



*Subject :*  
**Environmental  
Studies**

**Paper : 1.6**



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## **INTRODUCTION**

The significance of environmental science and environmental studies is paramount. The necessity for sustainable development is vital for the future of humanity. Ongoing challenges such as pollution, deforestation, poor solid waste management, environmental degradation, economic productivity concerns, threats to national security, global warming, the depletion of the ozone layer, and the loss of biodiversity have heightened global awareness of environmental issues. The United Nations Conference on Environment and Development, which took place in Rio de Janeiro in 1992, along with the World Summit on Sustainable Development in Johannesburg in 2002, have shifted global attention towards the deteriorating state of our environment. It is evident that no individual on this planet can afford to remain uninformed about environmental matters. Environmental management has garnered the interest of healthcare managers, as the management of environmental risks has become increasingly crucial. Since the dawn of civilization, humans have shown a keen interest in ecology. Even ancient texts have highlighted the importance of practices and values related to environmental conservation. Now, more than ever, it is essential for humanity to possess a thorough understanding of environmental issues and to engage in sustainable development practices. India boasts a rich biodiversity that offers various resources for its population and serves as a foundation for biotechnology. India is endowed with a wealth of biodiversity that provides numerous resources for its inhabitants. This diversity acts as a basis for advancements in biotechnology. Approximately 1.8 million living organisms have been identified and classified worldwide.

## **SYLLABUS**

### ***Value Added Course (VAC)- 01***

#### **VAC-01: ENVS- Environmental Studies Course contents:**

#### **Credits 04 (Full Marks-100)**

**Unit-I: Introduction to environmental studies** • Multidisciplinary nature of environmental studies;

- Scope and importance; Concept of sustainability and sustainable development.

**(2 lectures)**

#### **Unit-II: Ecosystems (6 lectures)**

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems: a) Forest ecosystem; b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

#### **Unit-III: Natural Resources: Renewable and Non-renewable Resources (8 lectures)**

- Land resources and land use change; Land degradation, soil erosion and desertification;
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Joint forest management.
- Water: Use and over--exploitation of surface and ground water, floods, droughts, conflicts over water (international & interstate).
- Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

**Unit-IV: Biodiversity and Conservation** • Levels of biological diversity: genetic, species and ecosystem diversity; Bio-

geographic zones of India; Biodiversity patterns and global biodiversity hot spots

- India as a mega---biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man--wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

**(8 lectures)**

**Unit-V: Environmental Pollution (8 lectures)**

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.
- Pollution case studies.
- Noise pollution.

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**-VI: Environmental Policies & Practices (7 lectures)**

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.
- Environmental policy and gender issues

**Unit-VII: Human Communities and the Environment (6 lectures)**

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g. CNG vehicles in Delhi)

**Unit-VIII: Field work** • Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

- Visit to a local polluted site--Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems--pond, river, Delhi Ridge, etc.
- Disaster management.
- Coastal ecosystem

**(Equal to 5 lectures)**

**Suggested Readings:**

- i. ii. iii. iv. v. vi. vii. viii. ix. x. xi. xii. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
- Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
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- Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
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- McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29---64). Zed Books.
- McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
- Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press
- Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co.Pvt. Ltd.
- Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.

## **CONTENTS**

**Multidisciplinary nature of environmental studies**

**Scope and importance; Concept of sustainability and sustainable development**

## **ECOSYSTEM**

**Natural Resources: Renewable and Non-renewable Resources**

### **Multidisciplinary nature of environmental studies;**

As we observe the area in which we reside, we recognize that our environment was initially a natural landscape, encompassing elements such as a forest, a river, a mountain, a desert, or a combination of these features. The majority of us inhabit landscapes that have been significantly altered by human activity, in villages, towns, or cities. However, even those of us who live in urban areas obtain our food supply from nearby villages, which in turn rely on natural landscapes like forests, grasslands, rivers, and seashores for essential resources such as water for agriculture, fuel wood, fodder, and fish. Therefore, our daily existence is interconnected with our surroundings and inevitably impacts them. We utilize water for drinking and various daily activities. We inhale air, we consume resources that produce food, and we rely on the community of living plants and animals that create a web of life, of which we are also a component. Everything surrounding us constitutes our environment, and our lives are contingent upon maintaining its vital systems as intact as possible. The industrial growth and intensive agriculture that supply the products for our increasingly consumer-driven society deplete significant quantities of natural resources, including water, minerals, petroleum products, wood, and more. Non-renewable resources, such as minerals and oil, are those that will be depleted in the future if we persist in extracting them without consideration for future generations.

### **Scope and importance; Concept of sustainability and sustainable development:**

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” By- Brundtland Commission in 1987. Sustainability emphasizes fulfilling the current needs without jeopardizing the capacity of future generations to satisfy their own requirements. This concept is built upon three fundamental pillars: economic, environmental, and social—commonly referred to as profits, planet, and people.

- ❖ Sustainability emphasizes fulfilling the current needs without jeopardizing the capacity of future generations to satisfy their own requirements.
- ❖ Investors may be cautious regarding companies that pledge to sustainability. While the perception can positively influence share prices, investors are concerned about the transparency of companies in relation to their earnings reports.

Major brands frequently make commitments to sustainability; however, it often requires a significant amount of time to realize these sustainability objectives.

The significance of sustainable development lies in its ability to harmonize our economic, environmental, and social requirements, thereby ensuring prosperity for both present and future generations. Sustainable development encompasses a long-term, cohesive strategy aimed at fostering and realizing a healthy community by collaboratively tackling economic, environmental, and social challenges, while also preventing the excessive use of essential natural resources. Everyone deserves a good standard of living, with improved job prospects. Economic prosperity is essential for our nation's success, and our businesses must therefore provide high-quality products that consumers worldwide desire, at prices they are willing to pay.

Sustainable development promotes the conservation and enhancement of our resource base by gradually transforming the methods we employ in developing and utilizing technologies. Countries should be permitted to fulfill their fundamental requirements for employment, food, energy, water, and sanitation. To achieve this sustainably, it is essential to maintain a sustainable population level. Economic growth ought to be encouraged, and developing nations should be afforded the opportunity to grow at a level comparable to that of developed nations. There are four key objectives of sustainable development: These encompass social progress and equality, environmental protection, conservation of natural resources, and stable economic growth. Everyone is entitled to a healthy, clean, and safe environment. This can be accomplished by mitigating pollution, poverty, inadequate housing, and unemployment. No individual, whether in the present or in the future, should face unfair treatment. Global environmental challenges, including climate change and poor air quality, must be addressed to safeguard both human and environmental health. The consumption of non-renewable resources, such as fossil fuels, should not be abruptly halted; rather, it should be managed efficiently, and the development of alternatives should be promoted to facilitate their gradual phase-out.

## **WHAT IS ECOSYSTEM?**

English botanist A.G. Tansley first used the term "ecosystem" in 1935. Abiotic (non-living) and biotic (living) components interact intricately to form ecosystems, which are the structural and functional units of ecology (nature). Ponds, for instance, are excellent illustrations of ecosystems. Common examples of ecosystems include ponds, lakes, deserts, grasslands, meadows, forests, etc.

Living beings cannot exist apart from their non-living surroundings because they provide the elements and energy required for their survival. Put another way, interactions between a biotic community and its environment produce an ecosystem, which is a naturally occurring, self-sufficient unit. Ecosystems are regions of the natural world where organisms interact with their natural environment and with each other.

## **STRUCTURE & FUNCTION OF ECOSYSTEM**

**Each ecosystem has two main components:**

- (1) Abiotic
- (2) Biotic

**1) Abiotic components (Nonliving):** The abiotic component such as primary energy source, crucial for photosynthesis and determining temperature. Temperature which affects metabolic rates, reproduction, and species distribution. Chemical factors such as pH levels, nutrients, and salinity (especially in aquatic ecosystems). Simple sediments are not nearly as complex as soils. They are made up of a variety of organic matter, living things, weathered rock fragments, and highly modified soil mineral particles. For organisms, soils offer a home, water, nutrients, and a structural growing medium. Because of nitrogen cycling, vegetation that grows on top of soil is intimately related to this ecological component. The atmosphere gives organisms in ecosystems oxygen for respiration and carbon dioxide for photosynthesis.

**(2) Biotic components:** The living organisms including plants, animals and micro-organisms (Bacteria and Fungi) that are present in an ecosystem form the biotic components.

**(A) Producers:**

The green plants have chlorophyll with the help of which they trap solar energy and change it into chemical energy of carbohydrates using simple inorganic compounds namely water and carbon dioxide. This process is known as photo-synthesis. As the green plants manufacture their own food they are known as **Autotrophs** (i.e. auto = self, trophos = feeder). The chemical energy stored by the producers is utilised partly by the producers for their own growth and survival and the remaining is stored in the plant parts for their future use.

**(B) Consumers:**

The animals lack chlorophyll and are unable to synthesise their own food. Therefore, they depend on the producers for their food. They are known as **heterotrophs** (i.e. heteros = other, trophos = feeder)

**(c) Decomposers:**

Break down dead/decaying matter, recycling nutrients (e.g., fungi, bacteria).

**ENERGY FLOW IN AN ECOSYSTEM**

The flow of energy within an ecosystem represents a unidirectional transfer of energy originating from the sun, proceeding through producers and extending to different levels of consumers. This process is regulated by the 10% rule, which indicates that approximately 90% of energy is dissipated as heat at each stage. This energy flow is fundamental to life, facilitating food chains and webs, starting with photosynthetic producers that transform solar energy into chemical energy.

**Food Chains**

- All the organisms need energy to grow, move and reproduce.
  - For this purpose, smaller insects eat plants, bigger animals eat smaller insects and so on.
  - This feeding relationship forms a food chain in an ecosystem.

- Thus, the Food Chain is a linear sequence of organisms through which the transfer of energy and nutrients takes place.
  - The energy and nutrients flow in the form of food from organism to organism by eating and being eaten.
  - This is what forms the basis of energy flow in the ecosystem.

## **Types of Food Chains**

Broadly, there are **two types of food chains in any ecosystem – Grazing Food Chains and Detritus Food Chains.**

### **Grazing Food Chains**

- This type of food chain is more prevalent in those ecosystems where a substantial part of the net primary production is grazed on by herbivores.
- Thus, there is enough energy to support the higher trophic level and in turn a food chain.
- It starts from a green plant base, goes to grazing herbivores and on to carnivores.

### **Detritus Food Chains**

- This type of food chain starts with dead organic matter which is decomposed by microorganisms, which, in turn, are eaten by other organisms.
- Thus, it is less dependent on direct solar energy and more on the supply of organic matter produced by another ecosystem.

### **Food Web**

- Food Chain follows a single path as animals eat each other.
- In a natural environment or an ecosystem, the relationships between the food chains are interconnected, as one organism may be a part of multiple food chains.
- Hence, in place of a linear food chain, a web-like structure is formed in energy flow in ecosystem.
- The web like structure is formed with the interlinked food chain and such matrix that is interconnected is known as a Food Web.
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- The primary source of energy in a food web is sunlight. Plants, algae, and certain bacteria known as primary producers (or autotrophs) capture this solar energy and use it to produce organic molecules through the process of photosynthesis.

## **Ecological Pyramids**

- **Ecological Pyramid** is the graphical representation of the relationship between the producer and different levels of consumers in terms of a number of species, biomass or energy accumulated.
- They are the graphical representations of trophic levels in energy flow in ecosystem.
  - They are also known as **models of energy flow in an ecosystem**.
- There are **three types of ecological pyramids**:
  - **Pyramid of Numbers**
  - **Pyramid of Biomass**
  - **Pyramids of Energy**

## **Pyramid of Numbers**

- It is the relationship between the producers and various consumers, as shown in terms of the population at each trophic level.
- A pyramid of numbers is advantageous over other types of pyramids because it is a simple method of showing energy flow in ecosystem.
  - In this case, one only needs to count the number of organisms.
- Also, it is good for comparing changes to the ecosystem at different times of the year.
- However, it has limitations, as the number of species may be too high to measure accurately.
- It also includes all the organisms ignoring their sizes, which leads to inverted pyramids.
- Based on its shape, the Pyramid of Numbers are of two types:

## **Erect Pyramid of Numbers**

- In these ecosystems, there are numerous small autotrophs that support lesser herbivores, which in turn support a smaller number of carnivores; hence, this pyramid is upright.
- This type of pyramid is found in the aquatic and grassland ecosystem.
- **For Example:** In grassland ecosystem, numbers of grasses are much more than the number of herbivores and, in turn, the number of herbivores is more than the number of carnivores.

## **Inverted Pyramid of Numbers**

- This type of ecological pyramid is seen in a parasitic food chain where one primary producer supports numerous parasites, which support more hyperparasites.
- **For example:** In the Tree ecosystem, there are many herbivores feeding on a single tree. In turn, the numbers of parasites feeding on a single herbivore are many.

## **Pyramid of Biomass**

- It is the graphical representation of the producers and various levels of consumers in terms of their biomass.
- A pyramid of biomass is a more accurate indication of how much energy flow in ecosystem happens at each trophic level.

## **Inverted Pyramid of Biomass**

- This happens when the smaller weight of producers supports consumers of larger weight.
- It is especially found in the case of **aquatic ecosystems**.
- For example, in a pond ecosystem, the phytoplankton (the producers) has a very short span of life and a rapid turnover rate (i.e. they are rapidly replaced by new plants).
  - Thus, at any given time, their total biomass is less than the biomass of the herbivores they support.

## **Case studies of the following ecosystems:**

### **a) Forest ecosystem:**

Forest ecosystems are complex, dynamic, self-contained associations of biotic and abiotic factors. It is most prominently dominated by trees, shrubs, and other vegetation and animal groups. Forest ecosystems play a vital role in supporting life on earth because they play an important part in regulating climate, biodiversity conservation, protection of watersheds, and the maintenance of human economies by supplying essential resources to human societies.

### **b) Grassland ecosystem:**

Grasslands are areas where the vegetation is dominated by grasses (poaceae) however, sedge (cyperaceae) and rush (juncaceae) families can also be found along with variable proportions of legumes, like clover (legume) and other herbs. Grasslands occur naturally on all continents except Antarctica. Grassland cover around 25% of the earth's surface.

### **c) Desert ecosystem:**

Desert ecosystems are the driest, most arid environments on Earth, defined by extremely low precipitation, high evaporation rates, and sparse vegetation. Covering about one-fifth of Earth's land, these systems feature extreme temperature fluctuations (both hot and cold) and specialized fauna and flora adapted for water conservation.

### **d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)**

An aquatic ecosystem is a community of organisms (plants, animals, microbes) interacting with each other and their water-based environment, categorized by salinity into marine (saltwater) and freshwater systems. These ecosystems, ranging from oceans and coral reefs to lakes and wetlands, are critical for biodiversity, oxygen production, And carbon cycling.

## ECOLOGICAL SUCCESSION

Ecological succession is the process by which the mix of species and habitat in an area changes over time. Gradually, these communities replace one another until a “climax community”—like a mature forest—is reached, or until a disturbance, like a fire, occurs.

**Primary succession** happens when a new patch of land is created or exposed for the first time. This can happen, for example, when lava cools and creates new rocks, or when a glacier retreats and exposes rocks without any soil. During primary succession, organisms must start from scratch. First, lichens might attach themselves to rocks, and a few small plants able to live without much soil might appear. These are known as “pioneer species.”

**Secondary succession** happens when a climax community or intermediate community is impacted by a disturbance. This restarts the cycle of succession, but not back to the beginning—soil and nutrients are still present.

For example, after a forest fire that kills all the mature trees on a particular landscape, grasses might grow, followed by shrubs and a variety of tree species, until eventually the community that existed before the fire is present again.

**Land resources and land use change; Land degradation, soil erosion and desertification:** Resources that we get from nature and that exist without any interference from humankind are called natural resources. Sunlight, water, air, and landform altogether form the essential ecosystem in which all organisms live. Over time humans have progressed, and to do that they have exploited all the natural resources, but the land resource has been the one that has been exploited most.

We have a limited amount of resources but human needs are unlimited. For human beings land has many needs: it functions as an asset, produces food, stores water, has minerals for plant growth, and more. The land resource is not a renewable resource, as the demand for land increases with the increase of population, the amount of land will remain the same. Many measures and techniques have been adapted to preserve the land that we have and we need to understand how to manage the land.

## **Land Use Pattern**

Land use pattern is the layout or arrangement of the uses and purposes of the land. Climate, soil, the density of population, technical and socio-economic features determine the land use pattern. Forests, wasteland, cultivation, and civilization are the most important types of land use. Land use in civilization is the most exploited, roads, transport routes, housing, industries, and human settlement.

Fallow land is the land that has not been in use for more than 3 to 5 years and the neglected or unused urban areas like an empty lot or a playground is called Wasteland. Wasteland is the type of land which has lost its capacity for vegetation and nor is in use for civilization. Whereas crops can be cultivated on Fallow land, it still has not loose fertility but no cultivation has been done on it for years. Physical, economic, and political cause the problem of land resources.

## **Land Degradation**

The process in which the value of the biophysical environment is affected by a combination of humankind and natural hazards is called land degradation. Land degradation is a serious issue that affects the environment and has an indirect impact on food production. The continued degradation of land leads to a decline in the productivity of the land capacity of vegetation.

### **Causes Of Land Degradation**

**Deforestation:** Forest is very important for maintaining the fertility of the soil. Roots of trees hold on to soil thus preventing washing away of soil by rain, flood, or wind.

**Overgrazing:** Farmers take their cattle and livestock for grazing, but they mostly don't do rotation. Due to this the grass and another type of vegetation do not get a chance to grow thus causing land degradation.

**Water-logging:** In the agriculture field when proper irrigation is not done or maintenance the drainage system lacks, then excessive waterlogging can happen. If this happens then the surface water and the groundwater gets mixed which will bring salt from the groundwater level, thus ruining the fertility of the land.

**Desertification:** In arid, dry sub-humid, and semi-arid regions due to natural and human activities desertification happens. Desertification is when land becomes desert-like.

**Soil erosion:** When the wind and water cause the displacement or washes away the top layer of soil it is called soil erosion. The loss of the top layer of soil causes degradation of the quality of land, then it will not be able to provide minerals to plants. It will reduce the crop yielding potential of land, the groundwater level will go down, and can cause sinkholes.

### **Conservation of land resources**

Steps and measures that should be taken to conserve land resources are afforestation, proper grazing and maintaining irrigation, regulating pesticides and fertilizers for agriculture, properly using wasteland and fallow land.

**Deforestation Causes and impacts :**The official **deforestation definition** is quite simple: It's when humans convert wooded land into something totally different, leaving previously dense green forests carved, cleared, and turned into a pockmarked desert-brown wasteland. Also damaging is **forest degradation**: the loss or reduction of a forest's ecosystem integrity through intensive logging and the targeting of older stands of trees within a forest by loggers.

Few places across the globe are spared. While the most intense focus on the issue of deforestation has been on tropical locales, such as the Amazon rainforest and Congo Basin, the problem is widespread. Northern forests—in particular, the peat-rich boreal forests in Canada and Russia, the lichen-rich forests of Sweden, and various forests across the western United States, among others—are being damaged as well but without the same scrutiny.

NRDC is calling for countries of the Global North to hold themselves accountable and step up their obligations to report on and rein in the rampant logging happening within their borders. Otherwise, standards for protecting forests are lowered everywhere, including in the Global South, which so often takes the heat for this issue. Deforestation and forest degradation are destroying some of the earth's most precious ecosystems and the natural resources that people depend on, in addition to fragmenting wildlife habitat. Together, they are also the second-largest source of global carbon emissions, after the burning of fossil fuels. (In brief: When we remove healthy trees, some of the carbon that's been stored in their fibers and surrounding soils gets immediately released into the atmosphere; some is released more slowly as wood products decay.) Forest degradation can also damage or diminish other ecosystem services that a healthy forest provides—everything from flood control for surrounding communities to availability of food and medicines derived from forest plants.

## **Causes of deforestation**

There are a few types of deforestation and forest degradation. Some are closely tied to the climate crisis, as when sea level rise surrounds the roots of coastal trees with salty water, parching and killing them—turning them into “ghost forests.” Similarly, some forests are being leveled by wildfires, which are intensifying with global warming. But industrial logging is by far the world’s largest driver of tree loss, whether for extraction of natural resources to make forest products—like lumber, paper, and biomass for energy—or conversion into farmland and other development.

### **Wildfires**

Forest fires are triggered either by lightning strikes or people. In some landscapes, such as boreal forests, natural wildfire cycles caused by lightning have played an integral role in maintaining ecosystem health for millennia. Wildfires can remove sick and dying vegetation, stimulate natural regeneration, and support biodiversity. When set through prescribed burns outside the wildfire window, fire can also sometimes be a beneficial way to clear out highly flammable shrubs and brush that make forests more prone to conflagration.

But with climate change creating drier, warmer, more flammable conditions, wildfires are burning hotter and longer than ever before and wiping out massive numbers of trees. Unprecedented hot, dry weather led to record-breaking Canadian wildfires that burned more than 18 million hectares of land in 2023 alone.

Extreme droughts also make forested landscapes more susceptible to wildfire and other climate impacts, such as increased insect infestations. Older, hardier trees are dying out and becoming replaced by shrubs. Scientists warn that we could eventually see the transformation of tropical forests (like the Amazon) into arid savannahs or coniferous forests (like the boreal) into shrubby grasslands, particularly if we hit a climate tipping point.

### **Clearcutting for agriculture**

Cattle ranching and monoculture farming of crops like soybeans also drive deforestation. In the Amazon rainforest, many international meat and animal feed companies have financed the clearing and burning of trees to make way for plantations and processing facilities. These operations feed robust export trades—and in turn, fuel demand for these products.

## **Biomass energy production**

Trees are also used to produce biomass pellets, an energy source that industry parades as carbon neutral. The biggest supply of those greenwashed pellets comes from forests in North Carolina and other parts of the American Southeast.

Scientists from NRDC and other groups have proven wood power to be remarkably inefficient, producing *more* greenhouse gas per unit of electricity than coal. Nevertheless, the European Union approved wood pellets as a renewable energy source in 2009, and the biomass industry has seen a resurgence in the years since.

- Water: Use and over--exploitation of surface and ground water, floods, droughts, conflicts over:

Water resources are essential for maintaining life and a variety of human endeavours. The use and overuse of surface and groundwater are discussed in general, with an emphasis on their importance, difficulties, and possible remedies. It addresses the numerous industries that rely on water supplies as well as the unsustainable behaviours that fuel their excessive consumption.

Groundwater depletion, intense floods, severe droughts, and escalating conflicts over water are critical global crises driven by over-utilization, climate change, and mismanagement. Excessive extraction lowers water tables, causing scarcity and land subsidence. Conversely, rapid urbanization and climate change increase flood disasters, while inefficient water usage in agriculture exacerbates droughts.

## • Energy resources: Renewable and non renewable energy sources:

**Renewable energy** is energy derived from natural sources that are replenished at a higher rate than they are consumed. Sunlight and wind, for example, are such sources that are constantly being replenished. Renewable energy sources are plentiful and all around us.

Fossil fuels - coal, oil and gas - on the other hand, are non-renewable resources that take hundreds of millions of years to form. Fossil fuels, when burned to produce energy, cause harmful greenhouse gas emissions, such as carbon dioxide.

Generating renewable energy creates far lower emissions than burning fossil fuels. Transitioning from fossil fuels, which currently account for the lion's share of emissions, to renewable energy is key to addressing the climate crisis.

Renewables are now cheaper in most countries, and generate three times more jobs than fossil fuels.

## **SOLAR ENERGY**

Solar energy is the most abundant of all energy resources and can even be harnessed in cloudy weather. The rate at which solar energy is intercepted by the Earth is about 10,000 times greater than the rate at which humankind consumes energy.

Solar technologies can deliver heat, cooling, natural lighting, electricity, and fuels for a host of applications. Solar technologies convert sunlight into electrical energy either through photovoltaic panels or through mirrors that concentrate solar radiation.

Although not all countries are equally endowed with solar energy, a significant contribution to the energy mix from direct solar energy is possible for every country.

The cost of manufacturing solar panels has plummeted dramatically in the last decade, making them not only affordable but often the cheapest form of electricity. Solar panels have a lifespan of roughly 30 years, and come in variety of shades depending on the type of material used in manufacturing.

## **WIND ENERGY**

Wind energy harnesses the kinetic energy of moving air by using large wind turbines located on land (onshore) or in sea- or freshwater (offshore). Wind energy has been used for millennia, but onshore and offshore wind energy technologies have evolved over the last few years to maximize the electricity produced - with taller turbines and larger rotor diameters.

Though average wind speeds vary considerably by location, the world's technical potential for wind energy exceeds global electricity production, and ample potential exists in most regions of the world to enable significant wind energy deployment.

Many parts of the world have strong wind speeds, but the best locations for generating wind power are sometimes remote ones. Offshore wind power offers tremendous potential.

## **GEOHERMAL ENERGY**

Geothermal energy utilizes the accessible thermal energy from the Earth's interior. Heat is extracted from geothermal reservoirs using wells or other means.

Reservoirs that are naturally sufficiently hot and permeable are called hydrothermal reservoirs, whereas reservoirs that are sufficiently hot but that are improved with hydraulic stimulation are called enhanced geothermal systems.

Once at the surface, fluids of various temperatures can be used to generate electricity. The technology for electricity generation from hydrothermal reservoirs is mature and reliable, and has been operating for more than 100 years.

## **HYDROPOWER**

Hydropower harnesses the energy of water moving from higher to lower elevations. It can be generated from reservoirs and rivers. Reservoir hydropower plants rely on stored water in a reservoir, while run-of-river hydropower plants harness energy from the available flow of the river.

Hydropower reservoirs often have multiple uses - providing drinking water, water for irrigation, flood and drought control, navigation services, as well as energy supply.

Hydropower currently is the largest source of renewable energy in the electricity sector. It relies on generally stable rainfall patterns, and can be negatively impacted by climate-induced droughts or changes to ecosystems which impact rainfall patterns.

The infrastructure needed to create hydropower can also impact on ecosystems in adverse ways. For this reason, many consider small-scale hydro a more environmentally-friendly option, and especially suitable for communities in remote locations.

## **OCEAN ENERGY**

Ocean energy derives from technologies that use the kinetic and thermal energy of seawater - waves or currents for instance - to produce electricity or heat.

Ocean energy systems are still at an early stage of development, with a number of prototype wave and tidal current devices being explored. The theoretical potential for ocean energy easily exceeds present human energy requirements.

## **Biodiversity and Conservation**

Biodiversity, defined as the variety of living organisms from all sources, is fundamental to all life on Earth. This encompasses diversity within species, between species, and across ecosystems, reflecting the genetic composition of plants, animals, microorganisms, and the intricate nature of ecosystems. Healthy communities rely on well-functioning ecosystems, which deliver essential services such as clean air, fresh water, natural medicines, and food security. These ecosystems also play a role in disease regulation and climate stabilization. For instance, forests sequester over 2.6 billion tonnes of CO<sub>2</sub> each year, aiding in climate control and diminishing the prevalence of pollution-related diseases. Nevertheless, the loss of biodiversity is occurring at an alarming pace, with around 1 million species facing extinction, jeopardizing these crucial services and heightening global public health threats.

## **India as a mega biodiversity nation**

India is recognized as one of the 17 megadiverse nations worldwide, belonging to a collective of countries that together contain over 70% of the planet's biological diversity. Although it occupies merely 2.4% of the Earth's land surface, India is responsible for approximately 7–8% of all documented species on a global scale.

## **Threats to biodiversity**

Prior to the industrial revolution, ecology was marked by a state of stability. In each habitat, ecosystems were formed through extensive evolutionary processes, allowing for the coexistence of predators and prey, collaborators and competitors, ranging from microbes to mammals, within intricate, interconnected networks. Changes in biodiversity – the variety of plants, animals, fungi, and microscopic organisms inhabiting each habitat – did occur, but these changes were predominantly influenced by long-term processes that unfolded over centuries to millennia. Human activities, including the combustion of fossil fuels and industrialized agriculture, have collectively exerted a profound influence on the planet's biomes and ecosystems. Climate change, deforestation, and pollution have led to the destruction or degradation of habitats, altered the distribution of species, and caused the extinction of species at a rate and magnitude comparable to significant extinction events in history.

## **Environmental pollution**

- A pollutant refers to any substance, type of energy (including heat, noise, or radiation), or material that is introduced into the environment as a result of human activities or natural occurrences, and which inflicts damage. Pollutants taint the air, water, or soil, disturb ecosystems, and have the potential to build up to hazardous levels. have led to a decline in some eco-friendly religious practices.

Pollution is the introduction of harmful contaminants—such as chemicals, smoke, and waste—into the natural environment, rendering it unsafe or unpleasant. Major causes include burning fossil fuels (coal, oil), industrial emissions, vehicular exhaust, agricultural runoff, deforestation, and improper waste disposal. It directly impacts human health, ecosystems, and climate.

## **TYPES OF POLLUTION:**

- **Air Pollution**: Primarily caused by emissions from industries, power plants, and vehicles (carbon monoxide, sulfur dioxide, nitrogen oxides). Other sources include burning wood/coal, agricultural waste burning, and construction dust.
- **Water Pollution**: Occurs through the discharge of untreated industrial waste, sewage, and agricultural runoff (fertilizers, pesticides) into water bodies. Oil spills and plastic waste also severely affect marine life.
- **Land Pollution**: Caused by improper solid waste disposal in landfills, mining operations, industrial waste, and the use of chemical pesticides in agriculture.
- **Deforestation**: Removing trees reduces the planet's ability to absorb CO<sub>2</sub>, intensifying air pollution and destroying habitats.

## **Major Pollutant Sources**

- **Fossil Fuel Combustion**: The largest source of pollution, driving both air pollution and global warming.
- **Industrial Processes**: Chemical plants, refineries, and factories release harmful chemicals and greenhouse gases.
- **Agricultural Activities**: Pesticides, fertilizers, and methane from livestock pollute land and water.
- **Waste Disposal**: Landfills release methane, while incineration releases toxic emissions.

## **Nuclear hazards and human health risks**

Exposure to very high levels of radiation, such as being close to an atomic blast, can cause acute health effects such as skin burns and acute radiation syndrome (“radiation sickness”). It can also result in long-term health effects such as cancer and cardiovascular disease. Exposure to low levels of radiation encountered in the environment does not cause immediate health effects, but is a minor contributor to our overall cancer risk. Exposure to low-levels of radiation does not cause immediate health effects, but can cause a small increase in the risk of cancer over a lifetime. There are studies that keep track of groups of people who have been exposed to radiation, including atomic bomb survivors and radiation industry workers. These studies show that radiation exposure increases the chance of getting cancer, and the risk increases as the dose increases: the higher the dose, the greater the risk. Conversely, cancer risk from radiation exposure declines as the dose falls: the lower the dose, the lower the risk.

## **Solid waste management**

The growing volume and complexity of waste linked to the contemporary economy poses a significant threat to ecosystems and human health. Each year, approximately 11.2 billion tonnes of solid waste are collected globally, with the decomposition of the organic component of this waste contributing around 5 percent to global greenhouse gas emissions. Of all waste streams, the waste generated from electrical and electronic equipment, which contains new and complex hazardous substances, represents the most rapidly escalating challenge in both developed and developing nations. Ineffective waste management—ranging from the absence of collection systems to inadequate disposal methods—results in air pollution, as well as contamination of water and soil. Open and unsanitary landfills lead to the pollution of drinking water and can facilitate the spread of infections and diseases. The spread of debris contaminates ecosystems, and hazardous substances from electronic waste or industrial refuse impose a burden on the health of urban populations and the environment. The primary solution is to minimize waste. When waste cannot be avoided, the recovery of materials and energy from waste, along with remanufacturing and recycling waste into usable products, should be the subsequent course of action. Recycling results in significant resource conservation. For instance, for every tonne of paper recycled, 17 trees and 50 percent of water can be conserved. Furthermore, recycling generates employment: the sector provides jobs for 12 million individuals in Brazil, China, and the United States alone.

## **Noise pollution**

Noise pollution can result in a range of negative consequences for human health. These may include hearing impairment, stress, sleep disturbances, and cardiovascular issues. Furthermore, it can adversely affect wildlife by disrupting their communication, feeding, and mating behaviors. Additionally, noise pollution can have economic repercussions, such as diminished property values and decreased productivity in the workplace

According to the Cambridge Dictionary, noise pollution is described as "noise, such as that from traffic, that disturbs individuals in their living or working environments and is deemed detrimental to their health." To elaborate, noise pollution signifies the existence of excessive or unwelcome sound that can adversely affect human health and the environment. It arises when sound levels surpass a specific threshold, leading to discomfort, annoyance, or physical harm to living organisms, or disrupting the natural equilibrium of the ecosystem. Sources of noise pollution may encompass transportation, industrial and construction activities, as well as recreational pursuits. Common instances include loud music, traffic noise, aircraft noise, and noise generated from construction sites.

### **CAUSES OF NOISE POLLUTION:**

- **Neighbours:** Noise from neighbours can be a significant cause of noise pollution in the home, particularly in high-density residential areas. Loud music, noisy parties and barking dogs are all examples of sounds that can disturb others and constitute noise pollution.
- **Air traffic:** Aeroplanes, helicopters and other aircraft can generate significant noise pollution. This is particularly problematic when they fly low over populated areas.
- **Traffic:** Noise from cars and other road vehicles is a pervasive source of noise pollution in urban areas and it can cause significant health problems to those who live near busy roads.
- **Construction work:** Building sites can generate a high level of noise pollution due to the use of heavy machinery, power tools and other equipment.

- **Animals:** Whether it's barking dogs, chirping birds or crowing cockerels, animals can be a cause of noise pollution, especially when they occur at night.
- **Nightlife:** Partying and loud music can cause significant noise pollution, especially in urban areas that have a vibrant nightlife scene.

Noise pollution can arise from a wide range of sources, including natural and human activities. To reduce or prevent noise pollution, it's necessary to identify its causes and implement effective reduction measures.

### **Impacts of human population on environment**

Rapidly growing human populations, currently over 8 billion, place immense pressure on the environment, driving resource depletion, biodiversity loss, and pollution increased consumption of fossil fuels, water, and land leads to climate change, deforestation, and waste accumulation, threatening ecosystem stability. Sustainable development requires addressing population growth and resource consumption. The accelerating pace of population growth in the last century was not due to any undue rise in birth rate of world population, but, because in the last century, there was a sharp fall in death rate, advancements in healthcare control over fatal diseases such as small pox, plague and cholera and improved food distribution system (result of food security). The average number of children born to a mother has declined from 5 to 3.5 since 1950, though the size of world population has more than doubled during the same period.

### **GLOBAL WARMING**

Global warming is the rapid and ongoing increase in the Earth's average surface temperature. While the planet has experienced natural temperature shifts throughout its history, the current warming trend is unique because it is primarily driven by human activities and is occurring at a rate unprecedented in thousands of years.

## Causes of Global Warming

The primary cause of global warming is the **greenhouse effect**. Human activities since the Industrial Revolution have significantly increased the concentration of greenhouse gases in the atmosphere, which act like a "blanket," trapping solar heat that would otherwise radiate back into space. The largest source of emissions comes from burning coal, oil, and natural gas for electricity, heat, and transportation. Cutting down forests reduces the Earth's natural ability to absorb carbon dioxide. Manufacturing products like cement, steel, and chemicals releases significant amounts of

Global warming triggers a range of environmental and socioeconomic shifts:

- **Melting Ice and Rising Seas:** Glaciers and polar ice sheets are shrinking rapidly, contributing to global sea-level rise and threatening coastal cities with flooding.
- **Extreme Weather:** There is a clear link between warming and the increased frequency and intensity of droughts, heatwaves, wildfires, and catastrophic storms.
- **Ecosystem Disruption:** Many species are being forced to migrate to cooler areas, and some, like those in coral reefs, are facing mass extinction due to thermal stress.
- **Human Health:** Rising temperatures expand the range of disease-carrying insects and increase the risk of heat-related illnesses and food insecurity.

Therefore Global warming refers to the increase in the planet's overall average temperature in recent decades. Natural processes have always affected Earth's temperature and climate, but more recently, the planet's temperature and climate have changed at a higher pace than nature alone can explain. These rapid changes are due to human activities and the widespread use of fossil fuels for energy.

- Fossil fuels include coal, oil and natural gas. Burning fossil fuels causes what is known as the "greenhouse effect" in Earth's atmosphere. The greenhouse effect happens when the sun's rays penetrate the atmosphere, and the Earth's surface reflects that heat. Some of the gasses in the atmosphere then trap heat over Earth. Gasses emitted by the burning of fossil fuels are very good at trapping heat and preventing it from leaving the atmosphere. These greenhouse gasses are carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and water vapor. The excess heat in the atmosphere has caused the planet's average global temperature to rise over time, otherwise known as global warming.

- The Industrial Revolution, beginning in the mid-18th century, led to the start of an anthropogenic (human-caused) rise in greenhouse gas emissions from Europe and the United States. The invention of the coal-fired steam engine introduced coal as a major source of energy. Soon it was heating homes and fueling machines in factories.
- Since that time, the burning of fossil fuels has steadily increased. Today, many countries around the world use fossil fuels to generate energy for electricity, heat and transportation. Emissions of greenhouse gasses have skyrocketed in the last 100 years, and especially since the 1980s. This has accelerated the rise in Earth's temperature.
- Global warming has presented humans with another issue: climate change. People often use the terms "global warming" and "climate change" interchangeably, but they are different. Global warming refers to Earth's rising average temperature, while climate change refers to changes in weather patterns and growing seasons around the world. Global warming causes climate change, which poses a serious threat to life on Earth.
- Humans are feeling the impact of global warming around the world as climate change brings intense droughts, wildfires and extreme storms with heavier rainfall. Higher temperatures are altering ecosystems, forcing animals to migrate to cooler places to survive. Scientists predict that, if nothing is done to lower global temperatures, many species will go extinct.
- The ocean is also warming, and glaciers, ice caps and ice sheets are melting. This is causing sea levels to rise, creating flooding problems for many people who live on islands and in coastal communities.
- Corals have been a symbol of the consequences of a warmer ocean. Many coral reefs—home to thousands of species of fish and other organisms—are dying. National Geographic Explorer Shireen Rahimi is an underwater storyteller who focuses her lens on the impact of global warming on tropical coral reefs. Her images capture humans' relationships to the changing seas in the South Pacific, the Coral Triangle, and the Caribbean. Rahimi is dedicated to telling personal stories that encourage environmental action.
- Countries around the world are trying to lower greenhouse gas emissions to slow global warming. In 2015, nearly 200 countries signed the Paris Agreement at a United Nations Climate Change conference. The international treaty tasks each country with lowering greenhouse gas emissions. The goal is to slow the pace of global warming and prevent Earth's temperature from rising 2°C (3.6°F) above pre-industrial temperatures.

## **Montreal Protocol**

The Montreal Protocol on Substances that Deplete the Ozone Layer is the landmark multilateral environmental agreement that regulates the production and consumption of nearly 100 man-made chemicals referred to as ozone depleting substances (ODS). When released into the atmosphere, those chemicals damage the stratospheric ozone layer, Earth's protective shield that protects humans and the environment from harmful levels of ultraviolet radiation from the sun. Adopted on 16 September 1987, the Protocol is to date one of the rare treaties to achieve universal ratification.

The Montreal Protocol phases down the consumption and production of the different ODS in a step-wise manner, with different timetables for developed and developing countries (referred to as "Article 5 countries"). Under this treaty, all parties have specific responsibilities related to the phase out of the different groups of ODS, control of ODS trade, annual reporting of data, national licensing systems to control ODS imports and exports, and other matters. Developing and developed countries have equal but differentiated responsibilities, but most importantly, both groups of countries have binding, time-targeted, and measurable commitments.

The Protocol includes provisions related to Control Measures (Article 2), Calculation of control levels (Article 3), Control of trade with non-Parties (Article 4), Special situation of developing countries (Article 5), Reporting of data (Article 7), Non-compliance (Article 8), Technical assistance (Article 10), as well as other topics. The substances controlled by the treaty are listed in Annexes A (CFCs, halons), B (other fully halogenated CFCs, carbon tetrachloride, methyl chloroform), C (HCFCs), E (methyl bromide), and F (HFCs).

## **The Kyoto Protocol**

The Kyoto Protocol was an international treaty that was adopted on December 11, 1997, in Kyoto, Japan. Its purpose was to decrease greenhouse gas (GHG) emissions and tackle global warming. This treaty marked the first legally binding agreement of its nature, specifically obligating industrialized countries to meet emission reduction targets grounded in the principle of "common but differentiated responsibility." The Kyoto Protocol is founded on the principles and provisions outlined in the Convention and adheres to its annex-based framework. It exclusively obligates developed nations, imposing a greater responsibility on them in accordance with the principle of "common but differentiated responsibilities and respective capabilities," as it acknowledges their significant contribution to the existing elevated levels of greenhouse gas emissions in the atmosphere.

## **CHIPKO MOVEMENT**

The term originates from the Hindi word "chipko", which translates to "to cling" or "to hug", as the local inhabitants wrapped their arms around the trees to stop them from being cut down. In the 1970s, there was widespread deforestation in India due to logging and commercial development, resulting in the loss of vast areas of wildlife habitat. This led to considerable ecological harm and disrupted the traditional lifestyles of individuals who relied on the forests for their means of survival. The movement originated in the Himalayan foothills, where a village community, under the leadership of female community leader Gaura Devi, opposed loggers. This instance of activism marked the inception of the Chipko movement; from this point, this form of resistance was replicated in other communities, spreading throughout India and beyond. The Chipko Movement is frequently regarded as the first ecofeminist movement. While men participated and held leadership positions within the movement, women were its foundation, as they constituted the backbone of numerous regional agrarian economies and were thus most directly impacted by environmental degradation and deforestation. The activism of those engaged in the movement has left a lasting legacy on forest management practices in India and has contributed to the global initiative to conserve forests and other natural resources. As a devoted follower of Mahatma Gandhi, Bahuguna's padayatras represented an extensive journey aimed at establishing connections with other environmentally vulnerable communities and rallying national support for the Chipko movement. This movement played a crucial role in empowering local communities to achieve self-sufficiency and to acknowledge the significance of protecting their natural environment for their livelihoods, which included their forests, through initiatives such as tree planting, cultivating fodder plants for livestock, constructing check-dams, and more.

## **SILENT VALLEY**

The Silent Valley movement (1973–1983) was an effective grassroots initiative in Kerala, India, aimed at preserving the untouched, biodiverse Silent Valley tropical evergreen forest from being flooded by a planned hydroelectric dam. Spearheaded by the Kerala Sastra Sahithya Parishad (KSSP) along with local activists, this campaign represented a significant clash between development and environmental protection, ultimately resulting in the designation of the area as a National Park.

## **BISHNOIS OF RAJASTHAN**

In 1730, when 363 members of the Bishnoi community gave their lives to safeguard Khejri trees (*Prosopis cineraria*), they probably initiated India's first environmental movement. The Bishnoi is a religious group predominantly located in the Great Indian Desert, also known as the Thar Desert, with a long-standing tradition of environmental conservation, wildlife protection, and sustainable resource management. Its ecological awareness and commitment to environmentalism can be traced back to the teachings of its fifteenth-century guru, Maharaja Jambheshwar, commonly referred to as Jambhoji. Currently, the Bishnoi community is confronted with various environmental challenges, including deforestation and the loss of biodiversity, declining groundwater levels, aggressive mining operations, illegal poaching, and land acquisition for development. In spite of these adversities, the Bishnoi effectively manage their own forest in the Thar region and strive to preserve wild animal populations by employing traditional ecological knowledge and customary laws rooted in their religious beliefs. In accordance with the teachings of Jambhoji, the Bishnoi aim to extract resources from nature only as necessary, as evidenced by a primary ethnographic field survey conducted in 2022–2023 among members of the Bishnoi community and non-governmental organizations in Khejarli, Jajiwali, and Gharab in Jodhpur, Rajasthan.

## **Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.**

Environmental ethics represents a field of philosophy that investigates the ethical relationship between humans and the natural environment. It questions conventional anthropocentric perspectives by inquiring whether non-human entities such as animals, plants, and ecosystems possess intrinsic value—value that is independent of their utility to humans.

### **Environment and religion.**

Religion and the environment share a profound, complex relationship where faiths often act as custodians of nature, framing environmental protection as a sacred duty. While many religions, such as Hinduism, deeply root their practices in honoring nature, others like Christianity, Islam, and Judaism emphasize environmental stewardship. However, this connection is not always direct, with some interpretations favoring "dominion" over care.

### **Eco-Spirituality and Conservation**

- **Sacred Geography:** The reverence for natural sites often leads to their protection, such as sacred groves that function as biodiversity hotspots.
- **Religious Environmentalism:** Organizations and faith leaders are increasingly using, for example, GreenFaith, to promote sustainable development, encouraging believers to view ecological protection as a spiritual duty.
- **Modern Challenges:** Despite traditional beliefs, factors like industrialization, urbanization, and the influence of consumerist, secular, and capitalist viewpoints

### **Stockholm declaration**

The 1972 Stockholm Declaration, containing 26 principles, established the foundation of international environmental law by linking human rights with environmental protection. Key principles emphasize that humanity has a fundamental right to a healthy environment and a responsibility to protect it for future generations, while promoting sustainable development.

## **Principles of the Stockholm Declaration:**

- **Fundamental Right to a Healthy Environment:** Humans have the right to live in an environment of a quality that permits a life of dignity and well-being.
- **Protection of Natural Resources:**  
Natural resources (air, water, land, flora, fauna) must be safeguarded through careful planning and management.
- **Environmental Protection and Development:** Development planning must balance economic growth with environmental protection; environmental policies should not hamper, but rather support, development.
- **Pollution Control:** States must prevent pollution that exceeds the environment's capacity to clean itself, particularly in the oceans.
- **Sovereignty and Responsibility:** While states have the right to exploit their own resources, they are responsible for ensuring that activities within their jurisdiction do not cause damage to the environment of other states.
- **Role of Technology and Science:** Science and technology must be used to identify, avoid, and control environmental risks.
- **International Cooperation:** Environmental issues should be managed cooperatively, with assistance for developing nations.
- **Conservation of Wildlife:** Wildlife and its habitat must be safeguarded.
- **Education:** Environmental education for all citizens is essential.

The declaration also advocated for national institutions to manage resources and the inclusion of environmental planning in development strategies. The landmark outcome of this conference was the creation of the **United Nations Environment Programme (UNEP)**.

## **FEATURES OF THE ENVIRONMENT PROTECTION ACT**

The Environment Protection Act of 1986 (the Environment Act) guarantees that the atmosphere is preserved and strengthened. The Law on Environmental Protection provides a basis for long- term safety research, preparation and implementation and creates a mechanism for rapid and effective environmental response. A structure for the cooperation of the central and national governments set up by the Water Act , 1974 and the Air Act. It is an umbrella law. In compliance

with s2(a) of the Environment Act, the word 'environnement' is very well known. This concerns the connection of water, air and ground, as well as other living things, plants, micro-organisms and properties of water , air and soil as well as human beings.

### **Objectives of Environment Protection Act 1986**

The objectives of the Environment Protection Act 1986 encapsulate its core purposes aimed at fostering an ecologically sustainable environment in India.

- **Protection and Enhancement of Environmental Quality:** The primary aim is to protect and improve the quality of the environment. This includes air, water, and land.
- **Regulation of Pollutants:** It seeks to control the discharge of pollutants into the environment and manage hazardous substances.
- **Central Coordination:** The Act allows for the central government to coordinate actions of various authorities established under other environmental laws.
- **Implementation of International Conventions:** It facilitates the implementation of decisions made at international environmental conferences. It also aligns Indian laws with global standards.

## **Salient Features of Environment Protection Act 1986**

The Environment Protection Act 1986 has several distinctive features that set it apart as a cornerstone of environmental legislation in India.

- **Comprehensive Reach:** The Act covers the entire country and all aspects of the environment. It addresses pollution control across air, water, and land.
- **Centralized Authority:** It empowers the Central Government to take all necessary measures to prevent and control environmental pollution. This includes setting standards and ensuring compliance.
- **Stringent Enforcement:** Provisions for penalties include imprisonment and hefty fines for non-compliance, ensuring robust enforcement.
- **Norm-Setting:** The Act enables the Central Government to establish standards for emissions and effluents discharge, and for the handling of hazardous substances.
- **Ecological Preservation:** It provides for the protection of ecologically sensitive areas. It prohibits and regulates activities that may harm these regions.

Various amendments have been made to the Environment Protection Act 1986. These are aimed at addressing evolving environmental challenges and strengthening its framework.

- **Environment (Protection) Rules, 1986:** These rules stipulate standards for emissions and effluents, waste management procedures, and environmental monitoring practices.
- **Biomedical Waste (Management and Handling) Rules, 1998:** These rules deal with the segregation, collection, and disposal of biomedical waste in an environmentally safe manner.
- **Hazardous Wastes (Management and Handling) Rules, 1989, and their subsequent amendments:** These rules focus on the management of hazardous waste to mitigate adverse environmental and health impacts.

- **E-Waste (Management and Handling) Rules, 2011:** These rules aim at robust management and disposal of electronic waste, emphasizing manufacturers' responsibility.

### **Case study on ganga pollution.**

M.C. Mehta v. Union of India and Ors is the 1<sup>st</sup> River pollution case to emerge in environmental public interest legal proceeding.

For over a century, Kanpur has been a serious Centre for India's tannery business and is one among the three necessary industries next to paper and textiles. Most of those tanneries are situated on the southern banks of the Ganga, outside from Kanpur and extremely contaminating. Among all the cities of state (Uttar Pradesh), Kanpur contributes to the vast pollution load into the Holy Ganga.

#### Facts of the case

- 1985 in the pilgrimage city of Haridwar, along the Ganga; a matchstick tossed by a smoker resulted in the river catching on fire for more than 30 hours, due to the presence of a toxic layer of chemicals produced by a pharmaceutical firm.
- In response to this incident M.C. Mehta, an environmental lawyer and social activist, filed a Public Interest Litigation (PIL) in the Supreme Court of India against about 89 respondents, wherein Respondent 1, Respondent 7, Respondent 8 and Respondent 9 were Union of India in 1985.
- Mehta filed a petition (PIL) charging that, despite the advances created within the code, government authorities had not taken effective steps to stop environmental pollution of the stream Ganga.
- The scale of the case – the whole 2,500-km stretch of the river – proved to be intractable. So the Court requested Mr. Mehta to narrow down his focus and he chose the city of Kanpur, despite neither being from the city nor living there.
- Exploitation the judicial remedy of writ, he referred to as upon state agencies to stop leather tanneries and also the municipal corporation of Kanpur from taking out industrial and domestic effluent within the stream.

- In some law reports, this can be referred to as the “Ganga Pollution Case. In this petition the petitioner requested the Supreme Court to restrain the respondents from cathartic effluents into the Ganga stream until the time they implements treatment plants for treatment of cyanogenic effluents to arrest pollution.
- Mehta requested the court to order the animal skin (leather) tanneries of the district of Kanpur to prevent discharging their untreated effluent into the stream. He additionally claimed that the Municipal Corporation of Kanpur wasn’t endeavor treatment of domestic biodegradable pollution.

### Issues Raised

- Whether the authorities had paid attention to the worsening condition of the sacred watercourse and had initiated probation into the matter?
- Whether any steps, had been taken by the state?
- Whether the smaller industries ought to be funded for fixing effluent treatment plants? If yes, then what should be the standards to determine ‘smaller industries’?
- In this petition the petitioner requested the court to request the Supreme Court to restrain the respondents from cathartic effluents into the Ganga watercourse until the time they incorporate sure treatment plants for treatment of unhealthful effluents to arrest pollution.
- At the preliminary hearing the Court directed the problem of notice under Order I Rule 8 of the CPC, The Court highlighted the importance sure provisions in our constitutional framework that enshrine the importance and therefore the would like for shielding our surroundings.
- Article 48-A provides that the State shall endeavor to shield and improve the atmosphere and to safeguard the forests and wild lifetime of the country.
- Article 51-A of the Constitution of India, imposes a basic duty on each national citizen to shield and improve the natural atmosphere as well as forests, lakes, rivers and wild life.

- The Court declared the importance of the Water (Prevention and management of Pollution) Act, 1974 ('the Water Act'). This act was passed to forestall and management pollution and maintaining water quality. This act established central and declared boards and bestowed them with power and functions about the management and interference of pollution.
- Section 24 of the Act prohibits the employment of the employment of any 'stream' for disposal of polluting matter. A 'stream' under section 2(j) of the Act includes watercourse, The Act permits the institution of Central Boards and State Boards.

### **Major CNG Vehicle Policy in Delhi**

The CNG vehicle policy Delhi 2025 update represents a more balanced approach to environmental concerns while considering the livelihood of thousands of drivers and vehicle owners. The Delhi government's recent extension of its Electric Vehicle (EV) policy has brought significant relief to thousands of CNG vehicle owners across the capital. The Delhi government has extended its Electric Vehicle (EV) Policy by three months and approved the continuation of power subsidies for domestic users, farmers, lawyers with chambers, and 1984 riot victims. Officials clarified there is no plan to ban auto-rickshaws or any category of vehicles. This development comes as welcome news for those concerned about the proposed restrictions on CNG vehicles outlined in the draft EV Policy 2.0. The most significant change is the clarification that there will be no immediate ban on CNG auto-rickshaws or other categories of vehicles. This reverses earlier concerns about the CNG vehicle policy Delhi 2025 that would have affected thousands of auto drivers who depend on these vehicles for their livelihood.

While the complete ban has been avoided, the government has introduced new compliance requirements. The Centre informed the Supreme Court on Tuesday that only BS-VI compliant CNG, LNG, and electric goods vehicles — light, medium, and heavy — will be permitted entry into Delhi starting November 1, 2025. This restriction, however, will not apply to vehicles registered in Delhi.

This means that commercial vehicle operators need to ensure their CNG vehicles meet BS-VI emission standards to enter Delhi from November 1, 2025. The CNG vehicle policy Delhi 2025 now focuses on emission standards rather than outright bans, providing a more practical approach to air pollution control.

## Impact of CNG Vehicle Policy on Commercial Vehicle Owners

The policy extension has provided much-needed clarity for stakeholders in the transport sector. Auto-rickshaw drivers, who were previously concerned about losing their source of income, can now continue operating their CNG vehicles without immediate displacement.

For commercial vehicle owners, the new policy means they need to upgrade to BS-VI compliant vehicles if they want to enter Delhi from outside the city. However, vehicles already registered in Delhi are exempt from this restriction, providing some relief to local commercial operators.

While immediate bans have been avoided, the government maintains its long-term vision for cleaner transportation. The CNG vehicle policy Delhi 2025 still includes future milestones for transitioning to electric vehicles, but with more realistic timelines that consider the practical challenges faced by vehicle owners and drivers.

The policy extension allows for better planning and preparation for the eventual transition to electric vehicles. This approach balances environmental goals with economic realities, ensuring that the shift to cleaner transportation doesn't disrupt livelihoods overnight.