

Biofuel

Biofuel is a fuel that is produced over a short time span from biomass, rather than by the very slow natural processes involved in the formation of fossil fuels, such as oil.

Biomass

Biomass is organic, meaning it is made of material that comes from living organisms, such as plants and animals. The most common biomass materials used for energy are plants, wood, and waste. These are called biomass feedstocks. Biomass energy can also be a non-renewable energy source.

Solar thermal storage (STS) refers to the accumulation of energy collected by a given solar field for its later use.

Photovoltaic (PV) materials and devices convert sunlight into electrical energy.

Nuclear power.

Nuclear power is the use of nuclear reactions to produce electricity. Nuclear power can be obtained from nuclear fission, nuclear decay and nuclear fusion reactions. Presently, the vast majority of electricity from nuclear power is produced by nuclear fission of uranium and plutonium in nuclear power plants.

Ocean thermal energy conversion

Ocean Thermal Energy Conversion uses

the ocean thermal gradient between cooler deep and warmer shallow or surface seawaters to run a heat engine and produce useful work, usually in the form of electricity.

Geothermal energy

Geothermal energy is a type of renewable energy taken from the Earth's core. This thermal energy is stored in rocks and fluids in the centre of the earth. It comes from heat generated during the original formation of the planet and the radioactive decay of materials. The promising geothermal sites for direct heat use applications are Rajgir in Bihar, Manikaran in Himachal Pradesh, Surajkund in Jharkhand, , Tapoban in Uttarakhand & Sohana region in Haryana.

Advantages

- Renewable
- Easy to exploit in some cases
- CO₂ production less than with fossil fuel
- High net energy yield

Disadvantages

- Not available everywhere: Geothermal hot spots are scattered and are at far away regions than the areas that need energy
- H₂S pollution: Large quantities of H₂S “The rotten eggs” gas can be released and inhaling it in too many quantities is fatal.
- Geothermal energy harnessing produces some water pollution (some what similar to mining).

Tidal energy

Tidal power or tidal energy is harnessed by converting energy from tides into useful forms of power, mainly electricity using various methods. Although not yet widely used, tidal energy has the potential for future electricity generation. Tides are more predictable than the wind and the sun

Wind energy

Wind power or wind energy is mostly the use of wind turbines to generate electricity. Wind power is a popular, sustainable, renewable energy source that has a much smaller impact on the environment than burning fossil fuels.

What Is Deforestation?

Deforestation refers to the decrease in forest areas across the world that are lost for other uses such as agricultural croplands, urbanization, or mining activities. Greatly accelerated by human activities since 1960, deforestation has been negatively affecting natural ecosystems, biodiversity, and the climate.

1. Agriculture is the Number 1 Cause of Deforestation (~80%)

2. Deforestation Caused By New Constructions (~15%)

Urbanization Is Causing Deforestation (~5%)

The Effects of Deforestation on Biodiversity.

80% of the Earth's land animals and plants live in forests.

By destroying the forests, human activities are putting entire ecosystems in danger, creating natural imbalances, and putting Life at threat.

4 – Soil Erosion is One of the Consequences of Deforestation

Deforestation weakens and degrades the soil. Forested soils are usually not only richer on organic matter, but also more resistant to erosion, bad weather, and extreme weather events. This happens mainly because roots help fix trees in the ground and the sun-blocking tree cover helps the soil to slowly dry out. As a result, deforestation will probably mean the soil will become increasingly fragile, leaving the area more vulnerable to natural disasters such as landslides and floods.

Deforestation Affects and Contributes to Climate Change

taking down trees means they'll release back into the atmosphere the CO₂ they were keeping. Secondly, fewer trees available means reducing the planet's overall ability to capture and store CO₂. Both these effects negatively contribute to the greenhouse effect and to climate change.

What is a Food Chain?

A food chain refers to the order of events in an ecosystem, where one living organism eats another organism, and later that organism is consumed by another larger organism. The flow of nutrients and energy from one organism to another at different trophic levels forms a food chain.

The food chain also explains the feeding pattern or relationship between living organisms. Trophic level refers to the sequential stages in a food chain, starting with producers at the bottom, followed by primary, secondary and tertiary consumers. Every level in a food chain is known as a trophic level.

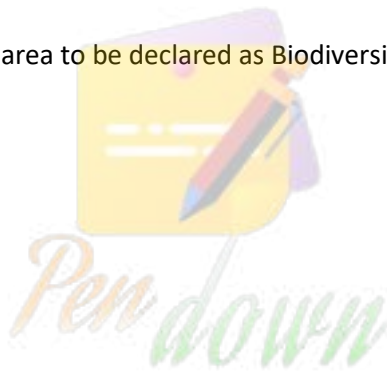
Biodiversity is all the different kinds of life you'll find in one area—the variety of animals, plants, fungi, and even microorganisms like bacteria that make up our natural world. Each of these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life.

According to Conservation International, a region must fulfill the following two criteria to qualify as a hotspot:

- The region should have at least 1500 species of vascular plants i.e., it should have a high degree of endemism.
- It must contain 30% (or less) of its original habitat, i.e. it must be threatened

Following the criteria must for an area to be declared as Biodiversity Hotspot, there are major four biodiversity hotspots in India:

- The Himalayas
- Indo-Burma Region
- The Western Ghats
- Sundaland



Ecosystem

An ecosystem consists of all the organisms and the physical environment with which they interact. These biotic and abiotic components are linked together through nutrient cycles and energy flows

Structure of ecosystem

The structure of an ecosystem is characterised by the organisation of both biotic and abiotic components.

Functions of Ecosystem

The functions of the ecosystem are as follows:

- It regulates the essential ecological processes, supports life systems and renders stability.
- It is also responsible for the cycling of nutrients between biotic and abiotic components.
- It maintains a balance among the various trophic levels in the ecosystem.
- It cycles the minerals through the biosphere.
- The abiotic components help in the synthesis of organic components that involve the exchange of energy.

In an ideal ecosystem, the energy and material flow is balanced without any hindrance. Living entities are in perfect sync with their abiotic environment

Ecological Succession Definition

“Ecological succession is a series of changes that occur in an ecological community over time.”

The ultimate aim of this process is to reach equilibrium in the ecosystem.

What is an Ecological Pyramid?

An ecological pyramid is a graphical representation of the relationship between the different living organisms at different trophic levels.

The importance of ecological pyramid can be explained in the following points:

- They show the feeding of different organisms in different ecosystems.
- It shows the efficiency of energy transfer.

- The condition of the ecosystem can be monitored, and any further damage can be prevented.

What is Sustainable Development?

- 'Development which meets the needs of the present without compromising the ability of future generations to meet their own needs'.
- Sustainable development (SD) calls for concerted efforts towards building an inclusive, sustainable and resilient future for people and planet.
- This most widely accepted definition of Sustainable Development was given by the Brundtland Commission in its report Our Common Future (1987).

Sustainable Development Index (SDI), 2019

India ranked 115 out of 162 countries.



Water Resources

- Water is one of the most precious natural resources and a key element in the socio-economic development of a country
- Water is used for drinking, bathing, washing, irrigation, industries and a host of other purposes. Hence, it is an essential part of life
- About 71% of earth's surface is covered by water
- India accounts for about 2.45% of world's surface area and 4% of the world's water resources
- Rainfall is main source of fresh water in India

Rainwater Harvesting

- It is a method to capture and store rainwater for various uses. It is also used to recharge groundwater aquifers.

Other measures

- The issue of desalinisation of water particularly in coastal areas and brackish water in arid and semi-arid areas, could be addressed by transfer of water from water surplus areas to water deficit areas through inter linking of rivers

Recycling and Reusing of water

- Use of water of lesser quality such as reclaimed waste-water would be an attractive option for industries for cooling and fire fighting

Namami Gange scheme for rivers in the Ganga basin, as well as through the National River Conservation Plan (NRCP) for other rivers.

The 'Jal Shakti Abhiyan' has been launched in 2019 with focus on five aspects

- water conservation and rainwater harvesting
- renovation of traditional and other water bodies
- reuse of water and recharging of structures
- watershed development
- intensive afforestation

common threats to forest resources

Deforestation

Construction of multipurpose projects

Cutting trees for firewood and overgrazing

Exploitation of forest resources by contractors

Jhumming or shifting cultivation

Forest fires

Community forest management (CFM) actively promotes the rights of people living in the forest through participation in decision making and equitable benefit sharing. CFM encourages participation in forest management by rural people, whose livelihood depends mainly on forest resources.

Joint Forest Management often abbreviated as JFM is the official and popular term in India for partnerships in forest movement involving both the state forest departments and local communities.

Environment Protection Act, 1986

Environment Protection Act, 1986 is an Act of the Parliament of India. It was enacted in May 1986. The Act is widely considered to have been a response to the Bhopal gas leak.

protecting and improving the quality of the environment and preventing controlling and abating environmental pollution.

The Water (Prevention and Control of Pollution) Act was enacted in 1974 to provide for the prevention and control of water pollution, and for the maintaining or restoring of wholesomeness of water in the country. The Act was amended in 1988. The Water Act of 1974 prohibits the discharge of sewage or pollutants into water bodies, including lakes, and it is the responsibility of the state pollution control board to intervene and stop such conduct.

The Air (Prevention and Control of Pollution) Act of 1981, or the Air Act, in short, was a law passed by the Parliament of India to prevent and control the harmful effects of air pollution in India. This act is seen as the first concrete step taken by the government of India to combat air pollution.

The key features of the Act include:

- Advising Central Government of Air and Air Pollution related issues
- Research about the causes and impact of Air Pollution
- Spread awareness to stop air pollution

- To establish central and State Boards and empower them to monitor air quality and control pollution

Differentiate between in-situ conservation and ex-situ conservation

In-situ conservation means conserving all the living species, especially all the wild and endangered species, in their natural habitats and environment. Ex-situ conservation means conserving all the living species in the man-made / artificial habitats that are similar to their natural living habitats.

energy village

Urjagram literally means an “energy village” (urja is energy and gram is village). The Urjagram programme is aimed at harnessing the locally available renewable energy sources such as biomass, solar and wind in an integrated way at the village level.

Bhopal disaster

The Bhopal disaster, also referred to as the Bhopal gas tragedy, was a chemical accident on the night of 2–3 December 1984 at the Union Carbide India Limited pesticide plant in Bhopal, Madhya Pradesh, India. The industrial disaster is considered the world's worst in history.

Over 500,000 people were exposed to methyl isocyanate (MIC) gas.

Land Degradation

Land is a vital resource to humankind, like air and water. Land degradation—the deterioration or loss of the productive capacity of the soils for present and future—is a global challenge that affects everyone through food insecurity, higher food prices, climate change, environmental hazards, and the loss of biodiversity and ecosystem services. Land degradation is happening at an alarming pace, contributing to a dramatic decline in the productivity of croplands and rangelands worldwide.

Solar pond

A solar pond is a solar energy collector, generally fairly large in size, that looks like a pond. This type of solar energy collector uses a large, salty lake as a kind of a flat plate collector that absorbs and stores energy from the Sun in the warm, lower layers of the pond. These ponds can be natural or man-made, but generally speaking the solar ponds that are in operation today are artificial.

Carbon Footprint

A carbon footprint is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions. The average carbon footprint for a person in the United States is 16 tons, one of the highest rates in the world. India's current CO₂ emissions (2021) are 2.88 Gt.

- The term carbon footprint is commonly used to describe the total amount of CO₂

and other

greenhouse gas (GHG) emissions for which an individual or organization is responsible.

- The full footprint of an organization encompasses a wide range of emissions sources from direct use of fuels to indirect impacts such as employee travel or emissions from other organization up and down the supply chain.
- When calculating an organization's footprint it is important to try and quantify as full a range of emissions sources as possible in order to provide a complete picture of the organization's impact
- In order to produce a reliable footprint, it is important to follow a structured process and to classify all the possible sources of emissions thoroughly.
- This includes the emissions released when burning fossil fuels for transportation, heating and electricity, as well as the leakage of refrigerants into the environment. A carbon footprint is one measure of a company's impact on global climate change.

COMPONENTS OF A CARBON

FOOTPRINT

- While six gases are internationally recognized by the Kyoto Protocol as greenhouse gases for emissions-reporting purposes (see Figure 1), only four are relevant to most food retailers:

- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Hydroflourocarbons (HFCs)
- The first three are byproducts of burning fossil fuels.

HFCs are the gases that make up a growing portion of refrigerants. Perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆) are typically associated with electronics and manufacturing.

- Consume local and seasonal products (forget strawberries in winter)
- Limit meat consumption, especially beef.
- Select fish from sustainable fishing.
- Bring reusable shopping bags and avoid products with excessive plastic packaging.
- Make sure to buy only what you need, to avoid waste.

Clear Indicators Our Climate is Changing

- Air temperatures over land are increasing.
- Arctic sea ice is decreasing.
- Glaciers are melting.
- Sea levels are rising.
- Ocean heat content is increasing.
- Sea surface temperature is increasing.
- Snow is decreasing.
- Earth's lower atmosphere temperature is increasing

India as a Mega Diversity Region

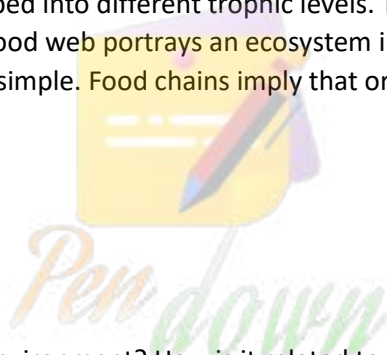


Mega diversity refers to a country's ability to exhibit a high level of biodiversity. A biologically diverse nation has at least 5,000 plant species and must be bordered by marine ecosystems. India is one of the world's megadiverse countries, with 45,000 plant species and twice as many animal species. India has only 2.4 per cent of the world's land area, but it has 8.1 per cent of the world's species diversity, making it one of the world's 12 mega diversity countries.

Why is a food web a more realistic way of portraying an ecosystem than a food chain?

A food web comprises all the food chains in one ecosystem. Each living organism in an ecosystem is a part of multiple food chains. In each food chain direct transfer of energy between organisms occurs. The study of the food chain and food web is useful in understanding the environmental pressure exerted by natural and man-made factors on ecosystems.

Organisms in food webs are grouped into different trophic levels. The trophic levels are producers, consumers and decomposers. A food web portrays an ecosystem in a more realistic way than a food chain because food chains are so simple. Food chains imply that organisms eat only one type of food which is rarely true.



What is carrying capacity of the environment? How is it related to sustainable development?

Carrying capacity of the environment implies that the resources extraction is not above the rate of regeneration of the resources and the wastes generated are within the assimilating capacity of the environment.

It is related to sustainable development because development is sustainable as long as an economy is operating within carrying capacity of the environment. As soon as we cross carrying capacity, we start facing the problem of environmental degradation and development is not sustainable anymore. If these two conditions are not fulfilled, then the environment fails to perform its vital functions of life sustenance and it leads to the situations of environmental crises.

Environmental impact assessment

Environmental Impact assessment is the assessment of the environmental consequences of a plan, policy, program, or actual projects prior to the decision to move forward with the proposed action.

The EIA process in India is made up of the following phases:

- ☐ Screening
- ☐ Scoping and consideration of alternatives
- ☐ Baseline data collection
- ☐ Impact prediction
- ☐ Assessment of alternatives, delineation of mitigation measures and environmental impact statement
- ☐ Public hearing
- ☐ Environment Management Plan
- ☐ Decision making
- ☐ Monitoring the clearance conditions

