

Environmental Science

Lecture 1

Environment

We will start off with the **definition of environmental studies**. If you look at the word environment it actually covers anything that surrounds or the surroundings where people live or plants live or animals live. So it actually is the external conditions influencing the development or growth of people, animals or plants which even affects the living or the working conditions. Circumstances and conditions that surround an organism, social and cultural conditions that affect an individual.

If you look at **the scope of environment**, the different components are:- **Atmosphere** which is the virtual ocean of air, **Hydrosphere** is the surface of earth which is filled with any form of water. **Lithosphere** is the outer shell of the earth composed of the crust and the rigid outer most mantle and **Biosphere** is the place on earth where actual life exists. So these 4 encompasses this scope of the environment.

If you look into **the details of environmental studies**, it actually encompasses systematic understanding of our environment, it's highly inter- disciplinary in the sense you cannot study the environment in a unilateral way. It is affected and it is a influence by many plains, many different branches of science and as well as the environment. It's inclusive, it's holistic, it's mission oriented in the sense it is very purpose driven. What is the purpose of studying environment of the environment and its precursor, the elements that are going to effect the environment all of this is very mission oriented. It's essential to study to overcome the environmental crisis.

If you look at the **objectives of environmental studies**, first is **Awareness**- about our environment and its allied problems. Second we have the **Knowledge** which is basically required for understanding and to experience our environment and associated problems. **Attitude** is what is the concern for the environment that people have? , how actively are we going to participate in its improvement and protection? **Skill** to identify and solve different environmental problems, what kind of skill set do we posses?, how do we go about developing this skill set? **Participation**- providing opportunity to be involved in resolving the environmental problems.

The importance of environmental studies. Its basically enlightens us about the importance of protection and conservation of our environment. It actually has become significant for the following reasons number 1 environment issues have gained a lot of international importance. The problems that have cropped in the wake of development especially in the western

hemisphere as the industrial revolution has happened we were not initially aware of the problems that is generating on the environment and the after effects in the environment. Now as other parts of the world are getting developed we are more aware that there are prepercautions from this process of development and industrialization. Explosive increase in pollution, need for an alternative solution, need to save humanity from extinction and need for wise planning of development. All of these are inter dependent on each other because of development now even development in different fields there's been a huge population explosion, and because of the population explosion even the rate of the death rate has decreased, mortality has decreased. So because of that the number of people existing has also increased and because of that the pollution has increased and all of these are just piling on, on each other. So there is obviously a need to find an alternative solution to protect and conserve the environment.

The **Basic Benefits of Environmental Studies**:- conservation of energy and fast depleting natural resources. We are running through our natural resources like there is no tomorrow. Where as we have to make sure that we come up with alternate sources of energy and ensure that the fuels are preserved for posterity as well, increase in economic productivity. Imparting knowledge about waste management, treatment and disposal, develop social responsibility towards environment protection, creating awareness to control population as well as the pollution which is generating from the increase in population , inculcating an attitude and values towards understanding inter dependence of nature and man and work towards a very sustainable development. So when you actually look at a social responsibility, it is no longer that the nature is required by man. It is crossed that stage where man requires every bit of nature to continue his life successfully on earth. So it is very much our responsibility to ensure that we protect the environment, protect nature which is part of the environment and we take it to the future generations as well.

If you look at the **Frame work for Addressing**, you have a series of ways you can address this problem of environment. First you need to **scientifically assess** what is important, how are things going to go about in a scientific a manner? Then there is a **risk analysis**. Then you have to **educate the public** and make sure they are involved. Because for environment to be preserved and protected it is not sufficient that governments and associations take large laws and public policies. It's very important that every lay man is contributing towards protecting and preserving the environment. Then **political action**. If someone does not adhere to some certain regulations, what action can be taken against such people? And finally you have an **evaluation** based on all of these above elements, where you have an **assessment** when you **analyze** how this assessment and what are the process you can go about to preserve or protect the environment and how you can **involve the public** and how you can **educate the public** before involving them so they are aware of the importance of the problem and **political action**

simultaneously to ensure that whatever the public does has repercussions and **evaluation** finally to ensure that whatever has been taken place is going on in the right path.

If you look at the **Major Global Environmental Problems** which is affecting world over different parts of the world different countries everywhere are global warming, ozone layer depletion, acid rain, deforestation, loss of bio-diversity, water pollution, desertification, waste disposal, rapid population growth, depletion of non-renewable energy sources, food and water shortage. If looking at this list it seems like it is a never ending list and its all again inter connected to each other because and these are not things that have happened because nature has suddenly stopped producing certain important things that the environment has decided to go on a strike. It is all happening because of our haphazard use of these elements, haphazard use of technology and development without any concern for the surrounding environment.

Need for Public Awareness

What is **the basic need for creating an awareness among the general public**? It is very important to understand that the natural environment and the man-made environment are interdependent. That is the most crucial thing. Many people don't even know if you look at the children there was a study which took place. They would ask the children where their milk came from which they drank. And all of them said it came out of the cartoon. That is the level of lack of education and awareness that they didn't know that their everyday livelihood and everyday food everything that they wanted and needed was from some natural resource or source. It is essential to make public aware of formidable consequences of the environmental degradation. Let it either be regional, local or even global. Reformative measures if not undertaken, would result in the extinction of life. Environmental protection is every individual's obligation and duty and so environmental consciousness needs to be propagated at all level. And it is not something that only adults need to get into. The main problem they have assessed is we are not educating our children enough. It needs to start at the very smallest level of homes and schools for it to reach a larger level.

The Goals of Environmental Education:- to develop teaching materials and aids for formal education sector, to encourage non-governmental organizations for promoting awareness, to promote the environment education through existing educational, scientific or research institutes, to ensure training and manpower development in environmental education, to mobilize people's awareness for preservation and conservation of the environment.

If you look at **Formal Environmental Education in our country:- in schools-** its through text books. In **college and university levels** you have M.Sc degrees, M.Phil degrees, and Ph.D programs in environmental, chemical, bio or toxicology. You have masters in engineering and

masters in technology in environmental engineering, P.G. diplomas courses in environmental management. But all of this tends to be very bookish and when you actually look at the level it gets transpired to reality it is a very small percentage. Especially in schools instead of having it just through text books it needs to be through class based activities, because especially in school level, learning time is not a constraint, and children are in a level where they can learn things faster and absorb them in their day to day livelihood, which will make a huger impact as they grow into adults. And once if children start doing certain things their parents in turn will be forced to follow certain things within the home front. You have **Environmental Appreciation Course**, which is done by IGNOU and MOEF, which is a non – credit three month awareness course, to create environmental consciousness and leadership among people. Usually this is done like without any requirement or this is a co-credit that is given, when you are doing your masters or your post graduation. **In management and business studies**, so that managers and leaders can introduce environmentally sound practices in their operations. This is that is something that is started in recent times, especially in the manufacturing industry or any industry. They want to reduce waste. They want to make sure they can reuse and recycle, and all of this they can learn through management and business schools, which teaches them how to run a business. Another branch of it could be, how to deal with the environment in a safe and precautionary way.

Non- formal education and awareness:- The **National Environmental Awareness Campaign NEAC**- this was introduced in mid 1986. It is a multi-media campaign. Nominal financial assistance provided to NGOs, schools and other institutions to conduct awareness activities. The activities could be seminars, workshops, camps, rallies, exhibitions, debates, street theatre, planting of trees, cleaning of public areas, water bodies anything. So all of this is what we even read in newspapers, like today, school students went to a particular lake area cleaned a particular water body. All of this is actually caught on only recently, even though, this was set nearly about 30 years ago. It is implemented through 28 regional resource agencies. Next step you have is **the Eco club of the National Green Corps**- to sensitize school students. Eco clubs are being set up in 100 schools of every district in the country. 50,000 have been set up so far. Government provides financial assistance and training to teachers as well as the resource material. Another thing which has happened in recent times is, encouraging students into gardening, into growing a terrace garden, into a farm within the school premises where they realize that how difficult it is to actually grow the vegetables they consume on an everyday basis. They are actually involved in the process of how a plant should be taken care of and the cycles of life that is required for a plant to grow and how dependant we are on plant life as human beings.

GLOBE: - That is **the Global learning and Observations to Benefit the Environment**. This is another non-formal education method. India joined this international program aimed at school

students in the year 2000. Students of GLOBE school collect data about environmental parameters under trained teachers and this data is used to explain various hypotheses. Students interact with globe scientists and participate in workshops on basic and advanced GLOBE protocols. **Mass awareness**- this main focus is on rural areas. Doordarshan and other channels telecast environmental based programs, commercials, films, or documentaries. Professional media agencies are hired to assist in this process.

Other awareness programs:-If you look at it is **the Green Olympiad** which is conducted by TERI- 80,000 schools students from Russia, UAE and India participate. **Awareness activities** by NGOs and other institutions on environment days like earth day. **TV quiz programs** for winners of regional which is written environmental based programs. **Vacation program on natural resources**- building a broader constituency of support for conservation, for high school students organized by Asoka trust for research in ecology and the environment which is an NGO. So in spite of all these activities happening, what is it happening at the grass root level, especially as students, not only in the urban sector but also in the rural sector. The usual preconceived notion is it's only the students in the urban sector that need to be taught about the environment, the rural students obviously realize how things are happening in villages . It may be true to a certain extent, especially with food resources but otherwise to understand how industries are working, what kind of pollution happens in cities. These say that even rural areas face a lot of different kinds of pollution. So it needs to be done throughout the country, irrespective of it being a rural area, or a urban area. The way its dealt with is obviously going to be different but there has to be both a formal and informal education base and an awareness program that needs to be conducted to ensure that at the very level, the smallest level, right from kindergarten, children are made aware that the environment plays a very important role in their lives.

You have different **centres of excellence**. This scheme was started in 1983, to strengthen research, awareness and training in priority areas of environmental science and management. Till now 9 centres have been established. You have some in Chennai, Ahmadabad, Coimbatore, Dhanbad, Delhi.

Green Technology

This is basically a branch of from technology at a time where they realize that all forms of technology is actually not helping man in the long term. There are certain types of technology that are actually causing more harm than doing any good. So the Green technology came about as a way of making sure that man is not compromising on his creature comfort and development. At the same time the environment can be saved. This is an advancement in science and technology which has led to indiscriminate exploitation of exhaustible resources and expulsion of hazardous chemical as well as synthetic waste in the environment. This has

created extraordinary technical, health, economic, environmental, political as well as social issues. **Green technology or clean technology** encompasses a continuously evolving group of methods as well as materials from techniques from generating energy to non toxic cleaning products. Like we mentioned it encompasses anything to make sure man does not have to compromise on his standard of living but at the same time the environment is not given up as a consequential by product.

Green technology or clean tech is the development and application of products, equipments and systems used to conserve the natural environment and resources, which minimize and reduce the negative impact of human activities. **Criteria of green tech products, equipments or systems** – it minimizes the degradation of the environment. It has zero or no green house gas that is GHG emissions. It is safe for use, and promotes healthy and improved environment for all forms of life. It conserves the use of energy and natural resources . It promotes the use of renewable resources .

Moving on to the **goals of green technology**. Number 1 **sustainability** which is like the go to in the today's world. Meeting present needs of society without compromising the ability of future generations to meet their own needs. **Cradle to cradle design**:- ending the cradle to grave cycle of manufacture of products by creating products that can be fully reclaimed or reused. **Source reduction**:- that is reducing waste and pollution by changing patterns of production as well as consumption. **Innovation** :- developing alternatives to technologies whether fossil fuels or chemical intensive agriculture that have been demonstrated to damage health and even the environment. Over a period of time by using continuous chemical fertilizers, the produce might come faster and faster. Say in 3months, in 6 months. But eventually the land becomes infertile. **Viability**:- creating a center of economic activity around technologies and products that benefit the environment, speeding their implementation and creating new careers that truly protect the planet.

Green technology subject areas:- If you look at the few options we'll first study are **Energy Development of Alternative Fuels** which means you are creating new means of generating new energy forms and improving energy efficiency and being less dependent on non renewable forms of energy sources. **Green Building**:- encompasses everything from choice of building materials to the very location of the building site. **Environmentally Preferred Purchasing**:- This is where government purchasing of products whose contents and methods of production have had the smallest impact on the environment. So by giving the incentives to such manufacturers and producers you are encouraging people to behave in an environmentally friendly manner. **Green Chemistry**:- invention, design and application of chemical products and processes to reduce and eliminate the use and generation of hazardous substances. **Green Nanotechnology application**:- is a combination of green chemistry and green engineering principles to materials

at a nano scale. **Green computing designing**:- manufacturing , using and disposing of computers and associated sub-systems effectively with minimal or very less impact on the environment.

Examples of clean technology:-Unleaded petrol, sulphur free coal, CNG, LPG, bio-fuels and hybrid vehicles. Air pollution control equipments like catalytic converters, electro static precipitators, fuel gas desulphurization units etc. Genetically engineered crops which require less chemical pesticides due to their genetic resistance to diseases and pests. Solar energy, hydro energy, ocean energy, geothermal energy, wind energy as alternatives. Recycling of waste paper, metal, glass, fly ash, slag, red-mud etc.

If you look at the **different types of basic natural resources**, we have forests resources, water resources, mineral, food, land and energy.

We'll start off with studying the **forests resources of India**. If you look at forests resources it is just not we are not talking only about massive jungles and the forests and greenery. You might think they have very little use. They just provide the green cover that is required. But it actually has a lot of in depth important role it plays in our economy of any country for its existence. It is highly complex, changing environment made up of living and nonliving things. Living things include trees, shrubs, wild life etc. and nonliving things include water, nutrients, rocks, sunlight and air. Even though in the nonliving things water is inclusive, it actually plays an important role in both the living as well as nonliving things. Forests varies a great deal in composition and density and are distant from meadows and pastures. Forests are very important to humans as well as the natural world. For humans they have many aesthetics, recreational, economic, historical, cultural and religious values. Forests provide fuel, wood, timber, wildlife, habitat, industrial forests products, climate regulations, medicine, etc. Even within our own city Chennai, if you look at the temperature throughout the city at a given day, areas around Guindy park which is one of the largest green belts within the city and then around Vandalur Zoo or the Anna Zoo, the temperature is about 3 degrees lesser. That is the importance of having a green area. So when temperature and precipitation makes a huge difference, we realize the importance of having a forests cover. Let it be a haphazardly planned initially or it could be even later on domesticated forests.

Looking at the **meaning of the word forests**, it is derived from the latin word 'foris' meaning outside. Originally it is uncultivated , uninhabited village boundaries consisting of natural plants which could be trees as well as shrubs and grasses. It means an association of plants, natural or cultivated, predominantly trees. In the words of Allen and Shorpe" Forests is a community of trees and associated organisms, covering a considerable area, utilizing air, water and minerals to attain maturity and to reproduce and capable of furnishing mankind with indispensable products and services."

If you look at **the Indian scenario of the forests resources** obviously we have large diverse country. We have regions with some of the greatest rainfall to dry deserts, coast lines to alpine regions, river deltas to tropical islands. The variety and distribution of forest vegetation is large. There are around 600 species of hardwoods, including Sal. India is one of the 17 mega bio diverse regions of the world. Indian forest types include tropical evergreens, tropical deciduous, swamps, mangroves, sub-tropical, Montana scrub, sub alpine and alpine forests. These forests support a variety of eco systems, with diverse flora and fauna. If you actually look at the forest cover in India overall 21% of the country's geographical area is under the green cover. The total forest cover in India is unimaginably beyond a realm of one of the topmost in the world. The forest cover is defined by all lands, more than 1 hectare in area with a tree canopy density of more than 10%. So like I just said it could be even cultivated or under control forest area like the Guindy Park and the Vandalur Zoo, or it could be even along the highways where its just random uncontrollably built forest. You have very dense forests to non forest areas. So all of these include about 21% of the country's geographical area.