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## **ENVIRONMENT AND ENVIRONMENTAL STUDIES: DEFINITION, SCOPE AND IMPORTANCE NEED FOR PUBLIC AWARENESS ENVIRONMENT AND HUMAN LIFE**

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### **DEFINITION OF ENVIRONMENT**

**Q. Define Environment.**

**Or**

**What do you understand by the term 'Environment'? Throw light on its scientific meaning.**

**Or**

**'Environment is the source of life on earth. It co-ordinates man, his activities, his existence, his development and his progress.' Keeping the above definition in mind, analyse what is environment.**

**Ans.** We inhabit two worlds. One is the natural world of plants, animals, soils, air and water that preceded us by billions of years and of which we are a part. The other is the world of social institutions and artifacts that we create for ourselves using science, technology, and political organisation. Both worlds are essential to our lives, but integrating them successfully causes enduring tensions.

Environment comes from the French word 'Environner' which means to encircle or to surround. Thus, **Environment can be defined as**

- 1. The circumstances and conditions that surround an organism or a group of organisms.**

2. The social and cultural conditions that affect an individual or a community. Since humans inhabit the natural world as well as the 'built' or technological, social and cultural world, all constitute important parts of our environment. Therefore, environment can simply be defined as one's surroundings which include everything around the organism i.e. abiotic (non-living) and biotic (living) environment. Abiotic environment consists of soil, water and air; while the biotic environment includes all other organism, with which the organism comes into regular contact. But to an environmental engineer, a more specific definition is required. Because for him '**environment**' may refer to a small localised area in which a specific problem is to be addressed, or it may take on global dimensions on the other hand.

**Einstein** once defined environment as 'everything that is not to me'. In other words we can say that 'final analysis of everything present outside of an individual is called environment. This outside world in which we live, being a part of it, is cosmos. It has air, water, soil, sun, moon and other planets. It has plants, animals, rivers, mountains, deserts and oceans. Collectively they make Nature. This Nature to which we belong is environment.

In the words of **T. N. Khoshoo**, Environment is the sum of all the factors that influence the life and development of living things. Environment is the basic source of life on earth. Without it, life on earth would disappear. It influences the basic life forms on earth very deeply. It allows them to grow and develop by providing the requisite platform. Man, his activities are very heavily dependent on it. **H. M. Saxena** says- 'Environment is the source of life on earth and it not only directs but also determines the existence, growth and development of mankind and its activities'. The **Universal Encyclopedia** defines environment as 'the sum total of all conditions, agencies and influences which affect the development, growth, life and death of an organism.'

**H. F. Hings** puts it as the total of milieu factors of an organism. **R. M. Macwver** has incorporated all the visible and invisible materials and life forms in his definition of environment. He says that earth and all its factors, natural resources, soil, water, mountains, landscapes, minerals, plants, animals and all the important natural powers present on earth that have an impact on mankind come under the environment.

All the above definitions bring out the interdependence of all the factors that make up the environment. Environment and the organisms that live in it are mutually dependent on each other. An organism directly or indirectly depends on its environment for food and nourishment. In short, all the factors, that may be physical and biological, that affects man and his life form the environment. Thus, environment is the sum of biotic components of biosphere, atmosphere and lithosphere. That is the reason why Environment is defined as a living tissue which is protected by the things that surround it.

## ENVIRONMENTAL SCIENCE

Q. What do you understand by the terms 'Environmental Science'?

Ans. Environmental Science is the systematic study of our environment and our place in it. A relatively new field, environmental science is highly interdisciplinary. It integrates information from biology, chemistry, geography, agriculture and many other fields. To apply this information to improve the ways we treat our world, environmental scientists also incorporate knowledge of social organisation, politics and the humanities. In other words, environmental science is inclusive and holistic. Environmental science is also mission-oriented. It implies that we all have a responsibility to get involved and try to do something about the problems we have created. Not only do we need the best ideas and information to deal successfully with the environmental problems, but we must also be aware of the cultural and historical context in which we make decisions about the environment and understand ways in which choices are made and implemented. The field of environmental science, thus, integrates the natural science, social science and humanities with environmental ethics, environmental impact and environmental planning. As a result, many disciplines contribute to environmental science and help us to understand the entire spectrum of relationships between people and environment.

## SCOPE AND IMPORTANCE OF ENVIRONMENT STUDIES

Q. Discuss the scope and importance of environmental study.  
Or

Why the major efforts have been made to inculcate general awareness for safe and sound environment?

Ans. Scope: If we study the natural history of the areas in which we live, we would see that our surroundings were originally a natural landscape,

such as a forest, a river, a mountain, a desert, or a combination of these elements. Most of us live in landscapes that have been profoundly modified by human beings in villages, towns or cities. But even those of us who live in cities must get our food supply from surrounding villages and these, in turn, are dependent on natural landscapes such as forests, grasslands, rivers, seashores, for resources such as water for agriculture, fuel wood, fodder, and fish. Thus, our daily lives are inextricably linked with our surroundings and inevitably affect them.

We use water to drink and for other day-to-day activities. We breathe air, we use resources from which food is made, and we depend on the community of living plants and animals which form a web of life, of which we are also a part. Everything around us forms our environment and our lives depend on keeping its vital systems as intact as possible.

Our dependence on nature is so great that we cannot continue to live without protecting the Earth's environmental resources. Thus, most traditions refer to our environment as 'Mother Nature' and most traditional societies have learned that respecting nature is vital to protect their own livelihoods. This has led to many cultural practices that have helped

traditional societies protect and preserve their natural resources. Respect for nature and all living creatures are not new to India; all our traditions are based on these values. Emperor Ashoka's edict proclaimed that all forms of life are important for our well-being, and this was as far back as the 4th century BC.

Over the past 200 years, however, modern societies began to believe that easy answers to the question of producing more resources could be provided by the indiscriminate application of technological innovations. Some examples are: growing more food by using fertilizers and pesticides, developing better strains of domestic animals and crops, irrigating farmland through mega-dams, and developing industry. All this has led to rapid economic growth; and this type of ill-considered development has inevitably led to environmental degradation.

The industrial development and intensive agriculture trial provides the goods for our increasingly consumer-oriented society uses up large amounts of natural resources like water, minerals, petroleum products, wood etc. Non-renewable resources, such as minerals and oil, are those which will be exhausted in the future if we continue to extract these without a thought for subsequent generations.

Renewable resources, such as timber and water, are those which can be used but can be regenerated by natural processes such as regrowth

or rainfall. But these too will be depleted if we continue to use them faster than nature can replace them. For example, if the removal of timber and firewood from a forest is faster than the regrowth and regeneration of trees, the supply of wood cannot be replenished. And the loss of forest cover not only depletes the forest of its resources, such as timber and other non-wood products, but also affects our water resources because an intact natural forest acts like a sponge which holds water in the rainy

season and releases it slowly over the drier periods.

In addition, deforestation leads to floods in the monsoon and dry rivers once the rains are over. Such multiple effects on the environment resulting from routine human activities must be understood by each one of us, if it is to provide us with the resources we need in the long-term.

Our natural resources can be compared with money in a bank. If we use it rapidly, the capital will be reduced to zero. On the other hand, if we use only the interest, it can sustain us over a longer term.

**Importance:** Environment is not a single subject; it is an integration of several subjects that include both Science and Social Studies. To understand all the different aspects of our environment we need to understand biology, chemistry, physics, geography, resource management, economics and population issues. Thus, the scope of environmental studies is extremely wide and covers some aspects of nearly every major discipline. We live in a world wherein natural resources are limited. Water, air, soil, minerals, oil, the products we get from forests, grasslands, oceans and from agriculture and livestock, are all a part of our life support systems. Without them, life itself would be impossible. As we keep increasing in numbers and the quantity of resources each of us uses also increases, the Earth's resource base must inevitably shrink.

The Earth cannot be expected to indefinitely sustain this expanding level of utilization of resources. Added to this is the misuse of resources.

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

pollution to gastro-intestinal diseases, and many pollutants are known to cause cancer.

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

Some of the common aspects indicating why environmental study is important have been cited below:

- Participation** - to provide individuals, groups and societies with opportunities to be actively involved in exercising their skills of environmental citizenship and be actively involved at all levels in working towards sustainable development.
- Knowledge** - to help individuals, groups and societies gain a variety of experiences in, and a basic understanding of, the knowledge and action competencies required for sustainable development.
- Values** - to help individuals, groups and societies acquire feelings which they can make judgments about appropriate ways of acting individually and with others to promote sustainable development.
- Skills** - to help individuals, groups and societies acquire the action competence or skills of environmental citizenship - in order to be able to identify and anticipate environmental problems and work with others to resolve, minimise and prevent them.
- Awareness** - to create an overall understanding of the impacts and effects of behaviours and life-styles - on both the local and global environments, and on the short-term and long-term.

## NEED FOR PUBLIC AWARENESS OF ENVIRONMENT STUDY

Q. Discuss the need for public awareness of environmental study.

Or  
Throw some light on the need for public awareness of environmental study.

Ans. Life on Earth began approximately 2.6 billion years ago and since that time has profoundly affected the planet. Since the emergence of life, numerous species of organisms have evolved, flourished and died, leaving only their fossils to record their place in history. Several millions years

ago, the forces of evolution set the stage for the eventual dominance of the humans on Earth. From a biological view point, the ultimate fate of every species is extinction, therefore, we - the humans, too, will disappear and the brief moment of humanity in the history of Earth may not be particularly significant. However, to the present and to all the generations still to come, how we affect our environment is important.

Among millions of organisms of different size, shape, colour and mode of living, man has become the dominant species in the biosphere by his ingenious brainpower, tool-making capacity, articulated speech and language. Man has acquired the capacity to change the environment more than any other organism on this planet. But he should remember that he is not the master; instead a part of the global environment. He uses much more material and energy for his agriculture, industry, transport, communication comfort, aesthetic pleasure and even war than any other species on the Earth. Human needs and greed coupled with shortsightedness have disturbed the delicate ecological balance. Not only this, humans are depleting and degrading the vital life-supporting systems including air, water and land which belong to the entire living world.

Environmental problems, as discussed latter in this text, are in part the result of the large number of human beings on the planet. Therefore, individual actions, summed over large number of people, can influence the environment greatly. So we must do more than simply identify and discuss environmental problems and solutions. We must think critically about them. It has to be recognized that the basis of human power and superiority lies in his knowledge of the environment. Individuals can involve themselves in many ways in the process of improving the environment. Similar to any social and political movement, environmentalism (a range of moral codes directed at achieving better environmental management) too encompasses a wide range of approaches. At the one end, there is the conservative style of the nature conservancy whose major function has been to help purchase lands that are important for conservation and to ensure that these lands are maintained as nature preserves; while at the other opposite extreme end is the radical activism of organizations such as Greenpeace whose activities have included maneuvering small boats between whaling ships and whales in an attempt to prevent and draw attention to the practice of whaling. At an even deeper level, environmentalism encompasses a broad range of political and philosophical approaches. The emphasis of environmental science is on a rational approach involving the application of scientific and technical

information to understand, conserve and manage the environment and its resources.

We should not forget that we have a special environmental responsibility towards ourselves and towards other fellow living beings. We have to conserve the environment not merely for the preservation of the rich biological diversity, natural resources or aesthetic value, but for sheer survival.

## **INDIVIDUAL'S RESPONSIBILITIES TOWARDS ENVIRONMENT AND CLEANSING**

**Q. What are the duties and responsibilities of State and individual towards clean environment?**

**Or**

**Describe the clean environment related rights and duties of Ans.**

Today the pollution of environment is not only a problem in India but also for the entire world. Industrial development adds significantly to this problem. Even an individual is greatly responsible for this deterioration. People that reside in ever expanding slums in urban cities are serious contributors to the damage. The mad race for unsustainable development has created havoc for the environment. It is but obvious to raise the questions as to whether the citizens of India have a right to live in a clean environment? In reply, the environments say that polluted environment gropes on the individual's freedom and right to live. In other words, ensuring the availability of a clean and pollution free environment is the government's duty. Another question related to it is that whether our constitution provides us with an assurance of protection of life and personal freedom? It is a known fact that exposure to a polluted environment causes, in humans, a number of diseases. It may also lead to some kind of impairment or loss of life. Our constitution has laid down certain rights which enable the citizens to live in pollution free environment. But does that include freedom to live in such environments as a fundamental right or not? What does personal freedom stand for? Is the freedom to live in a pollution free environment a form of personal freedom? If a person is forced to live in an unhygienic surrounding is it not a breach of his right to live in pollution free environment? The answer to all these questions is 'yes'. Hence, it is

the joint responsibility of the governing agencies as well as the citizens to think about maintaining a clean environment.

### **Cleanliness Of Environment As Laid In The Constitution:**

Two international conferences on Environment and development – one at Stockholm in 1972 and another at Rio de Janeiro in 1992 – have influenced Environmental policies in most countries, including India. Many

countries and international agencies have accepted the polluter pays principle, the precautionary principle and the concept of intergenerational equity as guidelines for designing Environmental policies. India adopted the socialist pattern of society in 1954 as a framework for social and economic policies. This framework articulates that public policy decisions must enable the society to maximise social gain and not private profit.

This framework also envisages a catalytic role for the State in the social and economic transformation of the country. The Constitution of India provides a number of Directive Principles of State Policy. Indian Five

year Plans have also stressed goals such as rapid economic growth, employment generation, poverty alleviation and balanced regional development. Since June 1991 there has been a tilt in economic policy towards economic liberalisation and globalisation. The importance of sustainable development is also being stressed as an objective of public policy.

This paper deals with the evolution of laws, institutions and policies relating to Environmental protection in India. It considers the following questions:

- (a) Whether the laws are evolved indigenously or influenced by external factors?
- (b) How have the mixed economy model and the stage of development influenced the design of policies for internalisation of the externalities?
- (c) How is liability allocated?
- (d) How are the laws enforced?
- (e) What is the scope for using non-market non-government institutions for achieving Environmental sustainability?

Section 2 deals with the evolution of Environmental laws and policies. We Consider four policy periods:

- (i) pre-independence period to 1947
- (ii) from independence to the Stockholm Conference, 1947 – 1972
- (iii) from the Stockholm Conference to Bhopal disaster, 1972-1984
- (iv) Bhopal Tragedy to 1998.

In the first two periods, there were no major legislations relating to Environmental protection. The Stockholm Conference on Environment leading to an amendment of the Constitution, passage of important legislations such as the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollution) Act, 1981 and creation of institutions such as Central and State Pollution Control Boards for implementing the provisions of the Acts.

The Bhopal gas tragedy in 1984 triggered the passage of Insurance Act in 1991. The new economic policy initiated in 1991 favours decentralisation, debureaucratisation and globalisation. Constitutional amendments were made in 1994 to facilitate devolution of powers and resources to local bodies. The Policy Statement on Pollution of powers and with market-based instruments and various supportive measures to deal with Environmental protection.

**Section 3** is devoted to implementation of the laws, rules and policies relating to Environmental protection. Problems in the determination and enforcement of source-specific standards are considered. It describes the active role of the courts not only in enforcing the laws and rules but also in giving directions to the central and state governments on creation of new authorities and policy matters. Section 4 deals with some issues in the transition from a state-allocative closed economy policy regime toward a market-oriented open economy policy regime. Section 5 contains some concluding remarks.

The Indian Constitution provides for a federal structure within the framework of parliamentary form of government. Part XI of the Constitution governs the division of legislative and administrative authority between the centre and states. Article 246 divides the subject areas for legislation into three lists, viz, Union List, State List and Concurrent List. The subject areas related to Environmental protection are:

- 6-Atomic energy and mineral resources necessary for its production.
- 14-Entering agreements with foreign countries and implementing of treaties, agreements and conventions with foreign countries.
- 24-Shipping and navigation on inland waterways.
- 25-Maritime shipping and navigation, including shipping and navigation on tidal waters

#### State List

- 6-Public health and sanitation, hospitals and dispensaries.
- 10-Burials and burial grounds, cremations and cremation grounds.
- 14-Agriculture.
- 15-Preservation, protection and improvement of stock and prevention of animal diseases.
- 17-Water, that is to say, water supplies, irrigation and canals, drainage and embankment, water storage and water power subject to the provisions of Entry 56 of Union List.
- 18-Land.
- 21-Fisheries.

#### Concurrent List

- 17-Prevention of cruelty to animals.

- 18-Adulteration of food stuffs and other goods.
- 19-Drugs and poisons.
- 20-Economic and social planning.
- 20A-Population control and family planning.
- 29-Prevention of the extension from one state to another of infecting or contagious diseases or pests affecting men, animals or plants.
- 32-Shipping and navigation on inland waterways as regards mechanically propelled vessels.
- 36-Factories.
- 37-Boilers.
- 38-Archaeological sites and remains other than those declared by or under law made by Parliament to be of national importance.

Under the Concurrent List, both Parliament and state legislature can enact laws. Article 248 gives the centre the residual power to legislate over a state law on any subject in the three lists. Articles 251 and 254 state that a central law not covered in the Concurrent List generally prevails over a state law on the same subject. Article 249 states that the centre can obtain a two-thirds majority in the State List provided it can obtain a two-thirds majority in the Rajya Sabha, the upper house of Parliament. Article 252 states that the centre can also pass laws on state subjects if two or more state legislatures consent to such legislation. Article 253 empowers the Parliaments to make any law for the whole or any part of the territory of India for implementing any treaty, agreement or convention with any other country or countries or any decision made at any international conference, association or other body. These provisions on matters relating to Environmental protection give a dominant role for the central government.

Even though many entries in the three lists deal with location-specific subjects which generally come under the jurisdiction of local bodies viz municipalities and panchayats, until 1992, they were not given the necessary powers to deal with these subjects. Part IV (Directive Principles of State Policy), Article 40 provides that 'the State shall take steps to organize village panchayats and endow them with such power and authority as may be necessary to enable them to function as units of self-government'. These are only guidelines for policy formulation. Until the 73<sup>rd</sup> and 74<sup>th</sup> amendments to the Constitution in 1992, the Constitution did not assign powers to the local bodies; local government was simply treated as a subject in the State List.

### Legislations

Some important legislations relating to Environmental protection enacted by the Parliament during this period were:

The Factories Act, 1948  
The Prevention of Food Adulteration Act, 1954

The River Boards Act, 1956  
The Mines and Minerals (Regulation and Development) Act, 1957

The Ancient Monuments and Archaeological Sites and Remains Act, 1958  
The Atomic Energy Act, 1962  
The Insecticides Act, 1968

### Constitutional Amendments

The 42<sup>nd</sup> Constitution Amendment Act, 1976, inserted specific provisions for Environmental protection in the form of Directive Principles of State Policy and Fundamental Duties. Article 48A (Directive Principles) enunciates that 'the state shall endeavour to protect and improve the Environment and to safeguard the forests and wild life of the country'. Article 51A(g) (Fundamental Duties): 'To protect and improve the natural Environment including forests, lakes, rivers, wildlife and to have compassion for living creatures'. Two entries 17A – Forests and 17B – Protection to wild animals and birds were added in the Concurrent List.

### Rights And Duties Of An Individual As Laid In The Constitution

#### Regarding The Protection Of Environment:

**Water:** Adequate water year round that protects in-stream species and is adequate for agriculture, manufacturing, and human consumption.

#### (a) Rights

1. Individuals have the right to access clean water now and in the future.
2. Communities have the right to Environmental education.
3. Communities have the right to clean and accessible water supplies.
4. Businesses have the right to use as much water as they need.
5. Businesses have the right to invest in Environmental issues.
6. Governments have the right to make laws to protect water for human and non-human species and set consequences for those breaking the laws.

#### Responsibilities

1. Individuals have the responsibility to use water efficiently.
2. Individuals have the responsibility to avoid polluting water.
3. Communities have the responsibility to educate themselves about the Environment.
4. Communities, including individuals, businesses and other stakeholders have the responsibility to report problems to local authorities.
5. Businesses have the responsibility to invest in better plans for their practice and the consumption of water.
6. Governments have the responsibility to hold individuals, communities, and businesses accountable for their actions.

**Sustainable Resource Recreation:** Recreation must remain an economically viable business but also sustain, protect, and restore those natural elements vital to the industry.

**(a) Rights**

1. Individuals have the right to use healthy Environmental resources freely and equally as it promotes an equal society with free access.
2. Individuals have the right to a clean and healthy Environment and to protect the ecosystem and their health.
3. Communities have the right to access clean air, water, and land in turn promoting health.
4. Businesses have the right to be economically viable.
5. Businesses have the right to provide access to the public and community.
6. Governments have the right to choose the best way of using natural resources in a manner that is healthy for the community and the Environment.

**(b) Responsibilities**

1. Individuals have the responsibility to plan ahead for the future and result for the Environment.
2. Individuals have the responsibility to allow a healthy social Environmental atmosphere for the future.
3. Communities have the responsibility to sustain if not improve their Environment.
4. Businesses have the responsibility to have Environmental and community friendly conduct.
5. Governments have the responsibility to respect the opinions of the community, provide resources to community members and businesses to maintain their surroundings as needed, and implement laws, regulations, and incentives that promote best management practices.

**Renewable and Non-renewable Resource Management:** We

must connect waste reduction to renewable resources so that both have a compatible economic and Environmental pace.

**(a) Rights**

1. Individuals have the right to Environmental education so that they are aware of the importance of recycling, reusing, and buying repaired/used products.
2. Individuals have the right to the fulfillment of needs (water, air, food, land work, etc.). They have the right to equal access to pure water, organic foods, health care, resources and the freedom to choose which resources to use.

Communities have the right to be informed about the Environment and any topics that are related so they can participate in the activities around them and as a result can fight for their Environment.

Communities have the right to access recycling facilities.

Businesses have the right to decide about the type of resources they use, how they use them, and their Environmental plans, which ultimately gives them the right to sell, produce, and profit.

Businesses have the right to manage their own resources without the interference of governments or selective groups. This grants them the right to use and access resources based on national needs.

**(b) Responsibilities**

1. Individuals have the responsibility to use their Environmental education to their advantage.
2. Individuals have the responsibility to not waste valuable resources by using their freedom to choose renewable resources.
3. Communities have the responsibility to be informed about the Environment and participate in Environmental activities.
4. Communities have the responsibility to decide, as well as choose, where to recycle.
5. Businesses have the responsibility to minimize pollution and waste of natural resources and to replace and neutralize everything they waste in order to maintain a balance between resources.
6. Governments have the responsibility to use and encourage the use of sustainable resources and to inform and provide its constituents the usage of sustainable resources.

**Restoration and Stewardship:** Restoration and stewardship are important aspects that help ensure community economics and Environmental health and are ethics and practices that have long-lasting positive impacts on communities.

**(a) Rights**

1. Individuals have the right to preserve nature.
2. Individuals have the right to enjoy biodiversity.
3. Communities have the right to be educated in order to preserve nature.
4. Businesses have the right to use nature to make a profit.
5. Governments have the right to have rules and regulations for clear water, air, and land.

**(b) Responsibilities**

- Individuals have the responsibility to not be harmful to Environment.
- Individuals have the responsibility to replace or fix what they damage or destroy.
- Communities have the responsibility to not overuse resources and care for them.
- Businesses have the responsibility to not use more land or other resources than is necessary.
- Governments have the responsibility to protect our Environment.

**Role Of An Individual In Protection Of Environment:**

Apart from legal duties, an individual has certain obligations toward protecting the environment from further damage as well as setting up some platform to reverse the harmful changes done to the environment. Every citizen can contribute his significant bit to improve the standards of the parameters to measure the levels of damage. Conservation of Nature can be interpreted as conservation of land. Conservation of land refers to the usage of land and natural resources in a manner that is eco-friendly protection before and individual. It's not easy for a single person to pay attention in equal proportion towards all the problems that affect the environment. Hence, they must go for correcting at least few of the total errors committed. Citizens must unite in the effort to repair the environment. People must become aware of the damages posed by them to the environment. They must make sincere efforts to undo those actions which have done a significant harm. A good idea supported with conviction will be a significant step on the way to conserving the environment.

## ENVIRONMENTAL ETHICS AND MORAL

**Q. What do you mean by Environmental Ethics? Discuss its issues and possible solution.**

**Ans.** Ethics is a branch of philosophy that deals with morals (the distinction between right and wrong) and values (the ultimate worth of actions or things). The term 'Ethic', derived from the Greek word 'Ethos', literally means 'the character of a person as described by his or her actions'. Ethics, thus, can be defined as a system of cultural values motivating people's behaviour. They draw upon human reasoning, morals, knowledge of nature, and goals to act as a sort of plumb-line for development and

shape a world view. Ethics operates at the level of individuals, institutions, societies and internationally.

In the 1970s, philosophers began to formulate a new field called 'Environmental Ethics'. Environmental ethics asks about the moral relationship between humans and the world around in contrast to traditional ethics, which concerns with relationship among people only.

The need of Environmental Ethics has arisen as a result of the following three factors:

- New Effects on Nature: The modern technological civilization has been affecting nature greatly; therefore, we should analyze the ethical consequences of human actions.
- New Knowledge about Nature: Until a few decades back, only a small section of people realized that human's activities could be changing (or altering) the global environment. Now, the modern science demonstrates how humans have changed and are changing the global environment in ways not previously understood. For example, it has now been proved that burning of fossil fuels and deforestation has increased the carbon dioxide concentration in the atmosphere, and that this may lead to irreversible changes in global climate. Thus, new knowledge and better understanding of nature is raising new ethical issues.
- Expanding Moral Concerns: Perhaps the most important question in environmental ethics is—whether moral extensionism encompasses non-humans. Does nature have rights? Do other species have rights as well? Are they (other species) moral agents or at least moral subjects? Do we have a moral obligation to leave the environment in good condition for our descendants, or are we at liberty to use environmental resources to the point of depletion within our life time? These expanded concerns lead to a need of environmental ethics.

The overwhelming impact of these concerns (or issues) has led some people to reject all science, technology and progress, and to seek a return to a simpler age. But this, at the most, can only be a short-term solution. The long-term solution, if there is to be one, will come from the best use of science and technology within the framework of evolving environmental ethics.

**Are there ethical principles that constrain how we use resources or modify our environment?**

In 1949, Aldo Leopold put forward the "Land Ethic". The land ethic affirms the right of all resources, including plants, animals and earth material, to continued existence and, at least in certain locations, the

continued existence in a natural state. The land ethic assumes that human atmosphere—that is, to the environment role of human from conqueror to steward. This ethic effectively changes nature, with a moral responsibility to sustain humans in the role of protector for future generations. This new role asks that we rever and love the land and not see it solely as an economic commodity to be used up and thrown away.

In the 1970s, the philosophers grapple with the complex issues of environmental ethics began of future generations and the idea of stewardship of the Earth. The right to have a moral responsibility to sustain nature for themselves and not see it solely as an economic commodity to be used up and thrown away.

From 1980s, the interest in the field of 'Environmental Ethics' has grown further, stimulating books and journals (e.g. Environmental Ethics & Behaviour; Ethics, Place and Environment; Environmental Ethics Values). Interestingly, some progressive environmental ethics literature has come from business. Unfortunately, there is plenty of environmental ethics theory, but little ethical pragmatism! Carley and Christie (1992) tried to summarize the range of environmental ethics, dividing them into

(a) **Technocratic Environmental Ethics** - which are resource exploitative and growth-oriented.

(b) **Managerial Environmental Ethics** - which are resource conservationist and oriented to sustainable-growth.

(c) **Communalist Environmental Ethics** - which are resource preservationist and oriented to limited or zero growth.

(d) **Bioethicist or deep ecology Environmental Ethics** - which are extreme preservationist and anti-growth.

Grouping (a) is anthropocentric and places faith in the capacity of technology to overcome problems; while grouping (d) is unlikely to attract support from enough people to be a viable approach; therefore, it is felt that the ethics of groups (b) and (c) are more likely to attract development and provide guidance for environmental management.

In 1989, G7 called a conference in Brussels on Environmental Ethics and the members present agreed that the important need for individual

and nations alike was to practice responsible stewardship. On behalf of this conference R. J. Berry formulated a "Code of Environmental Practice", which was mainly dependent upon the following:

1. **Environmental monitoring** by researchers to recognize and evaluate the distant and immediate impacts, spatially and temporally.
2. **Sustainable development**, which is a process of economic and social betterment satisfying the needs and values of all interest groups and also maintaining future options and conserving natural resources diversity.

3. **Full accounting of costs** ensuring the stocks of renewable resources are maintained constant and also that the amount of pollutants are kept below the assimilative capacity of the environment; and also the non-renewable resources are either substituted or harvested minimally.

4. **A recognition of interdependent values** by all individuals and communities to coming generations; and internally of nature itself. These values should include user values and existence values (as part of the total economic value of ecosystem and calculation of environmental damage).

5. **Individual and corporate stewardship**, which includes an acceptance that people are trustees, curators, guardians and wardens of the environment for both present and coming generations, providing accountability, responsibility and continuity.

The code is based on a simple environmental ethic-stewardship of the living and non-living systems of the earth in order to maintain their sustainability for present and future, allowing development with forbearance and fairness. It entails characteristics common to all good citizens, as well as states and corporations, involving responsibility, freedom, justice, truthfulness, sensitivity, awareness and integrity.

**Q. List and describe few of the issues concerned with environmental ethics.**

**Ans.** Environmental ethics deals with issues related to the rights of individuals that are fundamental to life and well-being. These concern not only the needs of each person today, but also those who will come after us. It also deals with the rights of other living creatures that inhabit the Earth.

**Resource consumption patterns and the need for equitable utilization:**

Environmental ethics deals with issues that are related to how we utilize and distribute resource. Can individuals justifiably use resources so differently that one individual uses resources many times more lavishly

## ETHICS AND MORAL

**Q. Describe the relationship of ethics with moral.**

**Ans.** 'Ethics' has been derived from a Greek word 'Ethica', which means traditions, customs and habits. Philosophers have often called 'ethics' the science of morality. 'Morality' comes from the word 'Mores', which also means traditions or customs. This means that ethics is related to traditions or customs. In context to this, Ashok Kumar Verma says that traditions or customs or habits are those activities of man which he has exercised often.

Moral thinkers are of the view that all the actions that come to a man constitute his behaviour. Behaviour is voluntary action as well as involuntary. Men cannot control them. Thus, they do not determine one's behaviour.

Moral thinkers study human behaviour with two different perspectives. Firstly why is human behaviour the way it is? How do we do a work in particular way? Secondly, what should human behaviour be like? What should we do in particular situation? Which aspects of our behaviour are acceptable and which are not? This means that morals are associated with the correctness of behaviour i.e. ethics. Moral science is mainly concerned with the thin line of distinction between which actions are good and which are bad.

To determine the morality of actions, we need certain rules of conduct or guidelines. It is not possible to evaluate anything in the world without the provision of certain standards or regulations. When we analyse the beauty of any object, we compare what we have with us with the parameters we have set for generally beautiful objects. If the object conforms with those rules, we assert it to be beautiful or else we deem it to be ugly. The same mentality is carry forward in the case of morals. We must have certain moral standards on the basis of which we can call actions worthy of being performed or not. Each one of us can decide for ourselves the moral genuineness of an action. But very little do we think about the moral standards underlying the decision-making. Thus, moral science sets the standards of human behaviour and is called the science of right conduct or the science of ideals of conduct.

Human behaviour is dependent on character has been called as the habit of wills. It is the difference in character which sets different responses to a situation. Human behaviour is the mirror to character. A man with a

good character shows morally upright behaviour. On the contrary, people with obvious character are bent on thinking on the wrong lines. Hence, the rise in illegal deeds. Moral Science is not only the science of behaviour but also the science of character.

In short, moral science is the science of ideal conduct which helps in determining man's duties and uprightness of his actions. Since behaviour is determined by character, therefore it has also been termed as the science of character.

## ENVIRONMENTAL MOVEMENT AND PEOPLE'S PARTICIPATION

**Q. Write a short note on Chipko movement.**

**Ans.** The forests of India are a critical resource for the subsistence of rural peoples throughout the country, but especially in hill and mountain areas, both because of their direct provision of food, fuel and fodder as well as because of their role in stabilising soil and water resources. As these forests have been increasingly felled for commerce and industry, Indian villagers have sought to protect their livelihoods through the Gandhian method of satyagraha non-violent resistance. In the 1970s and 1980s this resistance led to the destruction of forests spread throughout India and became organised and known as the Chipko Movement.

The first Chipko action took place spontaneously in April 1973 and over the next five years spread to many districts of the Himalaya in Uttar Pradesh. The name of the movement comes from a word meaning 'embrace': the villagers hug the trees, saving them by interposing their bodies between them and the contractors' axes. The Chipko protests in Uttar Pradesh achieved a major victory in 1980 with a 15-year ban on green felling in the Himalayan forests of that state by order of India's then Prime Minister, Indira Gandhi. Since then the movement has spread to Himachal Pradesh in the North, Karnataka in the South, Rajasthan in the West, Bihar in the East and to the Vindhyas in Central India. In addition to the 15-year ban in Uttar Pradesh, the movement has stopped clear felling in the Western Ghats and the Vindhya and generated pressure for a natural resource policy which is more sensitive to people's needs and ecological requirements.

The Chipko Movement is the result of hundreds of decentralised and locally autonomous initiatives. Its leaders and activists are primarily village women, acting to save their means of subsistence and their communities. Men are involved too, however, and some of these have

given wider leadership to the movement. Prominent Chipko figures included Sunderlal Bahuguna, a Gandhian activist and philosopher, whose appeal to Mrs. Gandhi results in the green-felling ban and whose 5,000 kilometre trans-Himalaya footmarch in 1981-83 was crucial in spreading the Chipko message. Bahuguna coined the Chipko slogan: 'ecology is permanent economy'.

Chandi Prasad Bhatt, one of the earliest Chipko activists, who fostered locally-based industries based on the conservation and sustainable use of forest wealth for local benefit.

Dhoom Singh Negi, who, with Bachni Devi and many village women, first saved trees by hugging them in the 'Chipko embrace'. They coined the slogan: 'What do the forests bear? soil water and survival'.

the Himalaya of Uttar Pradesh.

A feature published by the United Nations Environment Programme reported the Chipko Movement thus: 'In effect the Chipko people are working a socio-economic revolution by winning control of their forest resources from the hands of a distant bureaucracy which is concerned with selling the forest for making urban-oriented products.'

The solution of present-day problems lie in the re-establishment of harmonious relationship between man and nature. To keep this relationship permanent we will have to digest the definition of real development which is synonymous with culture. When we sublimate nature in such a way that we achieve peace, happiness, prosperity and, ultimately, fulfilment along with satisfying our basic needs, we march towards culture." **Sunderlal**

Q. What was the Tehri Dam Movement?

**Ans.** The Tehri dam, when completed, will be one of the highest dams in the world harnessing the waters of two important Himalayan rivers - Bhagirathi and Bhitangana. Tehri dam is finally expected to be 260.5 m high and impound 3.22 million cu m of water. The reservoir is expected to irrigate 2,70,000 hectares of land and generate 346 mw of hydel power. The dam will completely submerge Tehri town and 23 villages, while 71 other villages will be partially submerged. Nearly 5,200 hectares of land

will also be lost to the dam.

marshal their case, social and...  
between ecological, social and religious...  
environmental campaigns and cultural rehabilitation,  
in a wide gamut of environmental politics.  
Those opposed to the dam emphasise the economic life and structure  
and seismicity, displacement and religious values of

of the dam, its geology and cost and benefit. They also talk about the culture of the Ganga river and the Himalayan region. They attempt to use scientific knowledge to explain their perceptions of imaginative and emotional truths. They go on fasts, dharnas, demonstrations, and other agitational programmes, to focus on their demands. The anti-Tehri dam polities has been subject to a collaborative relationship between what is ‘factual’, ‘scientific’ and ‘technical’ and what is ‘religious’, ‘faith’, ‘emotional’ and ‘mythical’. This collaboration seeks to heal the great environmental and cultural wound that development and the dam has inflicted on the region. Towards this end, they speak the language of ecological politics, as it was the universal language of the anti big-dam movement of the 1970s. They also invoke certain metaphors, and it is through many of these that the anti-dam forces, more especially Sunderlal Bahuguna, reach out to particular religious practices and mythical beliefs. In their use of these metaphors and myths, the environmentalists often come close to the beliefs of conservative Hindu forces and their chosen communal path. In effect, the metaphor and the myth is the Trojan horse through which communal politics enters and re-enters green politics.

Attitudes against big projects and dams, the Tehri dam in particular, were part of the growth of the environmental movement in India in the 1970s. This period is generally seen as one of growing environmental consciousness and movements. One popular mode was to use facts and figures, scientific methods and techniques, to challenge a project that too claimed to be based on scientific calculation and assessment. The concern with reason and measurement, data and cost calculation was like a social enterprise and found expression not only in the setting up of the Tehri

Through an analysis of technical, social and environmental

years and the dam will not yield promised results within the next 10 years at least, by which time the reservoir would be substantially silted up.

Regarding the real life situation of the Tehri dam oustees, problems of agricultural pattern, destitution, inequality, abrupt and forced changes in village commons, breakage of the joint family system, total lack of preservation and pursuit of big projects against big projects are emphasised.

Environmental and health facilities were emphasised. Environmental politics against big projects is often also site and what constitutes natural and the beautiful. Aesthetic issue important part of the criticism against big projects like dams. In the particular case of Tehri dam, the region and the project site have been repeatedly referred to as pious, peaceful and solitary. The Himalayan beauty and a point of contact with the infinite. Though this landscape associated with mythical and religious figures and symbols

**Q. Write a short note on Narmada Bachao Andolan.**  
**Ans.** The internationalization of the Narmada Bachao Andolan, or Save Narmada Movement, has had a great impact on India's state sovereignty. International environmental NGOs, such as Oxfam, the Environmental Defense Fund and the International Rivers Network, took advantage of the porous nature of the state's territorial and national borders. International actors intervened in the domestic affairs of the Indian state and built up the Save the Narmada Movement. The NGOs took part in information exchange, proving that the state is unable to maintain "absolute control over territorial borders." (Brown 1995: 15) of ideas and strategy between local and international protesters. The state also, these interactions caused new, transnational identities to be formed eroding the state identity. Thus state sovereignty was compromised as a result of the internationalization of the Narmada Bachao Andolan.

Numerous local NGOs coalesced to form the Narmada Bachao Andolan in response to the construction of the Sardar Sarovar Dam along the Narmada River in the Indian state of Gujarat. The Narmada River is the largest westward flowing river in India and empties into the Indian Ocean. The state began planning the dam in 1946, but only started construction in the mid 1980s. Because the dam would not only affect the state of Gujarat, but also would cause flooding in Madhya Pradesh and Maharashtra, two neighbouring states, construction was delayed. By 1983 the states' disputes had been reconciled and extensive planning began. The plans called for the displacement of several thousand families will be displaced by the flooding of the valley. (Fisher 1995: 15) The Narmada Bachao Andolan, led by Medha Patkar, rose in protest over the displacement and the state's plans, or lack thereof, for the rehabilitation of the river valley. It is now estimated that well over 100,000 families will be displaced and the movement strengthened and grew and resettlement of the "oustees." The movements strengthened and deal with the environment as well as human rights, internationalized the incorporate dozens of international NGOs. Such groups, which deal with the environment as well as human rights, internationalized the movement. The fight against the Indian government and the dam's principle investors developed tremendous support and challenged state sovereignty.

In 1984, John Clark, of Oxfam United Kingdom, first became involved with the Sardar Sarovar Dam Protests. With his help the movement acquired an international following. He enlisted several environmental organizations, such as the Environmental Defense Fund and Friends of the Earth, who "for the first time heard of human rights issues associated with the SSP [Sardar Sarovar Project]." (A. Patel 1995: 84) This major transmission of information helped begin the International Narmada Campaign. Lori Udall claims that the internationalization of the Narmada Campaign is its partnership, information sharing and collaboration with international movements. "The heart of the International Narmada campaign is its partnership, information sharing and collaboration with international movements. "The heart of the International Narmada campaign is its partnership, information sharing and collaboration with the fire of the Save the Narmada Movement. The NGOs took part in information exchange, proving that the state is unable to regulate this exchange. The international actors were influencing enormous amounts of information exchange, proving that the state is unable to maintain "absolute control over territorial borders." (Brown 1995: 15) of ideas and strategy between local and international protesters. The state could not regulate this exchange. The international actors were influencing the state identity. Thus state sovereignty was compromised as a result of the internationalization of the Narmada Bachao Andolan.

The local movement, with the help of the international coalition of NGOs, was able to spread information throughout the world with hearings, symposiums and tours. Medha Patkar, for instance traveled to the United States and spoke before a Congressional panel on two separate occasions. Her goal during both occasions was to stop the World Bank, one of the



# 2

## **ECOSYSTEM AND ENVIRONMENTAL POLLUTION:**

**CONCEPT OF ECOSYSTEM, PRODUCERS, CONSUMERS AND DECOMPOSERS, ENERGY FLOW, FOOD CHAIN & WEBS, WATER, AIR, SOIL & NOISE POLLUTION, GLOBAL WARMING, CLIMATE CHANGE, WATERBORNE DISEASES, ADMINISTRATIVE STEPS IN ENVIRONMENTAL PROTECTION**

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### **ECOSYSTEM**

**Q. Throw light on the concept of ecosystem.**

**Ans.** A biotic community cannot live in isolation. It lives and flourishes in an environment which supplies and fulfills its material and energy requirements and provides other living conditions. The biotic community and its physical (non-living) environment in which matter (chemical elements) cycles and energy flows is called the 'Ecosystem'.

The term 'Ecosystem' was first proposed by A.G Tansley in 1935. He defined it as "**the system resulting from the integration of all the living and non-living factors of the environment**". He, thus, regarded the ecosystem as including not only the organism-complex, but also the whole complex of physical factors forming the environment. Keeping this in view, we can think of the earth as a 'giant ecosystem', where biotic (living) and abiotic (non-living) components are constantly acting and reacting upon each other bringing forth structural and functional changes in it. This vast ecosystem-the biosphere is, however, difficult to handle. Thus, for convenience, the study of nature is carried out by making its artificial sub-divisions into smaller units i.e. ecosystems.

An ecosystem, thus, is the smallest unit of biosphere that has all the characteristics to sustain life. An ecosystem is a natural grouping of nutrients, minerals, plants, animals and their wastes linked together by flow of food, nutrients and energy from one part of the system to another part. Ponds, streams, seas, deserts, grasslands, cities etc. are all examples of ecosystems. The ecosystems can vary in sizes. An ecosystem can be only a few centimeters square in size, like microbial mats; or its size can be in kilometers, like Tropical forests.

It is important to note here that, what is common to all ecosystems is not physical structure (i.e., size, shape, variations of borders etc.) but the existence of the processes-the flow of energy and the cycling of chemical elements.

**Q. Discuss the type of ecosystems.**

**Ans.** The kind of organisms which can live in a particular ecosystem depends upon their physical and metabolic adoptions to the environment of that place/ecosystem and on certain aspects of the history of our planet, which has determined what organisms have been able to travel where. On earth, there are sets of ecosystems within a geographical region which are exposed to same climatic conditions and having dominant species with a similar life cycle, climatic adoptions and physical structure. This set of ecosystems is called a Biome. In the biosphere, there are-natural and artificial biomes(ecosystems).

**1. Natural Ecosystem (Biomes)** - Natural ecosystems operate by themselves under natural conditions without any interference by man. Natural ecosystems carry out many public service functions for us. Wastewater from houses and industries is often converted to drinkable water by filtration through natural ecosystems, such as soils. Air pollutants from industries and automobiles are often trapped on leaves or converted to harmless compounds by forests.

**On the basis of particular type of habitat, they are further sub-divided as:**

- (a) **Terrestrial Biomes (Ecosystems):** They are often defined by the vegetation types that dominate the community. The types of vegetation affect the climate and soil structure and thus characterize the particular biome. Terrestrial vegetation has a rapid exchange of oxygen, water and carbon dioxide. The Carbon dioxide concentration is affected by terrestrial vegetation seasonally and annually. Terrestrial biomes include tropical rain forests, grasslands, deserts, cultivated lands, etc.

(b) **Aquatic Biomes (Ecosystems):** They fall into two categories, viz. freshwater and marine.

Freshwater biomes may be lotic (running-water) such as lakes, ponds; and rivers and springs; or lentic (standing-water) such as deep sea and oceans.

**2. Artificial Ecosystems (Biomes)** - They are maintained artificially swamps whereas, marine biomes include deep sea and oceans. 2. **Artificial Ecosystems (Biomes)** - They are maintained artificially by man. A pond constructed as part of a waste water treatment plant is an example of artificial ecosystem. In artificial ecosystems, the management is disturbed regularly by addition of energy and planned manipulations. For example, wheat, maize and rice-fields etc., where man tries to control the biotic community as well as the physicochemical environment. The smallest artificial ecosystems that have been known to sustain life over a long period of time are 'Folsom bottles'. These materially closed ecosystems were created by Prof. Glaire Folsom of University of Hawaii by placing water, algae, bacteria and sediment from Honolulu Bay in a litre flask and sealing the top. The sealed bottles were placed near the window so that sun energy be utilized by the biotic components during day time. Some of these have sustained life for nearly twenty years.

**Types of Ecosystems based on Energy Resource**

Ecosystems rely on two major sources of energy, the sun and chemical or nuclear fuels. So, on the basis of the major input, there can be solar-powered and fuel-powered ecosystems. On the basis of energy resources, the ecosystems are classified as:

- (i) **Unsubsidized Natural Solar-powered Ecosystems:** In these types of ecosystems, the only source of power/energy is solar energy. For example, ocean, upland forests, grasslands etc. These are unsubsidized in the sense that there is no auxiliary source of energy available to supplement solar radiation/energy. These types of ecosystems have a low productivity or capacity to do work as they are subjected to shortage of nutrients or water. But from human point of view, these ecosystems are of utmost importance-it is here that large volumes of air are purified, water is recycled and climates are controlled. The energy input in these types of ecosystems ranges from 1,000 to 10,000 kcal/m<sup>2</sup>/year and the average being 2,000 kcal/m<sup>2</sup>/year.
- (ii) **Naturally Subsidized Solar-powered Ecosystems:** In these types of ecosystems, the main source of energy is sun, which is augmented by natural non-solar energy. As a result of which extra amount of energy is



**2. Heterotrophic component:** It is the component in which utilization rearrangement and decomposition (breakdown) of complex organic substances predominate. The members (organisms) of heterotrophic component are called consumers which are heterotrophs (dependent on others for food) such as animals. They consume the organic matter built up by the producers (or autotrophs). The heterotrophs are further categorized as:

(a) **Macroconsumers:** Macroconsumers are heterotrophs, which are in an order as they occur in a food chain are-herbivores, omnivores or carnivores. Herbivores, also known as primary consumers, feed directly on living plants or plant residues i.e. they have vegetarian diet. Carnivores are secondary or tertiary consumers which feed on consumers i.e. they have non-vegetarian diet. While omnivores are consumers which feed on producers as well as on primary consumers i.e. they have vegetarian as well as non-vegetarian diet.

(b) **Saprotrophs:** These are microconsumers, popularly known as decomposers, such as bacteria, fungi, flagellates and actinomycetes. They feed on organic compounds of dead or living protoplasm of plants and animals for their food and energy. They absorb some of the decomposition (or breakdown) products and release inorganic compounds (nutrients) into the ecosystem, making them available again to producers (autotrophs).

#### Function

The functional aspects of an ecosystem illustrate how an ecosystem works or operate under natural conditions. From the operational point of view, the abiotic (non-living) and biotic (living) components of a ecosystem are so interwoven into the fabric of nature that their separation from each other becomes practically very difficult. The mode of movement of materials and energy in an ecosystem, though very complex, is briefly outlined in simplified form as under.

The chemical elements, including all the essential elements of protoplasm (material that is basis of life in living beings), tend to circulate in the biosphere in characteristic paths from environment to organism and back to the environment. These more or less circular paths, known as nutrient cycles, provide materials (or minerals) in an ecosystem. The producers, (self-nourishing green plants) fix radiant energy and with the help of minerals (C, H, N, O, P, K, S etc.) taken from the soil and environment (nutrient pool) they build up complex organic matter (carbohydrates, fats, lipids, proteins nucleic acids etc.). The energy (i

the form of food) then flows from producers to macroconsumers and to the decomposers.

In this simplified form the energy flows in non-cyclic manner (unidirectional) from sun to the decomposers via producer and macroconsumers (heterotrophs), whereas the minerals (nutrients) circulate in a cyclic manner. It should be noted here that the cycling of the minerals is accomplished by different biogeochemical (nutrient) cycles superimposed upon the unidirectional energy flow through the biotic component of the ecosystem. Further, the energy not only flows unidirectionally but also lost from the system in many ways and those minerals too similarly show a net loss in many ways.

Q. What do you understand by the terms Producers, Consumers and Decomposers?

Ans. All organisms in an ecosystem require energy for their life processes and materials for the formation and maintenance of body structures. Food supplies both energy and materials for the sustenance of life. Though, the ecosystems are characterized by a diversity of species; but for their long term survival, the ecosystems must have representatives from the three functional or metabolic groups viz. primary producers, consumers and decomposers.

(i) **Primary Producers:** Primary producers are those organisms that derive energy from either sunlight or inorganic compounds and make organic compounds from inorganic compounds (such as  $\text{CO}_2$ , water and nutrients like sulphate, phosphate and nitrate). For example, many primary producers like green plants, algae, and photosynthetic bacteria obtain energy from sunlight for making organic compounds (including carbohydrates, proteins and fats) by photosynthesis; while other producers such as sulphur oxidizing bacteria use energy stored in the chemical bonds of inorganic compounds for making organic compounds. As the green plants manufacture their own food, they are called as autotrophs.

The chemical energy (in the form of organic molecules; stored by the primary producers is utilized partly by themselves for their growth and survival, while the remaining is stored in the plant parts for their future use.

(ii) **Consumers:** Consumers are those organisms which use organic compounds for their food and energy. They cannot make organic compounds from inorganic compounds as they lack chlorophyll; but they can transform one form of organic compounds into other forms of organic compounds, for example animals, protozoa and many bacteria. They

consumption induces negative effects on the food we eat. The used. Their effect on human health as well as on others life forms to buildings and other human dwellings have come up in a manner where surroundings and accelerated degradation in different ways listed below:

- Industrial effluents
- Domestic effluents
- Sewage
- Agricultural effluents
- Oil effluents
- Thermal source
- Radioactive source
- Mining waste
- Transportation waste

## DEFINITION, CAUSES AND EFFECTS OF AIR POLLUTION

**Q.** Define air pollution. Also describe the sources or causes of air pollution.

**Ans.** Air pollution is basically the presence of foreign substances in air excessive concentration which adversely affects the well being of the individual or causes damage to property. Wherever we live, the air is contaminated to some degree. The earliest pollutants noted in the atmosphere were of natural origin, like smoke, fumes, ash and gases from

other natural sources. But the real problems of air pollution came on the scene when human induced or anthropogenic sources started emitting pollutants. Considering all these, specific definitions of air pollution are given or adopted by different organisations and countries.

According to World Health Organisation, air pollution is defined as, "substances put into air by the activity of mankind into concentration sufficient to cause harmful effect to his health, vegetables, property or to interfere with the enjoyment of his property."

Indian Standards Institute define air pollution as,

"Air pollution is the presence in ambient atmosphere of substances, generally resulting from the activity of man, in sufficient concentration, present for a sufficient time and under circumstances which interfere significantly with the comfort, health or welfare of persons or with the full use or enjoyment of property."

### Source of Air Pollutants

The sources may be natural or anthropogenic (man-made). Natural sources include volcanic eruptions, forest fires, cosmic dust, pollen grains, sand storms, hydrogen sulphide and methane from anaerobic decomposition of organic matter, etc. Man-made sources such as burning of fossil fuels, emissions from vehicles, rapid industrialization, agricultural activities, warfares, etc. are major causes of air pollution. The sources may also be classified as stationary or mobile sources (see Table Below).

Stationary Sources	Point Source	These are large stationary sources, such as, industrial power plants, municipal incinerators, etc.
	Area Sources	These are small stationary sources and mobile sources with indefinite routes, such as, residential heating, commercial and institutional heating, open burning, city traffic, etc.
Mobile Sources	Point Source	These are highways, railways tracks, navigation routes, etc.
	Area Sources	These are airports, railways stations, ports, etc.

### Classification of Air Pollutants

Air pollutants may be classified according to origin, chemical composition and state of matter.

- According to Origin

On the basis of categories-primary and secondary air pollutants.

Primary air pollutants can be divided into two examples, particulates, carbon monoxide (CO), oxides of Sulphur ( $SO_x$ ), particles of metal, pollen, bacteria, etc. The five

**Secondary air pollutants** are those which are produced by the interaction among two or more primary air pollutants with normal atmospheric constituents, with or without pollutants, or by formation of acid mists, smog (coal induced and photochemical etc.

## 2. According to Chemical Composition

### On the basis of chemical composition

as-organic and inorganic air pollutants. Organic compounds can be di and hydrogen, and many also contain certain elements such as nitrogen, sulphur and phosphorus. Examples of organic air pollutants are hydrocarbons, aldehydes, ketones, carboxylic acids, organic sul CO, SO<sub>x</sub>, SO, NO<sub>x</sub>, O<sub>3</sub>, etc.

## 3. According to State of Matter

On this basis, air pollutants are classified as-particulate and liquids dispersed in gaseous media. Particulate air pollutants include finely divided solid examples of solid particulates; while mist, spray, fog, etc., are particulate air pollutants. Gaseous air pollutants are organic gases benzene, methane, butane, aldehydes, ketones, etc., as well as inorganic gases like CO<sub>2</sub>, SO<sub>x</sub>, CO, NH<sub>3</sub>, H<sub>2</sub>S, NO<sub>x</sub>, etc.

## Q. Describe the effects of air pollution on human health.

**Ans.** The air we breathe has not only life sustaining properties, but it has life damaging properties. An average man breathes 22,000 times a day and takes in 16 kg of air each day. The impurities in the inhaled air affect human health in a number of ways, depending upon the nature concentration of the pollutants, duration of exposure, and age group of the receptor. Depending upon the chemical nature of the pollutants, some pollutants may be harmful when present in small concentrations and others only if they are present in high concentrations. The duration of exposure to polluted air is also an important factor. The infants, elders and the effects of air pollution. It has also been observed that the effect of pollution on human health is worst or maximum during winter season when pollution levels reach a climax. The various health effects are under:

- (i) Eye irritation can be caused by many air pollutants such as NO<sub>x</sub>, O<sub>3</sub>, PAN, smog, particulates, etc.
- (ii) Nose and throat irritation can be caused by SO<sub>2</sub>, NO<sub>x</sub> insecticides, pesticides, etc.
- (iii) Gaseous pollutants like H<sub>2</sub>S, SO<sub>2</sub>, NO<sub>2</sub> and hydrocarbons can cause odour nuisance even at low concentrations.
- (iv) Irritation of the respiratory tract can be caused by SO<sub>x</sub>, NO<sub>x</sub>, O<sub>3</sub>, CO, etc.
- (v) Increase in mortality and morbidity rate.
- (vi) A variety of particulates, particularly pollens, can initiate asthmatic attacks.
- (vii) High concentrations of SO<sub>2</sub>, NO<sub>2</sub>, SPM (suspended particulate matter) and photochemical smog can aggravate chronic pulmonary diseases like bronchitis and asthma.
- (viii) Carbon monoxide, which is two hundred times more reactive than oxygen, combines with haemoglobin in the blood and consequently increases stress on those suffering from cardiovascular and pulmonary diseases. Similarly, nitric oxide (NO) can react with haemoglobin and reduce the oxygen carrying capacity of the blood.
- (ix) Hydrogen fluoride can cause fluorosis and mottling of teeth.
- (x) Air pollutants such as polycyclic organic compounds, aliphatic hydrocarbons, etc. can cause cancer.
- (xi) Dust particles can cause dust specific respiratory diseases, such as, silicosis (associated with silica dust), asbestosis (associated with asbestos dust), etc.
- (xii) Heavy metals, like lead (emitted from vehicles), may enter the body through the lungs and can cause poisoning. Its high concentration can damage liver and kidney, and can cause abnormality in fertility and pregnancy, and mental development of children get affected.
- (xiii) Exposure to radioactive isotopes like Iodine 131, Phosphorus 32, Cobalt 60, Radium 226, etc. can cause anaemia (iron deficiency), leukaemia (RBC deficiency), cancer, and genetic defects.

## Q. Describe the effect of air pollution on plants.

**Ans.** The primary factor that governs the gas absorption by the plant leaves is the degree of opening of the stomata. The stomata are the openings in the leaf, generally in the bottom of the leaf, through which CO<sub>2</sub> enters to play its role in photosynthesis. When the stomata are wide open (day time), the absorption is maximum and vice-versa. As a result, the same conditions that enhance the absorption of CO<sub>2</sub> also expose the plant to

injury by absorbing a pollutant gas. Most of the plants close their leaves during night and are, therefore, much more resistant at night. The effects of some of the important air pollutants on plants are given in Table 1. The air pollutants that affect plants include  $\text{SO}_2$ ,  $\text{O}_3$ , fluorides,  $\text{NO}_x$ , ethylene,  $\text{NH}_3$ , mercury, smog, herbicides, etc.

Sl. No.	Pollutant	Effects on Plants	
1.	$\text{SO}_2$	Bleaching of leaves, necrosis (killing of tissues), premature aging, suppressed growth, necrosis bleaching.	
2.	$\text{O}_3$	collapse of leaf.	
3.	$\text{NO}_2$	Suppressed growth, bleaching.	
4.	Fluorides	Necrosis at leaf tip.	
5.	Ethylene	Leaf abscission (dropping of leaves), leaf epinasty (down curvature of leaf).	
6.	PAN	Suppressed growth, silvering of lower leaf surface.	

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These pollutants interfere with plant growth/yield at phenomenon of photosynthesis. Dust, smog etc. reduce the amount of light reaching the leaf, and also by clogging the stomata may reduce intake of carbon dioxide. Plant response to air pollutants varies from species to species, for example, some plants are sensitive to fluorides, resistant to sulphur dioxide. The sensitivity of plants to air pollutants depends on many factors, such as, climatic conditions (that includes rainfall, temperature, humidity, and light intensity), soil, water and fertilizer. Q. **What are the dangers faced by animals due to air pollution?** Ans. The process by which the animals get poisoned is entirely different from that by which human beings exposed to air pollutants are poisoned. In case of animals, it is a two-step process:

- Accumulation of air pollutants in the vegetation and forage;
- Subsequent poisoning of the animals, when they eat the contaminated vegetation/forage.

The pollutants mainly responsible for most livestock damage are Fluorine: Of all the farm animals, cattle and sheep are the most susceptible to fluorine toxicity. Horses are quite resistant, while pigs are probably the most resistant to fluorine of all the farm animals. Fluorine is a cumulative poison under conditions of continuous exposure to it. Its effects are lack of appetite, rapid loss of weight, and death. Lead: Chronic lead poisoning has been observed frequently among animals that have been grazing near smelters and lead mines. It causes

vomiting, irregular pulse and respiration, abnormal body temperature, diarrhoea, death in few hours. Chronic arsenic poisoning causes cough, diarrhoea, anaemia, abortion, paralysis, and death.

Q. **What are the economic effects of air pollution?**

Ans. Air pollution damage to property/material is a very important economic aspect of pollution, and it covers a wide range:

(i) **Corrosion:** Air pollution responsible for metallic corrosion is  $\text{SO}_2$ . metals. The prime air pollutant responsible for sulphuric acid, in the presence of oxygen and moisture, it is converted to sulphuric acid. Deposition of this acid on metal parts of building roofs, railway tracks,

overhead wires, metal on bridges, and other structures cause enormous loss due to corrosion.

(ii) **Damage to building materials:** The acid deposition reacts with lime stone, marble, and other building materials to cause deterioration and disfigured the building materials.

(iii) **Damage to paints and protective covering:** Pollutants like  $\text{SO}_2$ ,  $\text{O}_3$ ,  $\text{H}_2\text{S}$ , and aerosols damage protective coating and paints of the surface.

(iv) **Damage of textile dyes and textile fibers:** The fading of textile dyes, and deterioration of natural and synthetic textile fibers is caused by  $\text{SO}_2$ ,  $\text{NO}_x$  and  $\text{O}_3$ .

(v) **Rubber Cracking:** Rubber cracking of tyres and various forms of electrical insulation is caused by ozone and PAN.

(vi) **Deterioration of leather and paper:** Sulphur dioxide causes leather to lose much of its strength and ultimately disintegrate; which has posed a serious problem of storage of leather bound books in libraries. The impurities in paper absorb  $\text{SO}_2$ , and convert it into  $\text{H}_2\text{SO}_4$  in the presence of moisture, which makes the paper extremely brittle and decreases its folding resistance.

(vii) **Effect on glasses and ceramics:** Although glasses and ceramics are especially resistant to the chemical action of air pollutants, but long exposure for years showed a change in their surface appearance.

(viii) **Damage to objects of art and architecture:** Acid rains cause intangible loss to objects of art and architecture throughout the world. For example, effects on the Taj Mahal, Belur Temple, Cleopatra's needle (a

have changed the very complexion of soil. Thus the soil is getting heavily polluted day by day by toxic material and dangerous micro organisms which enter the air, water and food chain. For all this, man is the original and basic pollutant responsible for pollution hazards and toxic effects.

Nature of Pollutants in Soil

Source	Gases	Colloids	Suspended Particles	Dissolved Cations	Dissolved Anions
Soil	CO <sub>2</sub>	Clay, Fe <sub>2</sub> O <sub>3</sub> , Al <sub>2</sub> O <sub>3</sub> , MnO <sub>2</sub>	Clay Sand Silt	Na <sup>+</sup> , K <sup>+</sup> Ca <sup>2+</sup> , Mg <sup>2+</sup> , Mn <sup>2+</sup> , Co <sup>2+</sup> Fe <sup>3+</sup>	CO <sub>3</sub> <sup>2-</sup> , HCO <sub>3</sub> <sup>-</sup> , OH <sup>-</sup> , Cl <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , F <sup>-</sup> , HSO <sub>3</sub> <sup>-</sup>
Decomposed Organic matter	SO <sub>2</sub> , H <sub>2</sub> NH <sub>3</sub> , CH <sub>4</sub> , CO <sub>2</sub>	Organic waste materials	Humus organic wastes	H <sup>+</sup> , Na <sup>+</sup> , NH <sub>4</sub> <sup>+</sup>	Organic radicals NO <sup>3</sup> <sup>-</sup> , NO <sub>2</sub> , SO <sub>4</sub> <sup>2-</sup> , Cl <sup>-</sup>
Soil Organism	-	Algae, Fungi Bacteria, Protozoa, viruses Ascaris etc.	Algae Bacteria	-	-

### Sources of Soil Pollution

*Soil pollution mainly results from the following sources:*

1. Industrial wastes.
2. Urban wastes.
3. Radioactive pollutants.
4. Agricultural practices.
5. Chemical and metallic pollutant.
6. Biological agent.

1. **By Industrial wastes.** Disposal of industrial waste is the major reason for soil pollution. These industrial pollutants are mainly discharged from pulp and paper mills, chemical industries, oil refineries, sugar factories, tanneries, textiles, steel industries, distilleries, coal and mineral mining industries, drugs, glass, cement, petroleum industries etc. Thermal, atomic and electric power plants are also the villain to add pollutants to the soil.

Fly ash and many other industrial effluents are either discharged into streams or dumped into the surrounding land: Industrial wastes mainly

consist of organic compounds along with inorganic complexes and biodegradable materials. The pollutants affect and alter the chemical and biological properties of soil.

2. **By urban wastes.** Urban wastes comprise both complex and domestic wastes consisting of dried sludge of sewage. All the chemical wastes are commonly referred to as refuse.

Solid wastes and refuse contribute to soil pollution. This urban contains garbage and rubbish materials like plastics, glasses, metallic fibers, paper, rubbles, street sweepings, fuel residues, leaves, metallic abandoned vehicles and other discarded manufactured products. Pollution concentration in urban areas and unplanned industrial areas have to a greater extent contributed to soil pollution problems.

3. **Radioactive pollutants.** Radioactive substances resulting from explosions of nuclear devices, atmospheric fall out from nuclear power plants, radioactive wastes penetrate the soil and accumulate there creating pollution. Radioactive substances Radium, Thorium, Uranium, Cobalt (C-14) are very common in soil, rock, water and air.

The product of nuclear fission, rain water ( $\text{Sr-90}$ ,  $\text{Cs-137}$ ) to that some plants such as lichen and mushroom can accumulate  $\text{Cs-137}$  and other radio nuclides which concentrate in grazing animals.

4. **Agricultural Practices.** Agricultural practices pollute the soil to a large extent. Advanced Agro-technology, huge quantities of fertilizers, pesticides, herbicides, weedicides and soil conditioning agents are employed to increase the crop yield. Many agricultural lands have now excess amounts of plants and animals wastes which are posing soil pollution problems. Farm wastes, manure slurry, debris, soil erosion containing mostly inorganic chemicals are responsible for soil pollution. Some of the agents responsible for this pollution are as follows:

- (a) **Fertilizers.** Fertilizers are the chemical compounds that contain one or more of the plant nutrients i.e., nitrogen, phosphorous and potassium. Excessive use of fertilizers makes soil pollutant. Fertilizers are retained by the soil and crop efficiently but there are some possibilities for the nitrates to be washed out due to negligence and appliances in applying fertilizers to arable lands. These nitrates cause several undesirable effects on the water quality of low land lakes or rivers creating numerous health hazards.
- (b) **Pesticides.** By growing population density it is necessary to increase food production. Due to this it led to manipulation of land resources. Different kinds of pesticides used to control pests are causing a stress,

the natural environment. With the increasing use of pesticides it is observed that pesticide residues coexist within biological system with other forms of life.

- (c) **Soil conditioners and other chemical agents.** In addition to the fertilizers, pesticides and biocides, soil conditioners and fumigants are also employed to the land system to increase and protect the soil fertility, alterations in both agricultural and horticultural soil areas. They contain several toxic metals such as  $\text{Pb}$ ,  $\text{As}$ ,  $\text{Cd}$ ,  $\text{Hg}$ ,  $\text{Co}$  etc. which when applied to a land will accumulate on the soil permanently thereby introducing these chemical components into growing crops.

- (d) **Farm Wastes.** Increasing population of cow, cattle etc. have resulted in considerable soil pollution. Buildings in which grazing animals are housed can be cleaned using water but the manure is also washed out and deposited as wet slurry on the land. This slurry deposited on soil may seep into ground water and pollute it. Cattle faecal matter mainly consists of phosphates which in conjunction with nitrates cause numerous undesirable effects in the soil texture.

5. **Chemical and metallic pollutants.** A number of industries including textiles, dyes, soap and synthetic detergents, drugs, cement, rubber, paper and pulp etc. and metal industries pour their hazardous effluents in soil and water creating disastrous effects on living organisms. Synthetic chemicals and fertilizers are a source of trace metals which are added to the soil either deliberately or as an impurity. In many soils 50% to 100% of soil carbon is found complex with clay containing organic and inorganic components which affect the soil texture, its fertility and stabilization of soil organic matter.

6. **Biological Agents.** Soil gets large quantities of human, animals and birds excreta which constitute the major source of land pollution by biological agents. Digested sewage sludge as well as heavy application of manures to soil without periodic leaching could cause chronic salt hazard to plants within a few years. Sludges to have faults as they contain enough live viruses and viable intestinal worms. The pathogenic organisms that pollute the soil may be classified into three major categories:
- (a) **Pathogenic organisms occurring naturally in contaminated soil.** Bacteria algae, protozoans nematodes etc. These organisms are important agents in increasing or decreasing the soil fertility, in altering the physical texture of the soil and in attacking roots of plants.

(b) **Pathogenic Organisms Excreted by Man.** Human pathogens such as enteric bacteria and parasitic worm excrete vegetables or fruits.

(c) **Pathogenic Organisms Excreted by Animals** includes pathogenic bacteria and worms excreted by animals like worms, millipedes, dipterous larvae, snails including higher animals like fungal and bacteria spores. The disease producing organisms are transmitted to soil and then from soil to man.

7. **Other Sources.** Some other sources by which soil gets polluted are:

- By absorption of toxic metals.
- By soluble salts.
- By mining.
- By waste water added to soil.
- By solid waste applied to soils.
- By food processing wastes.
- By sugarcane trash in field.
- By municipal garbage and composts.

## CAUSES OF SOIL POLLUTION AND CONTROL

Q. What are the main causes behind soil pollution and suggest measures for their control.

Ans. The causes of soil pollution can broadly be classified as direct and indirect causes. Direct causes include poor waste management, application of agro-chemicals, faulty, sanitation practices, salination and irrigation and floods and soil erosion. Indirect causes include acid rain and disposed radioactive substances.

*The above-said causes of soil pollution along with their controls are briefly discussed as under.*

### 1. Poor Waste Management

Wastes are unwanted and useless substances resulting from different human activities. The wastes can be solid wastes and/or liquid wastes.

(i) **Solid Waste and its Control.** Unwanted or discarded substances that have weight and size are called solid wastes. It includes sewage sludge, domestic and municipal solid waste, industrial solid waste and agricultural solid waste.

The waste preventive approach, which considers solid waste as a resource, suggests two measures-reductions in solid waste, and reuse and recycling. Solid waste can be reduced by manufacturers by using less material and redesigning manufacturing processes. Further wastes can be reused after repairs and also can be recycled. For example solid waste like glass, metals, plastic, paper etc. can be segregated and recycled.

Finally, the control of solid waste can be done by using proper disposal methods such as composting of biodegradable solid waste, incineration of non-biodegradable, pulverization, sanitary land filling etc.

### (ii) Liquid Waste and its Control.

Liquid waste from point sources, such as domestic and industrial waste waters, not only cause water pollution but soil pollution too.

To control soil pollution from these sources, municipal and industrial waste waters have to be properly collected, treated and disposed of scientifically in water bodies or on lands. Proper care must be taken in treating heavy metal and other toxic waste materials.

### 2. Application of Agro-Chemicals

A variety of agro chemicals such as pesticides, insecticides and fertilizers are utilized in modern day agricultural practices for more and more yields. Pesticides are used to control pests whereas insecticides, herbicides are used to control insect and unwanted plants. Fertilizers are used for increasing production of agriculture products. These chemicals are not degraded quickly. Their concentration affected life and health of the man. It is important to know environmental hazards caused by these chemicals and take appropriate steps to check them out. One of the ways is the minimum use of these substances and utilising other operations along with the use of them.

### Health Problems due to Agro-Chemicals

- Chlorinated hydrocarbons cause cancer, birth defects, and neurological disorders.
- Most of the organic phosphates are toxic and humans may suffer from drowsiness, diarrhoea, vomiting, air and breathing difficulty. High concentration may cause paralyses tremors, coma and death.
- Carbonates cause birth defects and genetic damages.
- Food items contain residues of agro-chemicals which are harmful to our health.
- Farm and chemical workers are exposed to agro-chemicals. This causes many health problems in them.



# 3

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## NATURAL RESOURCES:

FOREST RESOURCES AND DEFORESTATION, WATER RESOURCES AND CONSERVATION, MINERAL RESOURCES – USE AND EXPLOITATION, FOOD RESOURCES, ENERGY RESOURCES: RENEWABLE AND NON RENEWABLE ENERGY SOURCES

### NATURAL RESOURCES

Q. What does the term 'Resources' stand for? What do you mean by 'Natural Resources'?

Ans. Simply stated, a resource is any useful information, material or service. Within this broad generalization, we can differentiate between 'natural resources' and 'human resources'.

Natural resources are the components of the environment (i.e. atmosphere, hydrosphere and lithosphere), which can be drawn upon for supporting life. In other words, natural resources are goods and services supplied by our environment (including sinks for wastes). These include energy, mineral, land (soil), food, forest, water, atmosphere (air), plants and animals.

Human resources refer to human wisdom, experience, skill, labour and enterprise.

#### Natural Resources

These are the components of our environment. These resources can be renewable or non-renewable:

i. **Renewable Resources (Inexhaustible Resources):** Inexhaustible resources have the inherent ability to reappear or replenish themselves by

recycling, reproduction or replacement. These renewable sources include sunlight, plants, animals, soil, water and living organisms. Biological organisms are self-renewing. The rate at which their renewal occurs varies.

**2. Non-renewable Resources (Exhaustible Resources):** The non-renewable resources are the earth's geologic endowments, i.e. mineral, fossil fuels, non-mineral resources and other materials which are present in fixed amounts in the environment. Unlike renewable resources, no renewable resources are finite in quantity and quality.

There is also one more category i.e. "Intangible resources"

abstract resources), such as, open space, information, diversity, satisfaction, serenity and beauty, which can be both exhaustible and inexhaustible. There is no upper limit to the amount of knowledge, information or beauty. But at the same time these can be destroyed easily. For example, a single small piece of trash can destroy the beauty of any place. It is important to note here that the two most powerful and largest industries of world-tourism and information management are based on the intangible resources.

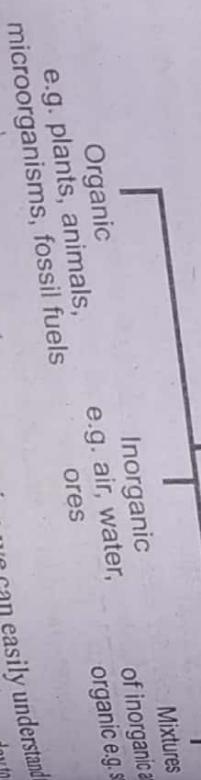
## CLASSIFICATION OF NATURAL RESOURCES

**Q.** Give a broad classification of a natural resources.

**Ans.** Natural resources can be classified in different ways depending upon the needs. Natural resources are of two types-exhaustible and inexhaustible.

These are usually classified as follows:

### NATURAL RESOURCES



It is wise to better utilize these resources for sustainability of the Earth as well as human kind for a long duration and for this it is essential to manage the natural resources meaning fully.

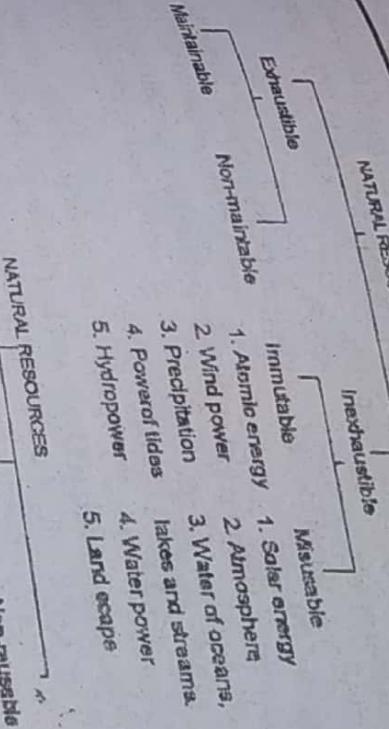
### FOREST RESOURCES\*

**Q.** What is the meaning of forest resources? Throw light on the historical perspective as well as the pattern of distribution of forests.

**Ans.** Forests are important renewable resources. A forest is a biotic community predominantly of trees, shrubs or any other woody vegetation usually with a closed canopy. Forests vary a great deal in composition and density and are distinct from meadows and pastures. Forests contribute substantially to the economic development of a country. They are the last natural resources for man that has been providing a broad array of commodities, amenities and environmental services. Fuelwood, timber, wildlife habitat, pasture for livestock, industrial forest products, animal

be water air soil or minerals.

So observing the above classification we can easily understand natural resources, whatever type it has are so important in our day-to-day life that we cannot ignore it, either during handling or hampering the whole world is conscious about the conservation of our Earth resources (all resources naturally present over Earth). Actually all these resources are for the Earth dwellers whether it is an ant or an elephant. The human being is the major manipulator of all these naturally occurring resources that is major manipulator of water air soil or minerals.



products, recreation, soil moisture retention, climate regulation, production of atmospheric oxygen, a source of new agricultural or grazing land, spiritual renewal are a few examples.

#### Historical Perspective

Wood was the principal building material and fuel of past societies. A large accessible supply of wood was, thus, a prerequisite to the flourishing of civilizations. History abounds with examples of societies that collapsed after exhausting their forests.

Around 2,700 B.C. the Sumerian civilization in Mesopotamia in the lower reaches of the Tigris and Euphrates rivers of the present Iraq. But by 2,000 B.C. the civilization had collapsed largely due to progressive decline of barley yields caused by salinization of soils, triggered by the clearing of the forests in the watersheds of the two rivers, exposing the salt-rich sedimentary rock on the denuded slopes.

The Romans financed the growth of their empire largely from mined and smelted in Spain, using local wood for fuel. During the years they operated, the furnaces consumed an estimated 500 million trees, deforesting about 1.8 million hectares of Spanish landscape. Silver production declined, not because the silver ore supply was exhausted but because fuel was inaccessible, the emperors were forced to debase the coinage progressively, until by the end of the 3rd century AD the public had little confidence in the almost silver less currency resulting in the collapse of the Roman Empire.

Scarcity of wood was created in England from centuries of iron and glass making, ship building, and domestic heating and cooking. English responded to their wood scarcity by seizing new forests in North America especially the tall white pine forests of New England primarily for masts on Royal Navy ships.

As in past centuries, the distribution and condition of the world's forests continue to be altered by human activities, generated by increasing demands for food, timber, shelter and energy of the growing population.

#### Forest Distribution

The United Nations Food and Agriculture Organization estimates the world's land area as of 1994 to be 144.8 million sq km, about 29% of the surface of the globe, of which forest and woodland account for 30% (See Fig.) The FAO defines forest and woodland as planted strands of trees, whether productive or

including land from which forests have been cleared but which will be reforested in the near future.

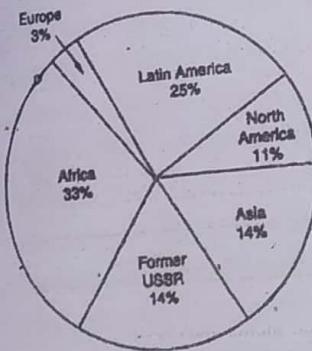
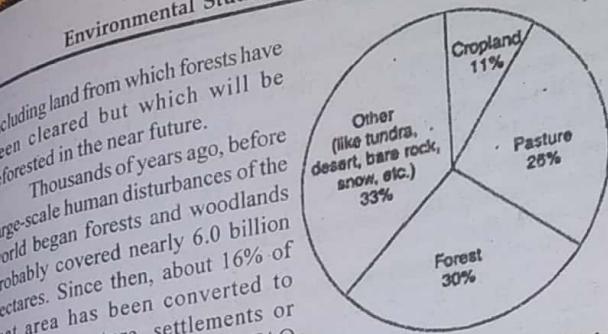
Thousands of years ago, before large-scale human disturbances of the world began forests and woodlands probably covered nearly 6.0 billion hectares. Since then, about 16% of that area has been converted to cropland, pasture, settlements or unproductive wastelands. The FAO estimates the world's area of forest and woodland as of 1994 to be about 4.7 billion hectares. About four-fifths of the forest is classified as 'closed canopy' in which tree crowns spread over 20% or more of the ground and has potential for commercial timber harvesting; and the rest is 'open canopy' forest or woodland, where tree crowns cover less than 20% of the ground.

World land use distribution.

The distribution of forest by region is shown in Fig. Russia, Canada and U.S.A. have vast areas of temperate deciduous or boreal coniferous forests. Together with Brazil, these countries account for about 56% of all closed forests. South America and Central Africa have the largest remaining closed-canopy, broad-leaved, seasonal or deciduous tropical forests. Africa has the largest areas of open woodlands.

As per the State of Forest Report 1999, the total forest cover of India is 637,293 sq km which

is 19.39% of the total geographical area of the country. Out of this, dense forest (crown density more than 40%) accounts for 11.48%, open forest (crown density 10 to 40%) represents 7.76%; while mangrove forest occupies 0.15%. Scrub and no-forest are the other classes in the scheme



World forest by region.

The forest resources are thus threatened due to overgrazing, other forms of over-exploitation, both for commercial and household encroachments, unsustainable practices like unscientific cultivation development activities.

### Effects of Deforestation

Deforestation adversely and directly affects and damages environment and humans both. Some of the ill-effects of deforestation (due to timber extraction, mining, construction of dams, etc.) on local and tribal people are as under:

- (i) **Soil erosion.** In the absence of forests/trees, especially on slopes the soil gets washed away with rain water.
- (ii) **Expansions of deserts.** Denuded land mass gradually gets converted into sand deserts due to the action of strong winds laden by fragments of rock dust. This effect is more pronounced in rain scarce areas.
- (iii) **Migration of local and tribal population from deserts to fertile land** in search of food, leaving behind vast tracks of sands on the way.
- (iv) **Decrease in rainfall.** Forests bring rains due to high transpiration and precipitation. In the absence of forests, rainfall decreases considerably.

(v) **Loss of fertile land.** Less rainfall results into the loss of land owing to less natural vegetational growth.

(vi) **Effect on climate.** The climate of a region is mainly controlled by the rainfall, snowfall, etc. Deforestation causes decrease in rainfall, which in turn increases the climatic temperature.

(vii) **Lowering of water table.** Decrease in rainfall results into a low water table due to lack of recharging of underground reservoirs.

(viii) **Economic losses.** Deforestation will cause loss of industrial and non-timber products and loss of long-term productivity on the part of local and tribal people.

(ix) **Loss of flora and fauna.** Certain species of flora and fauna are getting extinct from the face of planet, mainly due to deforestation.

(x) **Loss of biodiversity.** Loss of flora and fauna has resulted in loss of biodiversity, leading to disturbances in ecological balance worldwide.

(xi) **Loss of medicinal plants.** There are many species of plants which have medicinal and other advantages, like Neem (Indian Margosa) which has been used in India for centuries as insecticide, fungicide, in medicine and in bio-fertilizers. Deforestation may lead to the extinction of many types of valuable plants.

(xii) **Environmental changes.** The air we breathe is purified by forests. So, deforestation will lead to increase in carbon dioxide and other air pollutants concentration. This will lead to global warming, which is a serious effect as well as threat.

(xiv) **In many places the lack of fuelwood due to deforestation challenges local/tribal people, especially where fuelwood had already been scarce.**

(xv) **Agriculture may be negatively impacted if deforestation causes soil loss or compaction, or sedimentation of irrigation systems.**

(xvi) **Indigenous people may be forced into a new way of life for which they are unprepared.**

(xvii) **Human life and downstream structures may be endangered by floods that may be intensified by clearing forests on upstream watersheds.**

(xviii) **Disturbance of forest ecosystems in a particular location may result in important changes in other ecosystems that may be separated by great distances.**

(xix) **Shortage of firewood may cause serious misery among the tribal womenfolk. For example, shrinkage of forests has resulted in such an acute scarcity of fuelwood that gathering alone takes 360 women days a year per family in Gambia.**

(xx) **In rural and tribal societies, fuel budget constitutes the major portion of the household budget. There is a serious apprehension that time is not far when the cost of food would be far less than the fuel needed to cook it for the rural and tribal people.**

**Q. What are the effects of timber extraction on forest and tribal people?**

**Ans.** There has been unlimited exploitation of timber for commercial use. Commercial/industrial demand could out-strip supply leading to decimation of forests, particularly the wood.

**The major effects of timber extraction on forests and tribal people include:**

- Poor logging results in a degraded forest.
- Soil erosion, especially on slopes.
- Sedimentation of irrigation systems.
- Floods may be intensified by cutting of trees on upstream watersheds.
- Loss of biodiversity.
- Climatic changes, such as lower precipitation.
- New logging roads permit shifting cultivators and fuelwood gatherers to gain access to logged areas and fell the remaining trees.

# 4

## BIODIVERSITY, ENVIRONMENT AND HUMAN HEALTH:

GENERAL CONCEPT OF BIODIVERSITY,  
POPULATION EXPLOSION AND FAMILY  
WELFARE, HIV/AIDS

### CONCEPT OF BIODIVERSITY

Q What is bio-diversity? Discuss its concepts.

Ans. Simply stated, biodiversity is the variety of life on earth and its myriad of processes. It includes all life forms - from the unicellular fungi, protozoa and bacteria to complex multicellular organisms such as plants, birds, fishes and mammals. In simple terms, biodiversity means the large variety of flora and fauna on this planet earth. According to the World Resources Institute - "Biodiversity is the variety of the world's organisms, including their genetic diversity and the assemblage they form. It is the blanket term for natural biological wealth that undergirds human life and well-being. The breadth of the concept reflects the inter relatedness of genes, species and ecosystems. Because genes are the components of species, and species are the components of ecosystems. Therefore, altering the make-up of any level of this hierarchy can change the others species are central to the concept of biodiversity".

The term biodiversity is a relatively new term. It is a contraction of biological diversity.. The phrase 'biological diversity' was in use around 1980 and was used to refer mainly to the number of species present in some given area. While, the contracted form 'biodiversity' was coined as