Understanding environmental issues and problems require understanding of sociological, biological, physical, geographical, geological aspects associated with them.

② Importance —

(i) Human's survival without nature is impossible.
(ii) Products, goods and services from Nature.
(iii) Aesthetic services and values associated with Nature & Environment.
(iv) Optional values and responsibilities toward Future generations.

③ Awareness :

(i) Awareness can be generated with the help of different media such as Radio, TV, Newspaper, Internet.
(ii) Public Participation and awareness is needed.
(iii) Equal share of responsibilities from both sides ie govt. and people.
(iv) Awareness programmes, Workshops and Books.
— Discussions, Talks, Debates on the issue.
— Encouragement for Sustainable Methods & policies.
— Participation in Nature awareness events such Van-Mahotsav, Clean India Drive etc.
— 3 Rs — Reduce, Reuse, Recycle.
— Eco-clubs, Societies, NGOs
— Newspapers, articles, periodicals such as — Down to Earth, Hornbill

environmental education (EE), which has relatively simplified content and higher applicability for an individual. In India, EE has been made compulsory at graduate level (all branches or streams of higher education) in all the universities and colleges since 2003, following the directives of the Hon'ble Supreme Court of India.

1.2 MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL SCIENCE

Environmental science is the study of all the components or factors that make or influence our life-supporting biophysical environment, including earth processes, ecological systems, biodiversity, natural resource, alternative energy systems, climate change, various types of pollutions, and so on. These entities or processes are guided by complex interaction of physical, chemical, and biological processes, as well as significant human intervention. Therefore, environmental science integrates information from a number of other disciplines and thus is multidisciplinary in nature. Disciplines such as biology, chemistry, physics, geology, geography, sociology, economics, management, and ethics have largely been integrated to develop different subdivisions of environmental science. Its major subdivisions include ecology, geosciences, environmental chemistry, atmospheric science, environmental microbiology, environmental toxicology, environmental impact assessment, and so on.

Besides these, there are certain subdivisions—environmental studies, environmental engineering, environmental economics, environmental ethics, environmental management, environmental sociology, environmental biotechnology, and so on—that are generally treated as independent academic disciplines parallel to environmental science. Environmental conservation is the main emphasis for most of these disciplines, but the approaches vary. For example, environmental studies incorporate more of the social sciences for understanding human relationships, perceptions, and policies towards the environment. Environmental engineering, on the contrary, focuses on design and technology for improving environmental quality.

1.3 SCOPE OF THE SUBJECT

Principles and approaches of environmental sciences are applicable in several areas of development. These areas are studied as scope of the subject. Environmental science has a vast scope since it covers a wide range of subject matters or issues related to our complex life-supporting system. Scope of the subject can be described in terms of major areas

of applicability as well as career opportunities related to the subject. Three major areas of applicability of the subject are (i) management of natural resources, (ii) conservation of ecosystem and biodiversity, and (iii) prevention and control of pollution. In addition, environmental science plays a key role in solving complex environmental issues of varying scale, including climate change, ozone layer depletion, energy crisis, desertification, urbanization, population explosion, and so on.

Scope of the subject in terms of career opportunities is fairly vast. For the last two decades, environmental science has been considered to be associated with a number of career opportunities. Major career options related to the subject can be described as follows:

- **Industries:** Industries need to show compliance against a number of environmental norms. Hence, environment experts are needed to guide the industries for adopting clean technologies, controlling pollution, disposing the wastes, and carrying out environmental audit.
- **Consultancy:** Environment consultancies are hired by governments, industries, and NGOs for carrying out different types of laboratory-based analyses or field-based studies, which are often required in environment impact assessment (EIA) and other compliance processes.
- **Research and development (R&D):** R&D opportunities in this area include studying different types of pollution and their causes and effects. It also includes development of clean and efficient technologies for future. Scientists, researchers, and analysts are some of the common career profiles.
- **Academics:** Environmental science is taught at almost every level of education, that is, from school to university level. A large number of teachers or academicians are required to fulfil this need.
- **Green marketing:** Skilled manpower is required to promote eco-friendly products in market. Environmental quality certifications like ISO-14000 are also being incorporated in marketing strategy—this creates additional career opportunities.
- **Green media:** In order to generate awareness about the environment, there is an immense need for skilled manpower in the field of print and electronic media. A number of magazines and newspapers regularly publish articles on environmental theme, for example, *Down to Earth*, a magazine published by Centre for Science and Environment.
- **Green advocacy:** Environmental lawyers are emerging as major players in ensuring proper implementation of environmental norms, laws, and programmes. Public Interest Litigation (PIL) empowers a common man to fight against any anti-environment activity.

- **NGOs:** These days, most of the environmental programmes are being implemented through NGOs, with the help of funds from national and international agencies. Green-peace, CI, WWF, CSE, CEE, TERI, Tarun Bharat Sangh, and Vatavaran are some examples of environmental NGOs.
- **Government jobs:** A number of conventional jobs are available in government bodies such as environmental ministry, pollution control boards, national parks, and biosphere reserves.
- **International agencies:** Various international agencies such as UNEP, IUCN, TSBF, and World Bank require qualified human resources to implement environment-related projects.

1.4 IMPORTANCE OF THE SUBJECT

Today, the world is facing numerous environmental problems, ranging from local problems such as ground water depletion to global problems such as climate change. These problems can be solved only when everyone cares for the environment; for that everyone needs to be informed about the causes, consequences, and remedial measures of different environmental problems. In order to achieve this goal, environmental science is promoted and taught at different educational levels. The subject bears immense importance as it aims at saving the integrity of the life-supporting environment of earth, which is a unique planet that sustains life. Importance of this subject can be described in terms of the various objectives that it fulfils for saving the environment. So far, seven such objectives have been identified:

- It guides us to know how our developmental and day-to-day activities affect environment and how we are affected by changes in the environmental conditions.
- It guides 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 an efficient manner, that is, with maximum utility and minimum wastage, by adopting conservation and recycling strategies.
- It guides common public to live an eco-friendly lifestyle by adopting the above three features, that is, knowing environmental implications of one's activities, preventing and controlling pollution, and utilizing the resources efficiently in day-to-day activities.
- It guides industries to operate in an eco-friendly mode by adopting clean and efficient technologies and installing pollution control systems.

Eminent Personalities & Organisations —

(1) BNHS (Bombay Natural History Society)
- 1883, wildlife research
- Oldest Conservation research based NGO
- Magazine — Hornbill, Salim Ali's Handbook on B
  JC Daniel's — Book on Indian Reptiles.
- "Save Silent valley" Campaign.

(2) World Wide Fund for Nature (WWF-I)
- 1969 Mumbai ⟶ New Delhi
- Wildlife education and awareness.
- Think Tank and lobby force.
- Various Courses, Workshops & Seminars, courses, Environ Law.

(3) **CSE** - (Center for Science & Environment)
- Anil Aggarwal — 1980, premier Think Tank. looks for
- poor planning, policy changes, implementation of already existing policies.
- Sunita Narain, eminent activist
- "Recent reports on Cancer causing chemicals in Breads, pans, buns and pizza bases" *Potassium bromo *Potassium iodi
- Sunita Narain, also a member of enforcement authority on Green tax, on vehicles/Trucks entering in Delhi.

Wildlife Institute of India (WII) — Dehradun
- 1982, training establishment for Forest officers & Researchers.
- "Planning A Wildlife Protected Area Network for India"
- M.Sc. Courses, EIA cell.
- associated with biodiversity Conservation.
- Govt. of India, Institution.

④ Botanical Survey of India ✗
— 1890 at Royal Botanic Gardens, Calcutta
— Survey of Plant resources in diffen. regions.
— Carries out plant identification, EIA studies.
— Training in Herbarium Methodology, Plant cultivation
— Issues Plant and flora checklist.

⑤ Zoological Survey of India ✗
— 1 July, 1916
— to promote survey, exploration and research leading to advancement in our knowledge of various aspect of rich life.
— responsible for collection of "Type Specimens" on the basis of study of animal life.
— enormous work on taxonomy & ecology.

International Status

(i) GreenPeace —
— Founded by Canadian environmentalist in 1971
— Goal is to "ensure the ability of Earth to nurture life in all its diversity".
— Most visible environmental organization in the world.
— Offices in More than 40 countries.
— Headquarters — Amsterdam, Netherlands.
— major objectives are, *Energy revolution,
*Defending our Oceans
*Protecting the worldis ancient for
*Working for disarmament & pe
*Sustainable agriculture.

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Eminent personalities & Organisations :-

(6) MoEF –
→ Ministry of Environment, Forest & Climate Change
→ conservation & survey of flora & fauna, forests, prevention & control of pollution, afforestation & land degradation & mitigation.
→ Nodal agency to promote, co-ordinate & overseeing the implementation of environmental policy.
→ Nodal agency for UNEP, SAARC UNCED [United Nations conference on Environment & Develop]
→ Recent Order – Hazardous & other Wastes Amendment Rules, 2016.

(7) CPCB – Central pollution Control Board
→ established in 1974 under Water (Prevention & Control of pollution) Act, 1974, (fn & activities under Air Act 1981.
→ apex organisation under MoEF.
→ fn are –
(i) Technical and advisory support to govt. concerning prevention & control of air pollution.
(ii) Co ordinate the activities of State Boards.
(iii) Collection, Compilation and publication of technical & statistical data relating water & air pollution.

⑧ National Green Tribunal :-

→ established on 18/10/2010 under National Green Tribunal Act 2010.

→ responsible for disposal of cases relating to environmental protection & conservation of forests.

→ enforcement of legal right relating to environment

→ Specialised body equipped with the expertise to handle environmental disputes involving multi disciplinary issues.

→ Imp. judgements including — fine on Art of Living, phasing out diesel vehicles & keeping the details of groundwater use of Delhi metro.

* Eminent Personalities →

① Rachel Carson →

(i) Author of 'Silent Spring'

(ii) Book was based on the harmful effects of pesticides on environment

(iii) Every one of toxic chemical mentioned in the book was prohibited or restricted in US by 1975

(iv) among the "25 Greatest Science books of all time" — Discover Magazine.

② Al-Gore

(i) US vice president

(ii) 'An Inconvenient Truth' — Davis Guggenheim & Al-gore, 2006.

→ movie has been credited for raising international public awareness of Global Warming & re energizing environment mout.

→ Strong proponent of Kyoto Protocol & reduction in green house gases.

③ Wangari Maathai :—

→ founder of Green Belt mout. & Noble laureate of 2004.

→ Noble for sustainable develop., democracy & peace.

→ Books — The Green Belt Mout, Unbowed — a memoir

→ responsible for popular protest against govt for privatizing land and gained support for planting trees.

④ Sunderlal Bahuguna :—

→ Garwali environmentalist, leader of Chipko mout. & follower Gandhi's philosophy of Non-violence.

→ popular slogan — "Ecology is permanent Economy".

→ Spearheaded the Anti-Tehri mout.

→ due to his efforts, a ban on falling of green trees by Indira Gandhi, for 15 years.

* Introduction to Environmental Studies

Lithosphere = Crust + Upper part of Mantle

- Continental (Thick) [Thickness = 70km under Mountains]
- Oceanic (Thin) → [6 km below ocean]

* Weather & Climate differ.

(i) Weather refers to the daily conditions in our surroundings, including temp. & rainfall.
- can changes contantly from week to week, day to day or even hour to hour.
- weather patterns ultimately defines the climatic condition of that given area.

(ii) Climate is the avg. weather over a long period approx. 30 years.
- climate of a region determines the vegetation.
- 3 distinct climatic zones [amount of light & heat] — Tropics, Temperate, Poles
- Ocean Conveyor Belt, Global air circulation pattern are imp. factors controlling climate.

→ Atmosphere :— 4 layers
- Troposphere [0-16 km]
- Stratosphere [upto 50 km]
- Mesosphere [upto 80 km]
- Thermosphere [80km - Space]

lapse rate - applicable only in the case of free troposphere

Troposphere + Stratosphere = Lower Atmosphere

Troposphere
- lower part [ie in contact with earth k/a Boundry layer] → pollutant accumulates
- Free Troposphere [upper part]

lapse rate = 6.5°/k

* Composition of Atmosphere By Volume -
- (N_2) = 78.08%
- (O_2) = 20.94%
- (Ar) = 0.93%
- CO_2 = 0.04
- Others = 0.0