

ENVIRONMENTAL ECONOMICS - I (BEEC55A)

Objective

Economic development and general welfare of a society largely depend upon a pollution free environment. This bond between Environment and Economics is sure to motivate the future generation to undertake environment friendly economic activities.

UNIT-I

Theory and Concepts : Definition - Environment inter-linkages - Identification of the basic issue in preserving environmental quality - Tragedy of commons - Pollution as an externality - Material balance approach - Components of the Environment - Environmental quality as a Public Good.

UNIT-II

Environmental issues in Indian Economy: Environmental Pollution - Air Pollution, Water Pollution, Land Pollution, Marine Pollution, Noise Pollution - Role of an individual in prevention of pollution.

UNIT-III

Welfare Economics and Environmental Economics: Pareto optimality - Cost Benefit analysis - Private cost - Social cost, Pollution Cost - Pollution Control Cost -Evaluation of Environmental Benefit.

UNIT-IV

Population and Environmental Problems: Trends in global and National population levels - Consequences on environmental quality - problems of urbanization and Environmental quality in India - Environment and human health.

UNIT-V

Economic Growth Vs. Environmental Quality - Problems of Environmental Quality global level - Problems of Environmental Quality in developed economies - Problems of Environmental Quality in developing economies - Nature of Environmental Problems in India.

UNIT I

Theory and Concepts

Economics generally studies the cost of exploiting resource in the environment and the consequent benefits arising to the society at large.

With the increase in population and development of science and technology, the environment resources are over exploited leading to imbalance in the ecosystem. Much worse than this is the pollution of the environment leading to more of ill fare rather than welfare.

Environmental economics is a sub discipline of economics that applies the values and tools of mainstream macro economics and micro economics to allocate environmental resources more efficiently.

On the political stage, environmental issues are usually placed at odds with economic issues; environmental goods, such as clean air and clean water are commonly viewed as priceless and not subjected to economic consideration. There is however, substantial overlap between economics and the environment. In its purest form, economics is the study of human choice.

Because of that economics sheds light on the choices that individual consumers and producers make with respect to numerous goods, services and activities including those made with respect to environmental quality. Economics can not only identify the reasons why individuals choose to degrade the environment beyond what is most beneficial to society but it can also assist policy makers in providing an efficient level of environmental quality.

Environmental economics is interdisciplinary in nature and thus its scope is far-reaching. The field however remains rooted in sound economic principles. Environmental economists research a wide array of topics including those related to energy, biodiversity, invasive species and climate change.

Understanding Environmental Economics

The basic argument underpinning environmental economics is that environmental amenities (or environmental goods) have economic value and there are environmental costs of

economic growth that go unaccounted in the current market model. Environmental goods include things like access to clean water, clean air, the survival of wildlife and the general climate. Environmental goods are usually difficult fully privatize and subject to the problem known as the tragedy of the commons.

Destruction or overuse of environmental goods like pollution and other kinds of **environmental degradation** can represent a form of **market failure** because it imposes **negative externalities**. Environmental economists thus analyze the **costs and benefits** of specific economic policies that seek to correct such problem which also involves running theoretical tests or studies on possible economic consequences of environmental degradation.

Environmental Economic Strategies

Environmental economists are concerned with identifying specific problems to be rectified but there can be many approaches to solving the same environmental problem. If a state is trying to impose a transition to clean energy for example they have several options. The government can impose a forcible limit on carbon emissions or it can adopt more incentive based solutions like placing quantity based taxes on carbon emissions or offering tax credits to companies that adopt renewable power sources.

All of these strategies rely to varying degrees on state intervention in the market; therefore, the degree to which this is acceptable is an important political factor in determining environmental economic policy. This debate is also known as prescriptive (in which the government would manually control carbon emissions) versus market based (where the government would set goals and place incentives but otherwise allow companies to meet those goals however they wanted.)

Environmental Economics Challenges

Because the nature and economic value of environmental goods often transcend national boundaries, environmental economics frequently requires a transnational approach. For example, an environmental economist could identify aquatic depopulation, resulting from overfishing as a negative externality to be addressed. The United States could impose regulations on its own fishing industry, but the problem would not be solved without similar action from many other

nations that also engage in overfishing. The global character of such environmental issues has led to the rise of non-governmental organizations (NGO's) like the International Panel on Climate Change (IPCC), which organizes annual forums for heads of state to negotiate international environmental policies.

Another challenge relating to environmental economics is the degree to which its findings affect other industries. As explained earlier, environmental economics has a broad based approach and affects several moving parts. More often than not, findings from environmental economists can result in controversy. Implementation of solutions proposed by environmental economists is equally difficult because of their complexity. The presence of multiple marketplaces for carbon credits is an example of the chaotic transnational implementation of ideas stemming from environmental economics. Fuel economy standards set by the Environmental Protection Agency (EPA) are another example of the balancing act required by policy proposals related to environmental economics.

Environmental Economics - Meaning

Environmental Economics studies about the cause and effect in general, in over exploiting the environmental resources and the cost and benefit arising out of that to the society he need for economics to enter for allocating scarce resources of the environment without impairing the environment.

Economics is a science of allocating scarce resources between competing ends. Hence need for economics to enter for allocating scarce resources of the environment without impairing environment.

Thus economic growth leads to decrease in the supply of environmental quality and increase in the demand for the same and environmental quality becomes and economic commodity.

Definition

"Environmental economics is an area of economics that studies the financial impact of environmental policies". This field of economics helps users design appropriate environmental policies and analyze the effects and merits of existing or proposed policies.

Destruction or overuse of environmental goods, like pollution and other kinds of environmental degradation, can represent a form of market failure because it imposes negative externalities.

Environment and Economics - Linkage

s 1. Environment in economic analysis

Environmental cost-benefit analysis and input-output analysis becomes an integral part of mainstream economics. It is a key consideration in all the decisions of production, factor allocation, pricing etc.

Environmental considerations are very important in micro and macro economics, agriculture, industrial economics, regional economic planning etc.

2. Economics in environmental analysis

Environment resources, their allocation and utilization are considered in the context of their economic cost and benefit.

The demand and supply, benefit and losses, equilibrium of environment resources all are analyzed in the context of economics.

There are many environment theories which have developed with the integration of economic theories.

These include environment resource planning, sustainable environment, development environment, input-output model, environment cost analysis, environment policy, environment pricing, environment budgeting and environment fiscal analysis etc.

3. Environmental Problems and their Solution in Economics

With the help of input output analysis, cost benefit analysis, pollution tax and environmental subsidies, economics shows various ways and means to solve the environmental problems. There should be no over utilization of natural resources.

4. Mutual Dependence

There are environmental causes for economic problems and economic causes for environment problems. In the same way, environment theories are needed for economic theories and economic theories are essential for environment theories.

Industrial and domestic wastes are the prime cause of water pollution and air pollution economics has a solution for this.

5. Environment Provides Resource's to the Economy

Economic growth and environmental performance must go hand in hand. The natural environment is central to economic activity and growth providing the resources we need to produce **goods and services**, and absorbing and processing unwanted by products in the form of pollution and waste.

Basic Issues

Our environment faces several problems, and many of these seem to be worsening with time, bringing us into a time of a true environmental crisis. It is therefore becoming increasingly important to raise awareness of the existence of these issues, as well as what can be done to reduce their negative impact. Some of the key issues are:

1) Pollution

Pollution of the air, water and soil caused by toxins such as plastics, heavy metals and nitrates, caused by factors such as toxins and gases released by factories, combustion of fossil fuels, acid rain, oil spill and industrial waste.

2) Global warming

The emission of greenhouse gases due to human activity causes global warming, which in turn causes an increase in temperature that then leads to rising sea levels, melting of polar ice caps, flash floods and desertification.

3) Overpopulation

We are facing a shortage of resources such as food, water and fuel to sustain the rising global population, particularly in developing countries. Intensive agriculture attempting to lessen the problem actually leads to more damage through the use of chemical fertilizers, pesticides and insecticides.

4) Waste disposal

An excessive amount of waste is produced and dumped in the oceans. Nuclear waste is particularly dangerous, as well as plastics and electronic waste.

5) Ocean acidification

The increase in the production of carbon dioxide by humans causes the oceans' acidity to rise, which has a negative impact on marine life.

6) Loss of biodiversity

Species and habitats are becoming extinct due to human activity. This causes an imbalance in natural processes like pollination and poses a threat to ecosystems - coral reef destruction is particularly affected.

7) Deforestation

Loss of trees in order to make space for residential, industrial or commercial projects means that less oxygen is produced, and temperature and rainfall are affected.

8) Ozone layer depletion

Pollution caused by chlorofluorocarbons (CFCs) in the air creates a hole in the ozone layer, which protects the earth from harmful UV radiation.

9) Acid rain

Pollutants in the atmosphere such as sulfur dioxide and nitrogen oxides cause acid rain, which has negative consequences for humans, wildlife and aquatic species.

10) Public health issues

Lack of clean water is one of the leading environmental problems currently. Pollutants in the air also cause issues such as respiratory disease and cardiovascular disease.

Tragedy of Commons

The tragedy of the commons is a problem in economics that occurs when individuals neglect the well being of society in the pursuit of personal gain. This leads to over consumption and ultimately depletion of the common resource to everybody's detriment.

The concept originated in an essay written in **1833** by the **British economist William Foster Lloyd**, who used a hypothetical example of the effects of unregulated grazing on common land in great Britain and Ireland. The concept became widely known as the 'tragedy of the common over a century later after an article written by "**Garrett Hadrian**" in **1968**.

In a modern economic context, "commons" is taken to mean any open access and unregulated resource such as the atmosphere, oceans, rivers, oceans and fish stocks.

In a legal context, it is a type of property that is neither private nor public, but rather held jointly by the members of a community, who govern access and use through social structures, traditions or formal rules.

What is the Tragedy of the Commons?

Lloyd used the example of a common property (or "commons") shared by local communities where herdsman led their cattle to graze. If each herdsman acted in an economically rational way based solely on their own wellbeing, they would each allow more

than their fair share of cattle to graze on the land, thus leading to overuse. Every rational herdsman would be acting in their own best interest but they would collectively be destroying the grazing land they all relied on.

Tragedy of the commons theory rose in the popular consciousness in the 1960s when ecologist Garrett Hardin, a professor at the University of California, Santa Barbara, delved into Lloyd's theory in a scholarly article.

Examples of the Tragedy of the Commons

Examples of the tragedy of the commons can be seen throughout environmental science, especially in discussions of the causes of climate change. The original example of the tragedy of the commons had to do with overgrazing cattle on public land. Though this hypothetical is a bit dated, the principle can be easily applied to a growing human population that is depleting the earth of its natural resources. Some specific examples include:

1. Deforestation:

Overexploitation of the earth's forest has had enormous consequences on the environment. As a result of a lack of resource management our forests have disappeared at a rapid rate over the last century.

2. Animal extinction:

Overfishing and overhunting are examples of a common pool resource being depleted by individuals acting in their own self interest.

3. Depletion of natural resources:

When common resources are consumed with an eye towards short-term gain, the result can be a tragedy of the commons. For instance, when water is drawn from an aquifer faster than it refills, the immediate gains are undercut by the long term danger of drought.

4. Climate change:

Global warming is, on some level, a result of a tragedy of the commons, as governments, corporations and individuals fail to consider the cumulative effect their actions have on our shared environment.

Pollution as an Externality

Pollution is a negative externality. The social costs include the private costs of production incurred by the company and the external costs of pollution that are passed on the society.

What is an Externality?

An externality is a cost or benefit caused by a producer that is not financially incurred or received by that producer. An externality can be either positive or negative and can stem from either the production or consumption of a good or service. The costs and benefits can be both private to an individual or an organization or social, meaning it can affect society as a whole.

Externalities by nature are generally environmental, such as natural resources or public health. For example, a negative externality is a business that causes pollution that diminishes the property values or health of people in the surrounding area. A positive externality includes actions that reduce transmission of disease or avoids the use of lawn treatments that runoff to rivers and thus contribute to excess plant growth in lakes. Externalities are different from donations of parkland or open source software.

Understanding Externalities

Externalities occur in an economy when the production or consumption of a specific good or service impacts a third party that is not directly related to the production or consumption of that good or service.

Almost all externalities are considered to be technical externalities. Technical externalities have an impact on the consumption and production opportunities of unrelated third parties, but the price of consumption does not include the externalities. This exclusion creates a gap between the gain or loss of private individuals and the aggregate gain or loss of society as a whole.

The action of an individual or organization often results in positive private gains but detracts from the overall economy. Many economists consider technical externalities to be market deficiencies, and this is the reason people advocate for government intervention to curb negative externalities through taxation and regulation.

Externalities were once the responsibility of local governments and those affected by them. So, for instance, municipalities were responsible for paying for the effects of pollution from a factory in the area while the residents were responsible for their healthcare costs as a result of the pollution. After the late 1990s, governments enacted legislation imposing the cost of externalities on the producer. This legislation increased costs, which many corporations passed on to the consumer, making their goods and services more expensive.

Positive and Negative Externalities

Most externalities are negative. Pollution is a well-known negative externality. A corporation may decide to cut costs and increase profits by implementing new operations that are more harmful to the environment. The corporation realizes costs in the form of expanding operations but also generates returns that are higher than the costs.

However, the externality also increases the aggregate cost to the economy and society making it a negative externality. Externalities are negative when the social costs outweigh the private costs.

Some externalities are positive. Positive externalities occur when there is a positive gain on both the private level and social level. Research and development (R&D) conducted by a company can be a positive externality. R&D increases the private profits of a company but also has the added benefit of increasing the general level of knowledge within a society.

Similarly, the emphasis on education is also a positive externality. Investment in education leads to a smarter and more intelligent workforce. Companies benefit from hiring employees who are educated because they are knowledgeable. This benefits employers because a better-educated workforce requires less investment in employee training and development costs.

Overcoming Externalities

There are solutions that exist to overcome the negative effects of externalities. These can include those from both the public and private sectors.

Taxes are one solution to overcome externalities. To help reduce the negative effects of certain externalities such as pollution, governments can impose a tax on the goods causing the externalities. The tax, called a Pigouvian tax named after economist Arthur C. Pigou, sometimes called a Pigouvian tax is considered to be equal to the value of the negative externality. This tax is meant to discourage activities that impose a net cost to an unrelated third party. That means that the imposition of this type of tax will reduce the market outcome of the externality to an amount that is considered efficient.

Subsidies can also overcome negative externalities by encouraging the consumption of a positive externality. One example would be to subsidize orchards that plant fruit trees to provide positive externalities to beekeepers.

Governments can also implement regulations to offset the effects of externalities. Regulation is considered the most common solution. The public often turns to governments to pass and enact legislation and regulation to curb the negative effects of externalities. Several examples include environmental regulations or health related legislation.

Material Balance Approach: [Ayres-Kneese]

The functions of an economy are related to production, consumption and distribution activities. These activities have a direct relation with nature. Nature provides raw materials to the economy for its production and consumption activities.

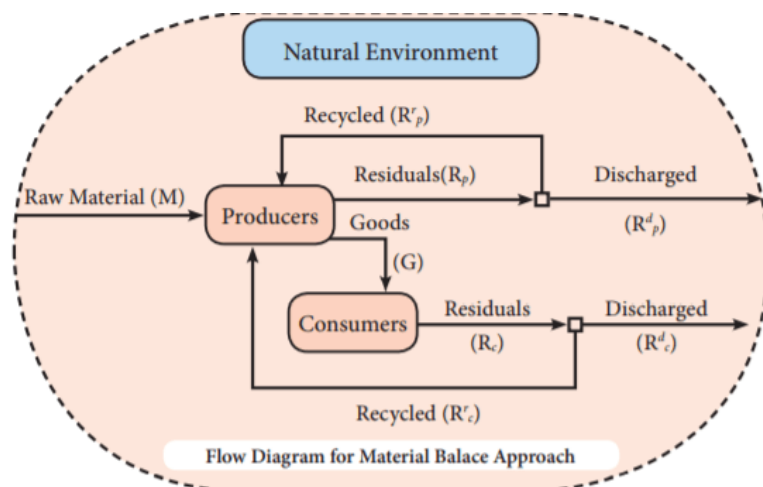
Residuals from both the production and consumption process usually remain and they usually render disservices like killing fish, reducing public health, soiling and deteriorating buildings due to industrial pollution.

Some wastes (residuals) from production and consumption activities are ultimately returned to nature. Remaining wastages are recycled. Further, all emission of residuals do not cause pollution damage because of assimilative capacity of the environment. Further energy that

is taken out of the environment must reappear somewhere else in the economic system. Its form may, however, be changed so that it appears as waste product and gases. Moreover, waste energy cannot be recycled but waste materials can be used up to a point. It means that economic activity always affects environment in a direct or indirect manner.

Thus the law of conservation of matter and energy holds that matter can be transformed to other but can never vanish. All inputs (fuels, raw materials, water and so forth) used in the economy's production processes will ultimately result in an equivalent residual or waste. The model is explained in the material flow diagram.

Material Flow Diagram



The material flow diagram implies that mass outputs for every process. Moreover, all resources extracted from the environment must eventually become unwanted waste and pollutants. This means among other things externalities (market failures) associated with production and consumption of materials are actually pervasive and they tend to grow in importance as the economy itself grows. Materials recycled can help but recycling is energy intensive and imperfect, so it cannot fully compensate.

According to John H. Baldwin the conventional mode of production and consumption omits important considerations. This omission results in emphasizing only sector of production and consumption that are monetized.

Most real production and consumption of goods and services in the world, especially in developing countries, occur even outside the formal monetized economy hence the material balance model brings a useful framework for analyzing alternative methods of resources and residuals management.

Thus, economics of the environments may be defined as a study which concerns allocation of resources among alternative uses in such way that there is an efficient reduction of the waste or residence in the environment, which leads to an increase in social welfare.

Environmental Quality as a Public Good

Public Goods

A public good is one whose consumption or use by one individual does not reduce the amount available for others. An example of a public good is water, which is available to one person and is also available to others without any additional cost. Its consumption is always joint and equal. It is non-excludable if it can be consumed by anyone.

It is non-rivalrous if no one has an exclusive right over its consumption. Its benefits can be provided to an additional consumer at zero marginal cost. Thus public goods are both non-excludable and non-rivalrous. Moreover, environmental quality is generally considerable as a public good and when it is valued at market price it leads to market failure.

The Paretian condition for a public good is that its marginal social benefit (MSB) should equal its marginal social cost (MSC). But the characteristics of a public good are such that the economy will not reach point of Pareto optimality in a perfectly competitive market. Public goods create externalities.

The externality starts when the marginal cost of consuming or producing an additional unit of a public good is zero but a price above zero is being charged. This violates the Paretian welfare maximization criterion of equating marginal social cost and marginal social benefit. This is because the benefits of a public good must be provided at a zero marginal social cost.

Suppose potable water is supplied by the municipal corporation. There are two individuals A and B who use it. Both consume the same quantity of water. But they differ in how much they are willing to pay for any given quantity.

This is illustrated in Figure 17.1. Where D_a and D_b are the demand curves of two individuals A and B respectively. Therefore demand prices are OP_a and OP_b corresponding to a given quantity OW of water. The curve ΣD is the vertical summation of D_a and D_b curves.

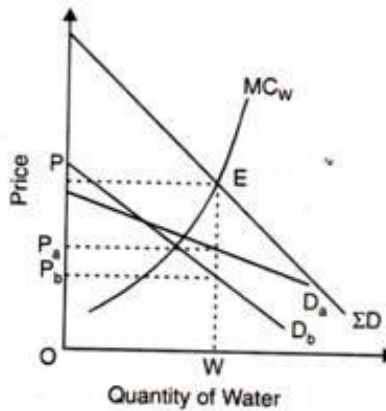


FIGURE 17.1

The Lindhal equilibrium for a public good exists where the sum of the individual prices equal marginal cost. Therefore,

$$OP = OP_a + OP_b - MC_W$$

But each consumer is being charged a different price. This is a case of price discrimination because price OP_a is greater than prices OP_b for the same quantity of water OW . Hence, there is market failure.

Public Bads

There are also public bads in which one person experiencing some disutility does not diminish the disutility of another, such as air and water pollution. Public goods and public bads cannot be handled by the institution of private property. K. E. Boulding has explained public bads with the following example: “If someone drives his car into my living room and pollutes it, I can sue him for damages. This is a private bad. If someone congests the road or pollutes the air, however, there is not much I can do about it as an individual. This is public bad.”

A public bad is any product on condition that it decreases the welfare of others in a non-exhaustive manner. For example, a factory situated in a residential area emits smoke which affects adversely health and household articles of the residents.

In this case, factory benefits by producing more quantities of commodities but at the expense of residents who have to incur extra expenses to keep them healthy and their households clean. These are social marginal costs which are higher due to negative externalities (public bads).

This is illustrated in Fig. 17.2 where the SMC curve is above the PMC curve which intersects the D curve at point E and determines the competitive price OP and output OQ. But the socially optimum output is OQ_1 and price is OP_1 , as determined by the intersection of SMC and D curves at point E_1 .

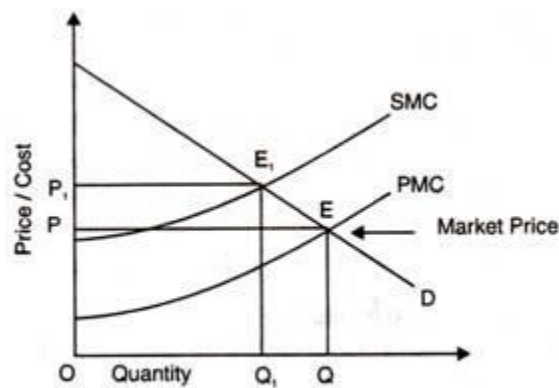


FIGURE 17.2

Thus the firms are producing Q_1Q more than the social optimal output OQ_1 . In this case, for every unit between Q_1 and Q , social marginal cost (SMC) is more than the competitive market price OP . Thus its production involves a social loss, i.e. $OQ - OQ_1 = QQ_1$.

Market failure is a necessary but not a sufficient condition for intervention. To be truly worthwhile, a government intervention must outperform the market or improve its functions. Second, the benefits from such intervention must exceed the costs of planning, implementation, and enforcement, as well as any indirect and unintended costs of distortions introduced to other sectors of the economy by such intervention.

UNIT II

Environmental Issues in India

Air pollution, poor management of waste, growing water scarcity falling groundwater tabler, water pollution, preservation and quality of forests, biodiversity loss, and land/ soil degradation are some of the major environmental issues India faces today.

There are many environmental issues in India. Air pollution, water pollution, garbage domestically prohibited goods and pollution of the natural environmental are all considered as challenges for India. Nature is also censing some drastic effects on India.

The situation was work between 1947 through 1995. According to data collected and environmental assessments studied by world bank experts, between 1995 through 2010, India has made some of the fastest progress in addressing its environmental issues and improving its environmental quality in it world.

Still, India has a long way to go to reach environmental quality similar to those enjoyed in develop economics. Pollution remains a major challenge and opportunity for India.

Environmental issues are one of the primary causes of disease health issues and long term live lid impact for India.

It is essential to make the public aware of the formidable consequences of the environmental degradation, if not retorted a reformative measures undertake would result in the extinction of life.

1. Growing population.
2. Poverty.
3. Agricultural growth.
4. Need of ground water.
5. Development and forests.
6. Degradation of land.

7. Reorientation of institution.
8. Reduction of genetic diversity.
9. Evil consequences of urbanization.
10. Air and water pollution.

Environmental Pollution

Environmental pollution can be defined as “The contamination of the physical and biological components of the earth/atmosphere system to such an extent that normal environmental processes are adversely affected”. It typically comes in seven types. These include air, water, land, radioactive, thermal light and sound pollution.

Pollution

Pollution is the introduction of contaminants into the environment that causes adverse change in nature. Pollution can take the form of chemical substances /energies or naturally occurring contaminants.

I. Air Pollution

Air pollution is a mixture of solid particles. Ozone, a gas, is a major part of air pollution in cities when ozone forms air pollution. It is also referred as smog. Some air pollutants are poisonous.

What is Air Pollution?

Pollution is now a commonplace term that our ears are attuned to. We hear about the various forms of pollution every day and read about it through the mass media. Air pollution is one such form that refers to the contamination of the air, irrespective of indoors or outside.

A physical, biological or chemical alteration to the air in the atmosphere can be termed as air pollution. It occurs when any harmful gases, dust, smoke enters into the atmosphere and makes it difficult for plants, animals, and humans to survive as the air becomes dirty.

Another way of looking at air pollution could be any substance that holds the potential to hinder the atmosphere or the well being of the living beings surviving in it.

The sustainment of all living things is due to a combination of gases that collectively form the atmosphere; the imbalance caused by the increase or decrease in the percentage of these gases can be harmful for survival.

The Ozone layer considered crucial for the existence of the ecosystems on the planet is depleting due to increased pollution. Global warming, a direct result of the increased imbalance of gases in the atmosphere, has come to be known as the biggest threat and challenge that the contemporary world has to overcome in a bid for survival.

Types of Pollutants

In order to understand the causes of Air pollution, several divisions can be made.

Air pollution can be classified into two sections - invisible and visible air pollution.

Visible air pollution, as the name suggests, can be visible. The smog you see over a city is an example of visible pollution.

Invisible air pollutants are less noticeable, but they can be more deadly. Good examples of invisible air pollutants are sulfur dioxide, carbon monoxide and nitrogen oxides.

It can be further divided into **primarily and secondary air pollutants** if we go deep.

Primarily air pollutants can be caused by primary sources or secondary sources. The pollutants that are a direct result of the process can be called primary pollutants. A classic example of a primary pollutant would be the sulfur dioxide emitted from factories.

Secondary pollutants are the ones that are caused by the intermingling and reactions of primary pollutants. Smog created by the interactions of several primary pollutants is known as a secondary pollutant.

Top-ten Causatives[causing agents] of Air Pollution

1. Sulfur dioxide
2. Carbon monoxide
3. Carbon dioxide
4. Nitrogen oxides
5. Volatile organic compounds (VOCs)
6. Particulates
7. Ozone
8. Chlorofluorocarbons (CFCs)
9. Unburned hydrocarbons
10. Lead and heavy metals

Sources of Air Pollution

When we try to study the sources of Air pollution, we usually enlist a series of activities and interactions that create these pollutants. There are two types of sources that we will take a look, namely Natural sources and man-made sources.

Natural Sources

Natural sources of pollution include dust carried by the wind from locations with very little or no green cover, gases released from the body processes of living beings (Carbon dioxide from humans during respiration, Methane from cattle during digestion, Oxygen from plants during Photosynthesis).

Smoke from the combustion of various inflammable objects, volcanic eruptions, etc. along with the emission of polluted gases also makes it to the list of natural sources of pollution.

Man-made Sources

While looking at the man-made contributions towards air pollution, it can be further divided into:

1. **Outdoor pollution sources**
2. **Indoor pollution sources**

Outdoor Pollution Sources

The major outdoor pollution sources include power generation, vehicles, agriculture/waste incineration, industry and building heating systems. Smoke features as a prominent component. The smoke emitted from various forms of combustion, like in biomass, factories, vehicles, furnaces, etc.

Waste dumped in landfills generates methane, which is harmful in several ways. The reactions of certain gases and chemicals also form harmful fumes that can be dangerous to the well-being of living creatures.

Indoor Pollution Sources

In low and middle income countries, mostly burning fuels such as dung, coal and wood in inefficient stoves or open hearths produces a variety of health-damaging pollutants. These include carbon monoxide, methane, particulate matter (PM), polycyclic aromatic hydrocarbons (PAH) and volatile organic compounds (VOC).

Even burning kerosene in simple wick lamps also produces significant emissions of fine particles and other pollutants. Exposure to smoke from cooking fires causes 3.8 million premature deaths each year.

Various Causes of Air pollution

1. The Burning of Fossil Fuels

Sulfur dioxide emitted from the combustion of fossil fuels like coal, petroleum for energy in power plants, and other factory combustibles is one the major cause of air pollution.

Billions of vehicles run on roads are powered by gasoline and diesel engines that burn petroleum for releasing energy. Petroleum is made up of hydrocarbons, and engines don't burn them cleanly.

As a result, pollutants such as PM, nitric oxide and NO₂ (together referred to as NO_x), carbon monoxide, organic compounds, and lead emit from vehicles including trucks, jeeps, cars, trains, airplanes, causing a high level of pollution. These modes of transportation form part of our daily basic needs, so we rely on them heavily.

But their overuse is killing our environment as dangerous gases are polluting the atmosphere. Carbon Monoxide caused by improper or incomplete combustion and generally emitted from vehicles is another major pollutant along with Nitrogen Oxides, which is produced from both natural and man-made processes.

As per the World Health Organization (WHO), exposure to outdoor air pollution contributes to as much as 0.6 to 1.4 per cent of the burden of disease and 4.2 million deaths every year.

2. Agricultural Activities

Ammonia is a very common byproduct of agriculture related activities and is one of the most hazardous gases in the atmosphere. The use of insecticides, pesticides, and fertilizers in agricultural activities has grown quite a lot. They emit harmful chemicals into the air and can also cause water pollution.

Farmers also set the field and old crops on fire in order to keep them clean for the next round of sowing. The burning to clean fields is said to cause pollution by releasing harmful gases in the air.

3. Waste in Landfills

Landfills are land areas in which waste is deposited or buried. These deposited or buried wastes generate methane. Methane is a major greenhouse gas that is highly flammable and very hazardous.

E-waste is another grave concern involving a lot of unscientific dismantling such as chemical leaching, burning wires and others.

4. Exhaust from Factories and Industries

Manufacturing industries release a large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air, thereby depleting the quality of air.

Manufacturing industries can be found at every corner of the earth, and there is no area that has not been affected by it. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.

5. Mining Operations

Mining is a process, wherein, minerals below the earth are extracted using large equipment. During the process, dust and chemicals are released in the air causing massive air pollution.

This is one of the reasons which are responsible for the deteriorating health conditions of workers and nearby residents.

6. Indoor Air Pollution

Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution. Have you ever noticed that once you paint the walls of your house, it creates some sort of smell that makes it literally impossible for you to breathe?

Suspended particulate matter popular by its acronym SPM, is another cause of pollution. Referring to the particles afloat in the air, SPM is usually caused by dust, combustion, etc.

Around seven million premature deaths caused every year due to the combined effects of ambient (outdoor) and household air pollution cause, WHO says.

7. Natural Events

There are certain natural events such as volcanoes, forest fires, and dust storms, which are nature born and cause air pollution.

Disastrous Effects of Air pollution

1. Respiratory and Heart Problems

The effects of air pollution are alarming. They are known to create several respiratory and heart conditions like asthma, chronic bronchitis, emphysema, heart attacks and strokes along with cancer, among other threats to the body. Several million are known to have died due to the direct or indirect effects of Air pollution.

2. Child Health Problems

Air pollution is detrimental to your health even before you take your first breath. Exposure to high air pollution levels during pregnancy causes miscarriages as well as premature birth, autism, asthma and spectrum disorder in young children.

It also has the potential to damage early brain development in a child and cause pneumonia that kills almost a million children below 5 years. Children are at a greater risk of short term respiratory infections and pulmonary diseases in areas exposed to air pollutants.

3. Global Warming

Another direct effect is the immediate alterations that the world is witnessing due to global warming. With increased temperatures worldwide, an increase in sea levels and melting of ice from colder regions and icebergs, displacement, and loss of habitat have already signaled an impending disaster if actions for preservation and normalization are not undertaken soon.

4. Acid Rain

Harmful gases like nitrogen oxides and sulfur oxides are released into the atmosphere during the burning of fossil fuels. When it rains, the water droplets combine with these air pollutants, becomes acidic and then falls on the ground in the form of acid rain. Acid rain can cause great damage to humans, animals and crops.

5. Eutrophication

Eutrophication is a condition where a high amount of nitrogen present in some pollutants gets developed on the sea surface and turns itself into algae and adversely affects fish, plants, and animal species.

The green colored algae that are present on lakes and ponds are due to the presence of this chemical only.

6. Effect on Wildlife

Just like humans, animals also face some devastating effects of air pollution. Toxic chemicals present in the air can force wildlife species to move to a new place and change their habitat. The toxic pollutants deposit over the surface of the water and can also affect sea animals.

7. Depletion of the Ozone Layer

Ozone exists in the Earth's stratosphere and is responsible for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to the presence of chlorofluorocarbons, hydro chlorofluorocarbons in the atmosphere.

As the ozone layer becomes thin, it will emit harmful rays back on earth and can cause skin and eye-related problems. UV rays also have the capability to affect crops.

Impressive Solutions to Air Pollution

1. Use the Public Mode of Transportation

Encourage people to use more and more public modes of transportation to reduce pollution. Also, try to make use of carpooling. If you and your colleagues come from the same locality and have the same timings, you can explore this option to save energy and money.

2. Better Household Practices

Discard fireplaces and/or wooden stoves used for heating homes. Use gas logs in place of wood. Also, eliminate the use of gas powered lawn and gardening equipment. Avoid setting fire to garbage, dry leaves, or other materials in your yard, and lighting bonfires in the open. Try to mulch or compost your yard waste. Use cleaning products and paints that are environmentally friendly.

3. Conserve Energy

Switch off fans and lights when you are going out. A large number of fossil fuels are burnt to produce electricity. You can save the environment from degradation by reducing the number of fossil fuels to be burned.

4. Understand the Concept of Reduce, Reuse and Recycle

Do not throw away items that are of no use to you. Instead, reuse them for some other purpose. For example you can use old jars to store cereals or pulses.

5. Emphasis on Clean Energy Resources

Use of clean energy technologies like solar, wind and geothermal is on the rise these days. Governments of various countries have been providing grants to consumers who are interested in installing solar panels for their homes. Undoubtedly, this can go a long way to curb air pollution.

6. Use Energy Efficient Devices

CFL lights consume less electricity than their counterparts. They live longer, consume less electricity, lead to lower electricity bills, and also help you to reduce pollution by consuming less energy.

Several attempts are being made worldwide on personal, industrial, and governmental levels to curb the intensity at which air pollution is rising and regain a balance as far as the proportions of the foundation gases are concerned.

This is a direct attempt at slacking Global warming. We are seeing a series of innovations and experiments aimed at creating alternate and unconventional options to reduce pollutants. Air pollution is one of the larger mirrors of man's follies, and a challenge we need to overcome to see a better tomorrow.

II. Water Pollution

Water pollution (or aquatic pollution) is the contamination of water bodies, usually as a result of human activities. Water bodies include for example lakes, rivers, oceans, aquifers and ground water. They may use the same polluted river water for drinking or bathing or irrigation.

Water pollution is one of the biggest issues facing India right now. As may be evident, untreated sewage is the biggest source of such form of pollution in India. There are other sources of pollution such as runoff from the agricultural sector as well as unregulated units that belong to the small-scale industry. The situation is so serious that perhaps there is no water body in India that is not polluted to some extent or the other.

In fact, it is said that almost 80% of the water bodies in India are highly polluted. This is especially applicable of ones that some form or the other of human habitation in their immediate vicinity. Ganga and Yamuna are the most polluted rivers in India.

Causes of water pollution in India

The single biggest reason for water pollution in India is "Urbanization at an uncontrolled rate". The rate of urbanization has only gone up at a fast pace in the last decade or so, but even

then it has left an indelible mark on India's aquatic resources. This has led to several environmental issues in the long term like paucity in water supply, generation and collection of wastewater to name a few.

The treatment and disposal of waste water has also been a major issue in this regard. The areas near rivers have seen plenty of towns and cities come up and this has also contributed to the growing intensity of problems.

Uncontrolled urbanization in these areas has also led to generation of sewage water. In the urban areas water is used for both industrial and domestic purposes from water bodies such as rivers, lakes, streams, wells and ponds. Worst still, 80 per cent of the water that we use for our domestic purposes is passed out in the form of wastewater. In most of the cases, this water is not treated properly and as such it leads to tremendous pollution of surface level freshwater.

This polluted water also seeps through the surface and poisons groundwater. It is estimated that cities with populations of more than one lakh people generate around 16,662 million litres of wastewater in a day. Strangely enough, 70 per cent of the people in these cities have access to sewerage facilities. Cities and towns located on the banks of Ganga generate around 33 per cent of wastewater generated in the country.

Following are some other important reasons of increasing levels of water pollution in India:

1. Industrial waste.
2. Improper practices in agricultural sector.
3. Reduction in water quantity in rivers in plains.
4. Social and religious practices like dumping dead bodies in water, bathing, throwing waste in water.
5. Oil leaks from ships.

6. Acid rain
7. Global warming.
8. Eutrophication.
9. Inadequate industrial treatments of wastes.
10. Denitrification.

Effects of water pollution in India

Water pollution can have some tremendously adverse effect on the health of any and every life form living in the vicinity of the polluted water body or using water that has been polluted to some extent. At a certain level polluted water can be detrimental to crops and reduce the fertility of soil thus harming the overall agricultural sector and the country as well. When sea water is polluted it can also impact oceanic life in a bad way. The most fundamental effect of water pollution is however on the quality of the water, consuming which can lead to several ailments.

Polluted water can lead to diseases such as cholera, tuberculosis, dysentery, jaundice, diarrhea, etc. In fact, around 80% stomach ailments in India happen because of consuming polluted water. The rural people are mostly affected by water-borne diseases.

Solution of water pollution in India

The best way to solve these issues is to prevent them. The first major solution in this context is conservation of soil. Soil erosion can contribute to water pollution. So, if soil can be conserved we can prevent water pollution too. We can follow measures such as planting more trees, managing erosion in a better way, and use farming methods that are better for the soil. In the same vein it is also important to follow the right methods in disposing toxic waste. For starters, we can use products that have lesser amounts of volatile organic compounds in them. Even in cases where toxic material like paints, cleaning supplies, and stain removers are used,

they need to be disposed off in the right way. It is also important to look into oil leaks in one's cars and machines.

It is said that leaked oil even from cars and machines is one of the principal contributors to water pollution. Hence, it is important to look at cars and machines, which run on oil, on a regular basis, to check them for any possible oil leak. It is important after work especially in factories and production units where oil is used to clean up the wasted oil and either dispose it properly or keep it for later use. Following are some other ways in which this problem can be addressed adequately:

1. Cleaning up waterways and beaches.
2. Avoiding the usage of non-biodegradable material like plastic.
3. Being more involved in various measures pertaining to preventing water pollution.

III. Land Pollution

Soil contamination or soil pollution as part of land degradation is caused by the presence of xenobiotics chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals or improper disposal of waste.

What is Land Pollution?

When we talk about air or water pollution, the reactions garnered are stronger. This is because we can see the effects caused by the pollutants and their extent very clearly. It is normal human psychology to believe in what you see firsthand. Our land, on the other hand, is living a nightmare too.

We may not be able to see the effects with clarity, but the land is being polluted and abused constantly, and we are unable to calculate the damages incurred. Land Pollution has emerged to become one of the serious concerns that we collectively battle.

Land pollution, in other words, means degradation or destruction of the Earth's surface and soil, directly or indirectly, as a result of human activities. Anthropogenic activities are conducted citing development, and the same affects the land drastically as we witness land pollution.

By drastic, we are referring to any activity that lessens the quality and/or productivity of the land as an ideal place for agriculture, forestation, construction, etc. The degradation of land that could be used constructively, in other words, is land pollution.

Land Pollution has led to a series of issues that we have come to realize in recent times, after decades of negligence. The increasing numbers of barren land plots and the decreasing numbers of forest cover are increasing at an alarming ratio.

Moreover, the extension of cities and towns due to the increasing population is leading to further exploitation of the available land.

Landfills and reclamations are being planned and executed to meet the increased demand for lands. This leads to further deterioration of land, and pollution caused by the landfill contents. Also, due to the lack of green cover, the land gets affected in several ways, like soil erosion, which washes away the fertile portions of the land. A landslide can also be viewed as an example.

1. Deforestation and Soil Erosion

Deforestation carried out to create dry lands is one of the major concerns. A land that is once converted into dry or barren land can never be made fertile again, whatever the magnitude of measures to redeem it is.

Land conversion, meaning the alteration or modification of the original properties of the land to make it use-worthy for a specific purpose, is another major cause. It hampers the land immensely.

Also there is a constant waste of land. Unused available land over the years turns barren; this land then cannot be used. So in search of more land, potent land is hunted and its indigenous state is compromised.

With the growing human population, the demand for food has increased considerably. Farmers often use highly toxic fertilizers and pesticides to get rid of insects, fungi and bacteria from their crops. However, with the overuse of these chemicals they result in contamination and poisoning of soil.

3. Mining Activities

During extraction and mining activities, several land spaces are created beneath the surface. We constantly hear about land caving in, which is nothing but nature's way of filling the spaces left out after mining or extraction activity.

4. Overcrowded Landfills

Each household produces tonnes of garbage each year. Garbage like aluminum, plastic, paper, cloth, wood is collected and sent to the local recycling unit. Items that cannot be recycled become a part of the landfills that hamper the beauty of the city and cause land pollution.

5. Industrialization

Due to an increase in demand for food, shelter, and house, more goods are produced. This resulted in the creation of more waste that needs to be disposed of.

To meet the demand of the growing population, more industries were developed, which led to deforestation. Research and development paved the way for modern fertilizers and chemicals that were highly toxic and led to soil contamination.

6. Urbanization

Humans have been making permanent settlements for at least the past 10,000 years. Most of the cities and towns, and the infrastructure created, will remain with us for thousands of more years into the future.

Many of us may not classify human settlements as “land pollution;” however, urbanization marks a significant change to the landscape that can cause land pollution in a variety of subtle and not so subtle ways.

7. Construction Activities

Due to urbanization, a large number of construction activities are taking place, which has resulted in huge waste articles like wood, metal, bricks, plastic that can be seen by naked eyes outside any building or office which is under construction.

8. Nuclear Waste

Nuclear plants can produce a huge amount of energy through nuclear fission and fusion. The leftover radioactive material contains harmful and toxic chemicals that can affect human health. They are dumped beneath the earth to avoid any casualty.

9. Sewage Treatment

A large amount of solid waste is leftover once the sewage has been treated. The leftover material is then sent to the landfill site, which ends up polluting the environment.

10. Littering

Littering is a common problem, no matter it is a city or a rural region. People just throw their garbage on the ground without caring about the adverse effects on the environment.

A common instance is that people just throw their cigarette butt on the ground every time. Since cigarettes contain elements harmful to the environment, it leads to land contamination.

Disastrous Effects of Land Pollution

1. Soil pollution

Soil pollution is another form of land pollution, where the upper layer of the soil or the topsoil's composition is damaged or becomes altered.

This is caused by the overuse of chemical fertilizers, soil erosion triggered by running water and other pest control measures, leading to loss of fertile land for agriculture, forest cover, fodder patches for grazing, etc.

The regeneration process takes at least 500 years for 2.5 centimeters of topsoil. The United States loses soil at the rate 17 times higher than it usually takes to generate new topsoil.

2. Groundwater poisoning

When harmful substances from industrial processes, chemicals are improperly disposed of on the land or in illegal landfills or storages, the chemicals and other substances could end up in the groundwater system.

The process is called leaching. It can happen on farms, industrial sites, and landfills and affect the health of animals, plants and also humans.

3. Drinking water problem

Drinking water is highly affected by land pollution. Nearly 50% of the world's population does not have access to safe drinking water, and each year water-based diseases cause up to 10 million deaths.

4. Change in climate patterns

The effects of land pollution are very hazardous and can lead to the loss of ecosystems. When land is polluted, it directly or indirectly affects the climate patterns.

5. Environmental impact

When deforestation is committed, the tree cover is compromised. This leads to a steep imbalance in the rain cycle. A disturbed rain cycle affects a lot of factors.

Most importantly, the green cover is reduced. Trees and plants help balance the atmosphere; without them, we are subjected to various concerns like Global warming, the greenhouse effect, irregular rainfall and flash floods, among other imbalances.

6. Effect on human health

The land, when contaminated with toxic chemicals and pesticides, lead to potentially fatal problems like skin cancer and the human respiratory ailments in particular.

Globally, 9,500 people are diagnosed with skin cancer every day. The toxic chemicals can reach our body through foods and vegetables that we eat as they are grown in polluted soil.

Land pollution also caused developmental deficiency in children. Chemicals, such as lead that are commonly found in contaminated soil and water, can impact a child's cognitive development even when the exposure is very low.

7. Causes air pollution

Landfills across the city keep on growing due to an increase in waste and are later burned, which leads to air pollution. They become home for rodents, mice, etc., which in turn transmit diseases.

8. Distraction for Tourists

The city loses its attraction when a tourist destination as landfills does not look good when you move around the city. It leads to a loss of revenue for the state government.

9. Effect on Wildlife

The animal kingdom has suffered most in the past decades. They face a serious threat with regard to the loss of habitat and natural environment.

The constant human activity on land is leaving it polluted, forcing these species to move further away and adapt to new regions or die trying to adjust. Several species are also pushed to the verge of extinction, due to no homeland.

10. Water nutrient enrichment

Chemicals that are frequently used on agricultural farms, such as nitrogen, end up benefitting the crops only in a small proportion. The rest ends up in water populated by fish, algae, and other life forms.

As the nutrient heavy water saps up most of the oxygen in the water, it leaves little oxygen for fish and other marine life. The water in that situation becomes unable to support most life forms.

11. Wildfires

When land areas are polluted, they usually become quite dry. The dry conditions created by pollutants in the soil create the perfect environment for wildfires and increases the probability of wildfires dramatically.

The fires can grow quickly because of the dry conditions and widening area of polluted land, thereby harming the whole environment and killing plants, animals and even humans.

12. Habitat shifting

When deforestation and soil erosion are in progress, animals are forced to move from their natural habitat to find shelter and food. The change is too traumatic for some animals, and this even leads to loss of life. As a consequence, some species are posed with a greater risk of extinction.

13. Other Issues

Other issues that we face include increased temperature, unseasonal weather activity, acid rains, etc. The discharge of chemicals on land makes it dangerous for the ecosystem too.

These chemicals are consumed by the animals and plants and thereby making their way in the ecosystem. This process is called bio magnification and is a serious threat to the ecology.

Solutions to Land Pollution

1. Make people aware of the concept of Reduce, Recycle and Reuse.
2. Reusing materials help to reduce the requirement of harvesting resources. The products that cannot be reused can likely be recycled.
3. Reduce the use of pesticides and fertilizers in agricultural activities.
4. Reduce the use of non biodegradable materials. By simply switching to a reusable cloth bag for groceries instead of plastic shopping bags will help cut down on the need for non-biodegradable materials.
5. Avoid buying packaged items as they will lead to creating garbage and end up in the landfill site.
6. Ensure that you do not litter on the ground and do proper disposal of garbage.
7. Buy biodegradable products.
8. Do organic gardening and eat organic food that will be grown without the use of pesticides or insecticide.
9. Create dumping ground away from residential areas.

10. Several creatures survive under the land. Disruption of the harmony of the land means disrupting their habitat as well. This has led to several creatures reaching the endangered status like Gilbert's Potoroo in Australia.

11. Avoid littering and properly dispose of waste, which is an essential measure against land pollution both for households as well as for industries.

12. Education is the key to mitigate the land pollution problem. We have to show people the adverse effects of land pollution and the way to mitigate them. Convincing others can motivate every one of us to make a significant contribution to save our environment.

We walk and survive on land. It is literally the base of our ecosystem. Therefore, it is in our good interest to take care of it and nurture it.

IV. Marine pollution

It is a combination of chemicals and trash, most of which comes from land sources is washed or blown in to the ocean. This pollution results in damage to the environment, to the health of all organisms, and to economic structures worldwide.

Marine pollution has been an ever present problem since the advent of large-scale agricultural activity and industrialization. However, significant laws and regulations at an international level to tackle the problem came only in the mid twentieth century. During United Nations Conventions on the Law of the Sea in the early 1950s, the various stakeholders came together to deliberate and formulate laws pertaining to marine pollution. Till mid twentieth century the majority of the scientists maintained that oceans were vast enough to be able to dilute the amount of pollution being drained into them thus, considering pollution harmless to the marine life.

Causes of marine pollution

The marine environment becomes polluted and contaminated through various sources and forms. Major sources of marine pollution are the inflow of chemicals, solid waste, discharge of

radioactive elements, industrial and agricultural effluents, man-made sedimentation, oil spills and many such factors. The majority portion of the marine pollution comes from the land that contributes to 80 per cent of the marine pollution; air pollution also carries pesticides from farms and dust into the marine waters. Air and land pollution is a major contributor to the growing marine pollution that is not only hampering the aquatic ecology but also affecting the life on land. The non-point sources like wind-blown debris, agricultural runoff and dust become the major source of pollution. Apart from these, factors like land runoff, direct discharge, atmospheric pollution, pollution caused by ships and deep sea mining of natural resources contribute heavily.

Types of Marine Pollution

Eutrophication: When there is an excess of chemical nutrients mainly nitrates and phosphates in the water, it leads to eutrophication or nutrient pollution. Eutrophication decreases the level of oxygen, reduces the quality of water, makes the water inhabitable for fish, affects the breeding process within the marine life and increases the primary productivity of the marine ecosystem.

Acidification: Oceans act as a natural reservoir for absorbing the carbon dioxide from the Earth's atmosphere. But, due to rising level of carbon dioxide in the atmosphere, the oceans across the world are becoming acidic in nature; as a consequence, it leads to acidification of oceans. Researches and scientists have not been able to uncover the potential damage ocean acidification may have on the Earth's atmosphere. But, there is a strong concerns that acidification might lead to dissolution of calcium carbonate structures that can affect the shell formation in shellfish and also the corals.

Toxins: There are persistent toxins that do not get dissolved or disintegrate with the marine ecosystem rapidly. Toxin such as pesticides, DDT, PCBs, furans, TBT, radioactive waste, phenols and dioxins get accumulated in the tissue cells of the marine life forms and lead to bioaccumulation hampering the life underwater and sometimes leads to a mutation in aquatic life forms.

Plastics: The ever growing dependence of human population on plastic has filled the oceans and the land; it consists of 80 percent of the debris found in the oceans. Plastic dumped and found in the oceans are dangerous for the marine life forms and wildlife, as sometimes it strangles and chokes them to death. The rising levels of plastic dumps found in the oceans are suffocating, ingesting, and entangling the life underwater as well as above it.

Effects of marine pollution

The contamination of water by excessive nutrients is known as nutrient pollution, a type of water pollution that affects the life under water. When excess nutrients like nitrates or phosphates get dissolved with the water it causes the eutrophication of surface waters, as it stimulates the growth of algae due to excess nutrients. Most of Benthic animals and plankton are either filter feeders or deposit feeders take up the tiny particles that adhere to potentially toxic chemicals. In the ocean food chains, such toxins get concentrated upward. This makes estuaries anoxic as many particles combine chemically depletive of oxygen.

When the marine ecosystem absorbs the pesticides, they are incorporated into the food webs of the marine ecosystem. After getting dissolved in the marine food webs, these harmful pesticides causes' mutations, and also results in diseases, which can damage the entire food web and cause harm to the humans. When toxic metals are dumped or flown into the oceans through drains, it engulfs within the marine food webs. It affects the biochemistry, reproduction process, can affect the tissue matter These can cause a change to tissue matter, biochemistry, behavior, reproduction, and suppress and alter the marine life's growth. Marine toxins can be transferred to several animals feeding on the fish or fish hydrolysate as a meal, toxins are then transferred to dairy products and meat of these affected land animals.

Steps to prevent marine pollution

Stop using plastic and littering garbage as they not only choke up the drains but also releases into the oceans. Ensure that chemicals mentioned above are not used anywhere near the streams of water and try cutting down on the usage of such chemicals. For farmers, they need to switch from chemical fertilizers and pesticides and move towards the usage of organic farming methods. Use public transport and reduce the carbon footprint by

taking small and substantial measures that will not help in reducing the pollution from the environment but will ensure a safe and healthy future for the upcoming generations. Prevent from any oil or chemical spill in the oceans and if in case there is an oil or chemical spill near you volunteer and help in cleaning out the ocean water. Volunteer or initiate beach cleanup activities and spread awareness about the same in the nearby vicinity.

V. Noise Pollution

It is generally defined as regular exposure of elevated sound levels that may lead to adverse effects in humans or other living organisms. Work place sounds often common in open space offices, constant loud music in or near commercial venues, industrial sounds like fans, generators, compressor and mills.

Effects of Noise Pollution

1. Hearing problems

Any unwanted sound that our ears have not been built to filter can cause problems within the body. Our ears can take in a certain range of sounds without getting damaged.

Man-made noises such as noises from jackhammers, horns, machinery, airplanes and even vehicles can be too loud for our hearing range.

Constant exposure to loud levels of noise can easily result in the damage of our eardrums and loss of hearing, causing tinnitus or deafness. It also reduces our sensitivity to sounds that our ears pick up unconsciously to regulate our body's rhythm.

2. Psychological Issues

Excessive noise pollution in working areas such as offices, construction sites, bars and even in our homes can influence psychological health.

Studies show that the occurrence of aggressive behavior, disturbance of sleep, constant stress, fatigue, depression, anxiety, hysteria and hypertension in humans as well as animals can be linked to excessive noise levels. The level of irritation increases with increased noise, and

people tend to become less and less patient. These in turn, can cause more severe and chronic health issues later in life.

3. Physical Problems

Noise pollution can cause headaches, high blood pressure, respiratory agitation, racing pulse, and, in exposure to extremely loud, constant noise, gastritis, colitis and even heart attacks may occur.

4. Cognitive issues & behavioral changes

Noise affects brain responses and people's ability to focus, which can lead to low-performance levels over time. Like other sound waves, too much noise when it goes to the brain leads to lower response rates as well as making the mind dull.

It is also poor for memory, making it hard to study. The studies have shown that school children living near railway stations or airports have problems in learning.

Research has shown that people, who live near airports or busy roads, usually have a higher incidence of headaches, take more sleeping pills and sedatives, are more prone to minor accidents, and are more likely to seek psychiatric treatment.

5. Sleeping disorders

While it may not seem like much at this point, excessively high levels of noise are likely to hamper your sleeping pattern, thereby leading to irritation and uncomfortable situations.

Without a good night's sleep, you might experience multiple problems related to fatigue. This will affect your performance in the office as well as at home. It is therefore recommended to take a sound sleep to give your body proper rest.

If a certain noise is disturbing your sleep, take an actionable measure to reduce it. While in some instances, it is completely unavoidable; there are other instances (like noise from TV or gadgets) that can be easily avoided by making good lifestyle changes.

Interestingly, our ears need rest for 16 hours and even more to make up for two hours of exposure to 100 dB.

6. Cardiovascular issues

Blood pressure levels, cardiovascular disease and stress related heart problems are on the rise.

Studies suggest that high-intensity noise causes high blood pressure and increases heartbeat rate as it disrupts the normal blood flow.

Since bringing these rates to a manageable level depends on our understanding of noise pollution, we need to be wary of the ill-effects and tackle these situations mindfully.

7. Trouble communicating

High decibel noise can put trouble and affect free communication between people. This may lead to misunderstanding, and you may get difficult understanding the other person. Constant sharp noise can give you a severe headache and disturb your emotional balance.

8. Effect on wildlife

Wildlife faces far more problems than humans because of noise pollution since they are more dependent on sound. Animals develop a better sense of hearing than us since their survival depends on it.

A recent study published in Biology Letters found that human-created noise affects a wide range of animals. The ill effects of excessive noise begin at home. Pets react more aggressively in households where there is constant noise.

They become disoriented more easily and face many behavioral problems. In nature, animals may suffer from hearing loss, which makes them easy prey and leads to dwindling populations. Others become inefficient at hunting, disturbing the balance of the eco system.

9. Effects on Species Depending on Mating Call

Species that depend on mating calls to reproduce are often unable to hear these calls due to excessive man made noise.

As a result, they are unable to reproduce and cause declining populations. Others require sound waves to locate and find their way when migrating.

Disturbing their sound signals means they get lost easily and do not migrate when they should. To cope up with the increasing sound around them, animals are becoming louder which may further add to the pollution levels. This is why understanding noise pollution can help us lower the impact it has on the environment.

Solutions to lower noise pollution

WHO agrees that awareness of noise pollution is essential to beat this invisible enemy. As of now, there are not many solutions to reduce sound pollution. However, governments can help in the following ways:

1. Establishing regulations that include preventive and corrective measures.
2. Governments can take measures such as protecting certain areas, parts of the countryside, areas of natural interest, city parks, etc. to ensure noise management and reduce noise pollution.
3. The mandatory separation between residential zones and sources of noise, like airports.
4. Creating pedestrian areas where traffic is not allowed to enter other than offload goods at certain times.
5. Fines for exceeding noise limits.
6. Other ways to battle noise pollution are by controlling the sound levels in clubs, bars, parties, and discos.

7. Removal of public loudspeakers is another way in which pollution can be countered.
8. Again, better urban planning can help create 'No-Noise' zones, where honking and industrial noise is not tolerated.
9. Replacing traditional asphalt with more efficient options can also help reduce traffic noise by up to 3 dB.

On a personal level, everybody can help to reduce the noise in the following ways:

1. Keep checking the surrounding noise levels and limit the sounds that you produce.
2. Stay in a green neighborhood full of trees as they are known to reduce the sound levels from 5 to 10 dB.
3. Reduce noise in homes by lowering the volume of the radio, music system and the television.
4. Avoid very noisy leisure activities and also going to areas that are too noisy.
5. Doing your housework at the recommended time also makes a difference.
6. Use proper noise absorbents in machines that make too much noise.
7. Listening to music with headphones is also a good step forward.
8. Use earplugs when you are in a noisy area because it lowers the overall noise of the surroundings.
9. Try alternative means of transport such as bicycles or electric vehicles instead of taking the car.
10. Get your vehicle checked regularly and lubricate it properly that it doesn't produce too much noise.
11. In the case of new buildings, you can insulate your home with noise-absorbing materials.

Role of an Individual in Prevention of Pollution

Environment production has been a burning issue in the last half century. In order to tackle the menace of pollution, urgent steps have to be taken at not only global or country level, but also at local level. In fact, the role of individuals in prevention of pollution is of critical importance.

because it is the individuals the make a community of country. Effort by each in individuals at his or her level can have a significant effect on global level.

The individuals who are aware and inspired are the strongest tool to tackle pollution. This is because an aware individual not only lessens the burden on state but also he/she is more familiar with problems persisting at local level and he himself/herself deals with them in his/her day to day life. It is better and more viable to prevent pollution by educating individuals than controlling pollution. Individuals should encourage to modify their lifestyle are not healthy for environment.

Way in which an individual can help in prevention of pollution

1. Individuals should minimize wastage of resources such as electricity.
2. Individuals can make considerable contribution by using mass transport instead of using personal vehicles.
3. Individuals should reuse items whenever possible.
4. Products that are made of recycled material should be given preference.
5. Take part in environment conservation drives such as tree planting drives.
6. Use of refrigerators should be minimized.
7. Organize drives to clean streets and clean drains with help of other people of locality.
8. Spread awareness and inspire other people to prevent pollution.
9. Individuals should be encouraged to acquire information and innovations from world over and implement them locally.

UNIT III

Welfare Economics & Environmental Economics

The kernel of the institutional problem in environmental welfare economics is to formulate the institutionally determined conditions for expressing the scarcity of nature in the prices of goods and services in accordance with present opinion. The whole system of taxes and subsidies falls within this scope.

This topic describes environmental economics as seen from the standpoint of neoclassical welfare economics. It discusses the theoretical framework for measurements of welfare effects of changes in the environment. This framework is founded on a “general equilibrium approach” to environmental problems.

This topic thus gives a conceptual theoretical framework for environmental economics. This framework has been presented in mathematical form. The chapter discusses the concept of “Lindahl equilibrium”.

It is the most natural correspondence in an economy with public goods to the “competitive equilibrium” in an economy without public goods. The traditional general equilibrium models discuss the case where all goods in the model are privately owned and sold brought on perfect markets.

The topic reviews that equilibrium in such an economy has some very desirable properties, the most important being. That it is Pareto efficient, that is, there are no other feasible allocations in the economy that are more desired by some individuals but less desired by all others. Three approaches are discussed.

1. To ask, people about their willingness to pay for environmental services.
2. To make assumptions on preferences that will enable one to derive the utility function over environmental services from the demand functions for private goods.

3. To make assumptions that imply that the value of some environmental services is capitalized in the price of some private goods.

Pareto (efficiency) optimality

Pareto optimality (also referred to as Pareto efficiency) is a standard often used in economics. It describes a situation where no further improvements to society's well being can be made through a reallocation of resources that makes at least one person better off without making someone else worse off.

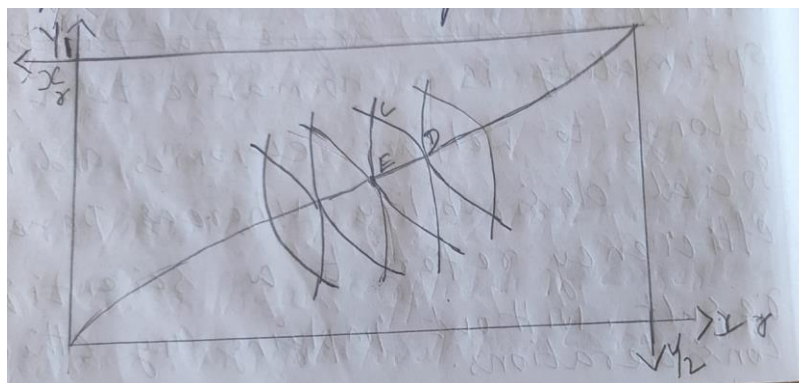
Arrow and Hahn (1971) and Lockwood (2008) argue that Pareto optimality is a normative term, which belongs to welfare economics and implies social desirability, whereas Pareto efficiency refers to a scientific result, without implying any ethical considerations.

Pareto optimality and market failure

This efficiency criterion was developed by Vilfredo Pareto in his book "Manual of political economy", 1906. An allocation of goods is Pareto optimal when there is no possibility of redistribution in a way where at least one individual would be better off while no other individual ends up worse off.

A definition can also be made in two steps:

- a change from situation A to B is a Pareto improvement if at least one individual is better off without making other individuals worse off.
- B is Pareto optimal if there is no possible Pareto improvement.



This can be easily understood using an edge worth box. Starting from point C, two Pareto improvements can be made

-from C to D: Individual 1 would increase its utility, since a further indifference curve would be reached while individual 2 will remain with the same utility;

-from C to E: Individual 2 would maintain its utility while individual 1 increases theirs.

Once we are at point either D or E, no further Pareto improvements can be made. Therefore, D and E is Pareto optimal.

Following the same steps for every indifference curve, we can say that every point in which indifference curves from different individuals are tangent is Pareto optimal. The curve that links these infinite Pareto optimal is called the correct curve.

Cost-Benefit Analysis

Environmental cost-benefit analysis (CBA) is the application of CBA to projects or policies that have the deliberate aim of environmental improvement or actions that somehow affect the natural environment as an indirect consequence.

A pragmatic approach similar to social welfare function in environment policy is benefit/cost analysis. This approach was first used in public investment projects like irrigational systems and reservoir dams. The benefits and costs of alternative projects were analyzed and the project providing the maximum benefit for a given priority. Benefit/cost analysis has also been applied in cases where a target level had to be determined. Thus, benefit/cost analysis can be used to determine the benefits and costs of environmental quality.

Assume that B is the gross benefits and C costs which are continuous functions of environmental quality U. Let N (U) denote net benefits. Then the problem of determining the optimal environmental quality is given by maximizing.

$$N(U) = B(U) - C(U)$$

The maximum net benefit is reached when:

$$\frac{dB}{dU} = \frac{dC}{dU}$$

This equation states that the marginal benefits of environment quality are equal to its marginal costs. Thus the benefit-cost approach can be regarded as a rudimentary optimality model determining optimal environmental quality.

Private cost

The private cost is any cost that a person or firm pays in order to buy or produce goods and services. This includes the cost of labour, material, machinery and anything else that the person or firm pays for. The private cost does not take into account any negative effects or harm caused as a result of the production.

Social cost

Social cost in neoclassical economics is the sum of the private costs resulting from a transaction and the costs imposed on the consumers as a consequence of being exposed to the transaction for which they are not compensated or charged. In other words, it is the sum of private and external costs. This might be applied to any number of economic problems: For example, social cost of carbon has been explored to better understand the costs of carbon emissions for proposed economic solution such as carbon tax.

Pollution cost

At the household level, the economic loss on account of pollution includes the cost of treatment and wage loss during sickness. Pollution impacts eco systems and related economic activities like agriculture and livestock air pollution causes climate change. Pollution is not disease, it is only a symptom.

Hence, pollution leads to the real and potential loss of the overall development opportunity in an economy.

Generally, pollution impacts the socially vulnerable and poor communities more due to their weak coping options. They are also less aware of the health hazards caused by pollution.

Remedial measures

Economic growth is an inevitable requirement, but it need not be at the cost of health. To tackle pollution, there should be public awareness about its consequences, adequate pollution-linked database, integration of pollution prevention policies into the development sector, strict enforcement of pollution control policies eco-friendly inputs in production, reliance on renewable energy, introduction of market based/economic instruments (charges/taxes/ levies ,tradable permits, subsidies and soft loans) and increase in ecosystem resilience through the conservation of biodiversity.

Environmental Impact Assessments (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.

UNIT IV

Population & Environmental Problems

The rapid increase of human population is putting an incredible strain on our environment. One of the largest environmental effects of human population growth is the problem of global warming. Some scientists fear that global warming will lead to rising sea levels and extreme weather conditions in the future.

Populations and Environmental Issues

More people require more resources which mean that as the population increases, earth's resources deplete more rapidly. The result of this depletion is deforestation and loss of biodiversity as humans strip the earth of resources to accommodate rising population members.

Population growth also results in increased greenhouse gases, mostly from CO₂ emissions. For visualization, during that some 20th century that saw fourfold population growth, CO₂ emissions increased twelvefold. As greenhouse gases increase, so do climate patterns. Ultimately result in the long-term pattern called climate change.

The Biggest Impacts

The use of resources and the impact of environmental issues are not equal around the global. People in developed countries require substantially more resources to maintain their lifestyle compared with people in developing countries. For example, the United States, Which contains 5 per cent of the world's population, currently produces a full 25 per cent of CO₂ emissions.

People in developing countries tend to feel the impacts of environmental problems more, acutely, especially if they live in coastal areas directly affected by sea level rise and the extreme weather events that accompany climate change. The most vulnerable populations also experience decreased access to clean water increased exposure to air pollution and diseases-which may result from decreased biodiversity-and may feel the impact more immediately as local resources including plants and animals deplete.

While the interconnected problems of population growth and environmental issues seem overwhelming, it is important to remember that positively impact the planet.

One good starting point is understanding and applying the concept of sustainability, which is the opposite of resources depletion. Sustainability describes a model of resources usage in which the current generation uses only the resources the earth provides indefinitely (like solar or wind power instead of burning fossil fuels) to ensure that future generations inherit resources.

Trends in global and National Population Level

Environmental science is a diverse and dynamic field, as it comprises the protection of land, water, air and the rich bio-diversity of this planet. It is the bounden duty of new professionals of environmental science to develop new strategies to deal with new and complex forms of pollution caused by chemicals, industrial and hazardous wastes. With the closing of the last millennium, there has been an increased awareness and concern about environmental issues. We require well qualified and excellent engineers and professionals to continue the task of this planet earth from total destruction.

The present generation of people has to make an immediate choice will affect like on earth for generations to come.

With the dawn of the new millennium, several well established environmental trends have lost their status and the future is being shaped for the worse in the form of abominable population, growth, rising temperature, shrinking cropland per person, collapsing fisheries, shrinking forests and the loss of plant and animal species.

1. Environmental trends.
2. Rising temperature.
3. Depletion of drinking water.
4. Shortage of food.
5. Carbon emissions.

1. Environmental Trends

The projected growth in population over the next half-century may more directly affect economic progress than any other single trend. Exacerbating nearly all other environmental and social problems. Between 1950 and 2000, world population increased from 2.5 billion to 6.1 billion, a gain of 3.6 billion. Even though birth rates have fallen in most of the world, recent projections shows that population is projected to grow to 8.9 billion by 2050, an increase of 2.8 billion our numbers are expanding and multiplying, but unfortunately. Earth's natural system does not.

Another miserable factor affecting the entire world is the rise in temperature that results from increasing atmospheric concentrations of carbon dioxide. This increase has become one of the earth's most predictable environmental trends.

2. Rising Temperature

The global average temperature is slowly rising during the past three or four decades, as the carbon dioxide level is rising rapidly. The average global temperature for 1969-71 was 13.99 degree centigrade. By 1996-98 it had increased to 14.43 degree centigrade further, it is estimated that the global temperature is likely to rise by even 4 to 5 degree century of the new millennium, as the concentration of carbon dioxide would become more and more thicker. Meanwhile the sea level is projected to rise from a minimum of 17 cm to as much as one meter by 2100. The fundamental change would alter the ecosystem on earth.

3. Depletion of drinking water

Another irritating visible trend of the future is falling water tables Although problems relating to irrigation, water logging, salting and silting are perennial problems for several thousands of year, that most disquieting feature is the depletion of aquifer water and falling of water tables and disappearance of ground water tables low level ground water has to be pumped by powerful diesel and electric pumps at an enormous cost which aggravates the problem still further, as the recharge of ground water could not cope with excessive discharge of ground water by mechanical means at a faster rate. As India's population has tripled since 1950, water demand has increased to fantastic levels and as a result, water tables are falling everywhere and wells are running dry in thousands of village. Aquifer depletion and the resulting cutbacks in irrigation

water could drop India's grain harvest by up to one fourth. A shrinking harvest could increase hunger-related death, adding to the 6 million worldwide who die each year from hunger and malnutrition.

4. Shortage of food

If world grain land productivity which increased by 170 percent over the last half-century, were to rise rapidly over the next half-century, the shrinkage in cropland area per person might not pose a serious threat. Unfortunately, the rise is slowing. From 1950 to 1990, world grain yield per hectare increased at more than 2 per cent a year, well ahead of world population growth. But from 1990 to 1999, it grew at scarcely one per cent a year. While biotechnology may reduce insecticide use through insect-resistant varieties, it offers little potential for rising yields.

Humanity also depends heavily on the oceans for food, particularly animal protein. Catch expanded from 19 million tonnes to more than 90 million tones. This five-fold growth since mid-century has pushed the catch of most oceans cannot sustain an animal catch of more than 95 million tones. The final result will be decline of catch per person in the decades to come.

5. Carbon emissions

Stabilizing earth's climate now depends on reducing carbon emissions by shifting from fossil fuels to a solar is here defined broadly, including not only direct sunlight, but also indirect forms of solar energy. We can now see electricity generated from wind being used to electrolyze water to produce hydrogen. Hydrogen then becomes the basic fuel for the economy relying initially on the distribution and storage facilities of the natural gas industry. The only feasible alternative is a solar/hydrogen based economy, one that taps the various sources of energy from the sun, such as hydropower, wind power, wood or direct sunlight. The transition to a solar/hydrogen economy has already begun, as can be seen in energy use trends from 1990 to 1998. But the transition is not moving fast to avoid potentially disruptive climate change.

Consequences on Environmental Quality

Environmental consequences are concerned with the impact on the environment of various types of product releases. The environmental pollution ranking is determined by the

recovery years of the natural resource, which is decided by the recovery of the local resource and local governmental efforts.

Environmental consequence Rankings

COF Factor	COF Identification	Description
A	Very low	None, small or insignificant impact on the environment. There is either no release of internal media or only insignificant release of low toxic or nonpolluting media.
B	Low	Minor release of polluting or toxic media. The released media will be dispersed decompose, or be neutralized rapidly by air or seawater.
C	Medium	Minor release of polluting or toxic media or large release of low-polluting or toxic media. The released media will take some time to disperse, decompose or be neutralized by air or seawater, or can easily be removed.
D	High	Large releases of polluting and toxic media, which can be removed, or will after some time disperse, decompose, or be neutralized by air or seawater.
E	Very high	Large releases of highly polluting and toxic media, which cannot be removed and will take a long time to disperse, decompose, or be neutralized by air or seawater.

Problems of Urbanization and Environmental Quality

Urbanization is the process of population moving towards towns and cities from rural areas and taking up the culture and work prevailing in those urban areas. The country's population is spread over villages will have their nativity with formal occupations, mostly agricultural or its allied ones, making their living with or without ancestral property, like lands or houses. The people in urban areas will be mostly employed in industrial establishments, commercial organizations or in any jobs, mostly non-farming and non-agricultural, depending on their status, education, training and skill.

The distribution of population between rural areas and urban areas of the country tells about the extent of urbanization. Generally urbanization is associated with industrialization and development of secondary and tertiary sectors of the economy.

Effects of Urbanization

The unprecedented growth of population with technological development and economic growth, naturally leads to increased urbanization, as cities and towns have become focal points of trade, commerce and industry giving greater opportunities for the people to eke out their living. These were adverse impacts.

1. The first adverse impact of urbanization is the disturbance of ecological balance. The demand for fuel, building material, space for dwelling etc, will result in deforestation and conversion of prime agricultural and pastoral land to urban uses.

2. Rapid urban growth leads to accelerated and exploitative drawl on the resource base. Large areas around cities are dug up for making bricks for construction of buildings. These leave the soil in an unusable condition and all forms of vegetation, insects and animal life and even birds are destroyed. What is of great concern is that the resources are converted into uses which are not biologically degradable and hence, cannot be recycled at the end of their utilities.

3. Environmental pollution is another important effect of urbanization. The metabolism of the city increases, resulting in a higher generation of metabolic by products, such as, waste water, air pollution and noise. Apart from these, the effluents of economic activities affect the

environment seriously. Much of the pollution of the rivers can be traced to the discharge of untreated human waste into the natural drainage system. The air is affected by gases from individual units and vehicles. The weather undergoes a distinct change, as the density of population increases.

4. Proliferation of slums is another important effect of urbanization, particularly in third world countries, nearly 30 per cent of the third world population live in slums: Devoid of any basic human facilities like sanitation, hygiene, food clothing etc. As a result they are affected by many diseases like cholera, malaria, tuberculosis, bronchial congestion and malnutrition. The condition of children dwelling in slums will be still worse uncared, unattended, uneducated and underfed. Many children die at the infant stage due to lack of medical facilities and those survive prove to be inefficient and useless citizens.

5. Poor living standard this is yet another hall mark of urbanization. Through the dualism will prevail with highly affluent classes imitating western style of living with over consumption, majority of the people in urban cities will have only hand-to-mouth existence.

Environment and Human Health

Environmental Health is the branch of public health concerned with all aspects of the natural and built environment affecting human health. Environmental health focuses on the natural and built environments for the benefits of human health.

Although the environment sustains human life, it can also cause diseases lack of basic necessitation is a significant cause of human mortality. Environmental hazards increase the risk of cancer, heart disease, asthma and many other illnesses.

An even more direct connection between the environment and health is the potential enhancement of our physical, mental and social well being through our daily exposure to the natural environment.

Improving the quality of the environment in key areas such as air, water and noise can prevent disease and improve human health.

UNIT V

Economic Growth Vs Environmental Quality

Economic growth and wellbeing Economic growth typically refers to an increase in the level of goods and services produced by an economy, as estimated by measures such as Gross Domestic Product (GDP). Whilst GDP and other similar measures reflect the value of goods and services provided through the market, they exclude many others that are not provided through the market but that nevertheless contribute to overall welfare.

For example, voluntary and unpaid activities or work within the home, and many services provided by the natural environment in facilitating economic activity. As a result, GDP does not reflect many of the factors that affect the society's wellbeing. Human wellbeing is a complex and diverse concept, determined by a wide-range of factors including levels of income (absolute and relative), health status, educational attainment, housing conditions and environmental quality. It has sometimes been characterized in terms of self reported or subjective happiness. Many studies have found that increases in GDP in high-income countries do not result in subsequent increases in levels of happiness.

However, some others have found to the contrary; for example, Stevenson and Wolfers (2008) find a robust relationship between increases in GDP and increases in reported wellbeing for both developed and developing countries. In the absence of a clear-cut relationship between GDP and self-reported happiness, it is worth focusing on the range of factors affecting wellbeing.

Defra produces a range of indicators on progress towards improving welfare and other measures of sustainable development. Defra is currently exploring further the relationship between economic growth and the determinants of individual wellbeing. Measurement of Economic Performance and Social Progress identifies a number of dimensions to wellbeing material living standards, health, education, personal activities including work, political voice and governance, social connections and relationships, environment (present and future condition), and insecurity (of an economic as well as a physical nature).

However, while wellbeing is a multi-dimensional concept, economic growth remains an important factor in driving or enabling improvements along many of these dimensions. It is vital for supporting continued improvements in material living standards, health, life expectancy, education and economic opportunity and to help the government deliver on a range of economic, social and environmental objectives. The debate over economic growth and the environment, while economic growth has produced many benefits: raising standards of living and improving quality of life across the world - it has also resulted in the depletion of natural resources and the degradation of ecosystems.

There has been much debate over whether or not it is possible to achieve economic growth without unsustainably degrading the environment, and a growing realization that economic growth at the current rate of depletion and degradation of environmental assets cannot continue indefinitely. For example, the increase in CO₂ levels in the atmosphere as a result of human activity means that the world is already locked into some climate change, and faces a major challenge to keep global temperature rises to below two degrees. In the context of environmental resources more generally, the Millennium Ecosystem Assessment (2003) found that 15 out of the 24 ecosystems services it examined were being degraded or used unsustainably, and the use and consumption of natural resources such as minerals and metals continues at an increasing pace. Some take the view that the finite resources of the Earth place limits on the extent to which economies can keep expanding in the long term. Others believe that using environmental resources sustainably is consistent with continued economic growth, with the costs of inaction likely to be far greater than the cost of acting now.

Problems of Environmental Quality Global Level

For years now, humans have mistreated and contaminated the very environment that sustains them. But the broad concern for the environment can be so overwhelming that people don't know what to do or where to start making a difference.

The list of issues surrounding our environment goes on, but there are three major ones that affect the majority of them overall: global warming and climate change; water pollution and ocean acidification; and loss of biodiversity. These three issues need immediate attention and proactive action on our part to ensure conservation of the only habitable planet which we call our

home. And, focusing attention on these three major topics will have a ripple effect on a number of smaller environmental issues like inefficient recycling systems and food waste.

Global Warming and Climate Change

Human activities have made global warming and climate change a global threat. The rising levels of CO₂ and other greenhouse gases have caused an increase in average global temperatures, extreme weather events, rising sea levels and other negative changes. These changes are directly and indirectly affecting all life forms. Pollution of air, land and water through excessive deforestation, industrialization and overfilling landfills which emits CO₂ and adds to greenhouse gas emissions are all topmost causes of these environmental issues. Here are some effective solutions to these problems:

1. Invest in and encourage production of sustainable technology
2. Commercial and residential buildings should aim to achieve zero-emission or zero-waste
3. Improve waste compaction in landfills with smart technology like stationary compactors which helps free up space for other constructive uses. It comes in varying capacities and configurations for handling different volumes of trash
4. Increase forest cover, restore sea grasses and boost use of agricultural cover crops to reduce the amount of CO₂ in atmosphere.

Problems of Environmental Quality in developed economies

Canada, the United States and the European Union are among the developed nations in the world. Their trade and industry puts them on top of the world list in terms of per capita. Ironically, it also tops them in terms of pollution by the same standard. But it is difficult to get them to make firm commitments to reduce environmental degradation because it will affect their industrial output. This is why these developed nations play it hard to get in the Kyoto protocol.

Unfortunately, trade concerns and environmental issues do not go hand in hand. Protagonists for trade and industry view environmental issues as detrimental to their progress. The quest for profits easily overshadows the fruits of environmental normalization.

The developed nations try to bypass environmental responsibilities through loop holes such as the carbon credits. Carbon credit is one good way of handling environmental issues. But it is not enough. Much more is required by way of technological advancements or shift to less environmentally harmful technologies in order to cope with the need for normalization of the environment.

It is important for the developed nations to take a good look at the harmful effects of environmental degradation in their backyard so that it becomes easier for them to comply with the Kyoto protocol. Over a hundred million people in North America and the European Union are exposed to unsafe air even now. Incidents of diseases like asthma are rising with coastal ecosystem disruptions due to excessive use of fertilizers in the developed world. These are some of the dangers arising from environmental degradations. Other threats result from biological contamination and trade associations with the third world.

That is why it is imperative for trade and industry in the developed world to pay greater heed to environmental issues. It will directly or inversely impact their societies and localities. There is need for governments and businesses to interact more closely to see better results environmentally.

Problems of Environmental Quality in Developed Economies

(Low-income levels, high costs of improvement, political factors undermining efficient policymaking, and market failures all explain the prevalence of pollution in developing countries.)

Poor environmental quality is an inescapable presence in many developing countries. This pollution can lead to sickness and shortened life spans. The health effects of pollution can also lead to low productivity and high health care costs. Yet despite the high costs of pollution, there are generally low levels of investment in improvements to environmental quality in developing countries.

Why? This is the central question of an emerging economics field at the intersection of environment and development economics: envirodevonomics.

“We can’t properly analyze and answer questions about environmental quality in developing countries with the tools of environmental or development economics alone,” says Michael Greenstone, an author of the study, and the Milton Friedman Professor of Economics and director of the Energy Policy Institute at the University of Chicago. “Instead, we must look at the problems with a lens that combines insights from both fields.”

Greenstone and his coauthor Kelsey Jack, an assistant professor at Tufts University, analyze the puzzle underlying envirodevonomics and propose four possible explanations for why environmental quality is so poor. First, they lay out the simple truth: when people are poor, what little money they have frequently goes towards immediate consumption needs.

“In many instances, the immediate need to put food on the table outweighs all the benefits an individual could get from efforts to reduce pollution,” says Jack. “This is because these benefits are usually delayed and they also are shared by others - the environment is a public good. It is also, importantly, because the benefits of higher consumption are large and immediate when you have next to nothing.”

Second, weak policy design, implementation and enforcement raise the cost of environmental improvements, they say. For example, if policymakers lack the means to collect tax revenue efficiently, then the very process of collecting revenue for environmental quality investments may be costly.

Policymakers who don’t place the needs of their constituents ahead of their own could also cause problems in developing countries. Corruption and favoring certain groups may cause worthwhile investments in environmental quality to go unmade.

The types of market failures often seen in developing countries, such as weak property rights and poor access to credit, also distort the costs of improvements to environmental quality. For example, if a family or business cannot take out a loan, then they may not be able to make promising investments in environmental quality that would pay off in the future. Similarly, weak property rights give owners less incentive to make long-run investments like planting trees or installing energy saving technologies because they are uncertain that they will retain the benefits from the investments.

All of these factors are only enhanced by the very real threat of climate change, say Greenstone and Jack. As their populations and energy needs grow, developing countries will be among the greatest contributors to climate change. At the same time, many of the same countries are projected to receive the worst impacts from climate change, including rising sea levels and more frequent and damaging storms that threaten agriculture, infrastructure and more.

“For all of these reasons, climate change is a critical area of focus for the budding field of envirodevonomics,” says Greenstone.

Nature of Environmental Problems in India

It is essential to make the public aware of the formidable consequences of the Environmental Degradation, if not retorted and reformative measures undertaken would result in the extinction of life.

We are facing various environmental challenges. It is essential to get the country acquainted with these challenges so that their acts may be eco-friendly. Some of these challenges are as under:

1. Growing Population

A population of over thousands of millions is growing at 2.11 per cent every year. It puts considerable pressure on its natural resources and reduces the gains of development. Hence, the greatest challenge before us is to limit the population growth. Although population control does automatically lead to development, yet the development leads to a decrease in population growth rates.

2. Poverty

India has often been described a rich land with poor people. The poverty and environmental degradation have a nexus between them. The vast majority of our people are directly dependent on the nature resources of the country for their basic needs of food, fuel shelter and fodder. About 40 per cent of our people are still below the poverty line.

Environment degradation has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenge of poverty and the challenge environment

degradation are two facts of the same challenge. The population growth is essentially a function of poverty. Because, to the very poor, every child is an earner and helper and global concerns have little relevance for him.

3. Agricultural Growth

The people must be acquainted with the methods to sustain and increase agricultural growth with damaging the environment. High yielding varieties have caused soil salinity and damage to physical structure of soil.

4. Need to Ground Water

It is essential of rationalizing the use of groundwater. Factors like community wastes, industrial effluents and chemical fertilizers and pesticides have polluted our surface water and affected quality of the groundwater.

It is essential to restore the water quality of our rivers and other water body as lakes is an important challenge. It so finding our suitable strategies for consecration of water, provision of safe drinking water and keeping water bodies clean which are difficult challenges is essential.

5. Development and Forests

Forests serve catchments for the rivers. With increasing demand of water, plan to harness the mighty river through large irrigation projects were made. Certainly, these would submerge forests; displace local people, damage flora and fauna.

As such, the dams on the river Narmada, Bhagirathi and elsewhere have become areas of political and scientific debate. Forests in India have been shrinking for several centuries owing to pressures of agriculture and other uses. Vast areas that were once green stand today as waste lands.

These areas are to be brought back under vegetative cover. The tribal communities inhabiting forests respect the trees and birds and animals that give them sustenance. We must recognize the role of these people in restoring and conserving forests.

The modern knowledge and skills of the forest dept. should be integrated with the traditional knowledge and experience of the local communities. The strategies for the joint management of forests should be evolved in a well planned way.

6. Degradation of Land

At present out of the total 329 mha of land, only 266 mha possess any potential for production. Of this, 143 mha is agricultural land nearly and 85 suffer from varying degrees of soil degradation. Of the remaining 123 mha, 40 are completely unproductive.

The remaining 83 mha is classified as forest land, of which over half is denuded to various degrees. Nearly 406 million head of livestock have to be supported on 13 mha, or less than 4 per cent of the land classified as pasture land, most of which is overgrazed. Thus, out of 226 mha, about 175 mha or 66 per cent is degraded to varying degrees. Water and wind erosion causes further degradation of almost 150 mha.

7. Reorientation of Institutions

The people should be roused to orient institutions, attitudes and infrastructures, to suit conditions and needs today. The change has to be brought in keeping in view India's traditions for resources use managements and education etc. Change should be brought in education, in attitudes, in administrative procedures and in institutions. Because it affects way people view technology resources and development.

8. Reduction of Genetic Diversity

At present most wild genetic stocks have been disappearing from nature. Wilding including the Asiatic Lion are facing problem of loss of genetic diversity. The protected areas network like sanctuaries, national parks, biosphere reserves are isolating populations. So, they are decreasing changes of one group breeding with another. Remedial steps are to be taken to check decreasing genetic diversity.

9. Evil Consequences of Urbanization

Nearly 27 per cent Indians live in urban areas. Urbanization and industrialization has given birth to a great number of environmental problems that need urgent attention. Over 30 per cent of urban Indians live in slums. Out of India's 3,245 towns and cities, only 21 have partial or

full sewerage and treatment facilities. Hence, coping with rapid urbanization is a major challenge.

10. Air and Water Pollution

Majority of our industrial plants are using out-dated and population technologies and makeshift facilities devoid of any provision of treating their wastes. Great number of cities and industrial areas are identified as the worst in terms of air and water pollution.

Acts are enforced in the country, but their implement is not so easy. The reason is their implementation needs great resources, technical expertise, political and social will. Again the people are to be made aware of these rules. Their support is indispensable to implement these rules.

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