INTRODUCTION

The word environment is derived from the French word ‘environner’ which means to ‘encircle or surround’.

Thus our environment can be defined as “the Social, Cultural and Physical conditions that surround, affect and influence the survival, growth and development of people, animals and plants”

This broad definition includes the natural world and the technological environment as well as the cultural and social contexts that shape human lives.

It includes all factors (living and nonliving) that affect an individual organism or population at any point in the life cycle; set of circumstances surrounding a particular occurrence and all the things that surrounds us.

**Scope of environmental studies**

Environmental studies discipline has multiple and multilevel scopes. This study is important and necessary not only for children but also for everyone. The scopes are summarized as follows:

1. The study creates awareness among the people to know about various renewable and nonrenewable resources of the region. The endowment or potential, patterns of utilization and the balance of various resources available for future use in the state of a country are analysed in the study.

2. It provides the knowledge about ecological systems and cause and effect relationships.

3. It provides necessary information about biodiversity richness and the potential dangers to the species of plants, animals and microorganisms in the environment.

4. The study enables one to understand the causes and consequences due to natural and main induced disasters (flood, earthquake, landslide, cyclones etc.,) and pollutions and measures to minimize the effects.

5. It enables one to evaluate alternative responses to environmental issues before deciding an alternative course of action.

6. The study enables environmentally literate citizens (by knowing the environmental acts, rights, rules, legislations, etc.) to make appropriate judgments and decisions for the protection and improvement of the earth.

7. The study exposes the problems of over population, health, hygiene, etc. and the role of arts, science and technology in eliminating/ minimizing the evils from the society.

8. The study tries to identify and develop appropriate and indigenous eco-friendly skills and technologies to various environmental issues.

9. It teaches the citizens the need for sustainable utilization of resources as these resources are inherited from our ancestors to the younger generating without deteriorating their quality.

10. The study enables theoretical knowledge into practice and the multiple uses of environment.

**Importance of Environmental studies**

**Environmental Issues are global:** The environmental issues we talk about are not limited to a single city or a country but affect the whole global environment in a direct or indirect manner. Wind patterns, current ocean patterns, monsoon patterns, etc., are all a part of the global climate change. This requires detailed research and then finding possible solutions to these problems. These also require efforts and resources by multiple countries or the whole globe.

**Reducing the gap between Rich and Poor:** Wondering what the environment has to do with the rich and poor? This is because wealth depends on the resources possessed or accessible to a person. And here, we refer to the wealth of companies, countries, etc. The developed nations have more access and technology, while the underdeveloped and developing countries less so.

With the help of environmental education, there would be equal access to the technology and know-how of the environment and resources, hence helping everyone to achieve the common goal.

**Sustainable Development**: As we all know, sustainable development is basically about the development achieved without compromising on the needs of the future generation. It starts and goes hand in hand with environmental conservation.

**Environment and ecological conservation**: It is preserving the quality of nature, environment, and its components and maintaining its integrity throughout. Anthropogenic activities have caused incalculable damage to the environment. A basic environmental education gives us the knowledge of what is needed to conserve the earth and the various resources we obtain.

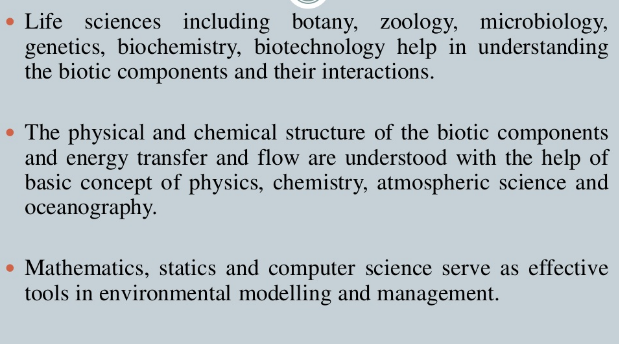
**A Search for Alternatives**: Many industries—from agriculture to the IT industry, are looking for natural or eco–friendly alternatives as products or resources. This has helped in spreading awareness and in reducing the pollution caused by hazardous substances. Severe pollution and the eco–friendly nature of the alternatives will help cutting pollution at the individual level as well.

**Waste management**: The rising waste in every country and the problem of its safe treatment and disposal is one of the integral parts of environment conservation and reducing pollution.

**Energy efficiency**: Saving energy ultimately reduces the carbon footprint, saves money, and has a positive impact on the environment.

**Improvement of Communities**: Local communities of people are directly dependent on the environment—forests, oceans or deserts—for their livelihood. Their habitation is of mutual benefit for the respective ecosystems as the people have traditional knowledge of the environment.

**Research & Development**: It is the most important component of environmental education as it forms the groundwork on which products, services, plans, for use and environment conservation will be based. It serves the dual purpose of getting a deeper knowledge of the environment, and of inventing applications thereof.



Concept of ECOSYSTEM

The term ecosystem was coined in 1935 by the Oxford ecologist Arthur Tansley to encompass the interactions among biotic and abiotic components of the environment at a given site. The living and non-living components of an ecosystem are known as biotic and abiotic components, respectively.

It is an unit that includes all the organisms, i.e., the community in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycles, i.e., exchange of materials between living and non-living, within the system”.

**We can classify ecosystems as follows:**

#### Natural Ecosystems:

These ecosystems are capable of operating and maintaining themselves without any major interference by man.

**A classification based on their habitat can further be made:**

1. Terrestrial ecosystems: forest, grassland and desert.

2. Aquatic ecosystems: fresh water ecosystem, viz. pond, lake, river and marine ecosystems, viz. ocean, sea or estuary.

#### (b)Artificial Ecosystem:

These are maintained by man. These are manipulated by man for different purposes, e.g., croplands, artificial lakes and reservoirs, townships and cities.

**Abiotic Components**

Basic inorganic compounds of an organism, habitat or an area like carbon dioxide, water, nitrogen, calcium, phosphorus, etc. that are involved in the material cycles are collectively called as abiotic component. The amount of these inorganic substances present at any given time, in an ecosystem is called as the standing state or standing quality of an ecosystem.

Whereas, organic components e.g., proteins, amino acids, carbohydrates and lipids that are synthesized by the biotic counterpart of an ecosystem make the biochemical structure of the ecosystem. The physical environment, viz. climatic and weather conditions are also included in the abiotic structure of the ecosystem.

#### Biotic Components:

From the trophic (nutritional) point of view, an ecosystem has autotrophic (self-nourishing) and a heterotrophic (other nourishing) components:

**Autotrophic component (Producers):**

This component is mainly constituted by the green plants, algae and all photosynthetic organisms. Chemosynthetic bacteria, photosynthetic bacteria, algae, grasses, mosses, shrubs, herbs and trees manufacture food from simple inorganic substances by fixing energy and are therefore called as producers.

**(b) Heterotrophic component (Consumers):**

The members of this component cannot make their own food. They consume the matter built by the producers and are therefore called as consumers. They may be herbivores, carnivores or omnivores. Herbivores are called as primary consumers whereas carnivores and omnivores are called as secondary consumers. Collectively we can call them as macro-consumers.

**(c) Decomposers:**

Heterotrophic organisms chiefly bacteria and fungi that breakdown the complex compounds of dead protoplasm, absorb some of the products and release simple substances usable by the producers are called as decomposers or reducers. Collectively we call them as micro consumers.

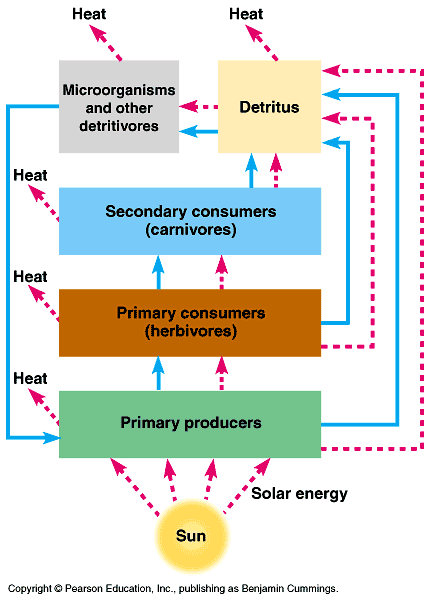
**Food Chain**

A food chain also represents a series of events and consumption in which food and energy are consumed from one organism in an [ecosystem](https://simple.wikipedia.org/wiki/Ecosystem) to another. Food chains show how energy is passed from the sun to producers, from producers to consumers, and from consumers to decomposes such as fungi. They also show how animals depend on other organisms for food

**Food web**

A food web is a detailed interconnecting diagram that shows the overall food relationships between organisms in a particular environment. It can be described as a "who eats whom" diagram that shows the complex feeding relationships for a particular [ecosystem](https://www.thoughtco.com/how-do-species-interact-130924).

**Energy flow and nutrient cycling**



Living organisms can use energy in two forms radiant and fixed energy. Radiant energy is in the form of electromagnetic waves, such as light. Fixed energy is potential chemical energy bound in various organic substances which can be broken down in order to release their energy content.

Organisms that can fix radiant energy utilizing inorganic substances to produce organic molecules are called autotrophs. Organisms that cannot obtain energy from abiotic source but depend on energy-rich organic molecules synthesized by autotrophs are called heterotrophs. Those which obtain energy from living organisms are called consumers and those which obtain energy from dead organisms are called decomposers

When the light energy falls on the green surfaces of plants, a part of it is transformed into chemical energy which is stored in various organic products in the plants. When the herbivores consume plants as food and convert chemical energy accumulated in plant products into kinetic energy, degradation of energy will occur through its conversion into heat. When herbivores are consumed by carnivores of the first order (secondary consumers) further degradation will occur. Similarly, when primary carnivores are consumed by top carnivores, again energy will be degraded.

Balanced Ecosystem

It is a term used to describe the equilibrium between living organisms such as human being, plants, and animals as well as their environment.

Photosynthesis that takes place in ecosystem contributes to building a good environment that stabilizes the coexistence of all organisms. Harmonious relationships reflect healthy and desirable ecological balance. Human being plays a key role to maintain ecological balance because they have the highest thinking capacity as compared to other living organisms. Sufficient food availability to all living organisms and their stability reflect the existence of ecological balance. Therefore, this balance is very important because it ensures survival, existence and stability of the environment.

Ecological balance is also important because it leads to the continuous existence of the organisms. It ensures that no particular species is exploited or overused.

For example, human activities such as farming and resources exploitation are checked to prevent excessive destruction of the forests. Deforestation leads to drought. Drought reduces food production resulting to insufficient food. Insufficient food leads to starvation and later death occurs, hence reducing the existence of some species.

### Species diversity

Species diversity refers to the variety of different types of species found in a particular area. It is the biodiversity at the most basic level. It includes all the species ranging from plants to different microorganism.

No two individuals of the same species are exactly similar. For example, humans show a lot of diversity among themselves.

### Genetic diversity

It refers to the variations among the genetic resources of the organisms. Every individual of a particular species differs from each other in their genetic constitution. That is why every human looks different from each other. Similarly, there are different varieties in the same species of rice, wheat, maize, barley, etc.

### Ecological diversity

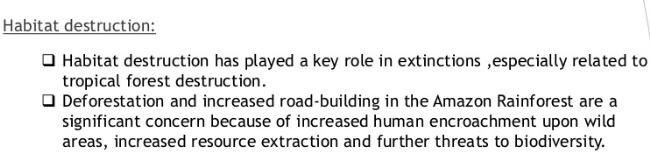
An ecosystem is a collection of living and non-living organisms and their interaction with each other. Ecological biodiversity refers to the variations in the plant and animal species living together and connected by food chains and food webs.

It is the diversity observed among the different [ecosystems](https://byjus.com/biology/ecosystem/) in a region. Diversity in different ecosystems like deserts, rainforests, mangroves, etc., include ecological diversity.

Ecological values of biodiversity

* Balance in ecosystem
* Biological productivity
* Regulation of climate
* Waste management
* Minimizing environmental pollution
* Nutrient cycling
* Land stabilization against erosion
* Maintaining of soil fertility

Threats to biodiversity



### Applications of Sustainable Development

### 1. Wind Energy

People have utilized the power of the wind for millennia, dating back to the first recorded windmill in Persia between 500 and 900 AD. Fast forward to the 21st century and, in many localities, energy generated by wind power has become either competitive with or less expensive than coal-generated electricity.

Wind turbines are a great solution for power generation due to their cost and the fact that they require a very small land footprint. Other land uses such as farming, conservation and recreation can happen simultaneously with wind power generation. As the price of wind power technology continues to drop and energy storage and transmission infrastructure improves, wind energy could significantly supplement or replace entire grid systems.

### 2. Solar Energy

From roof-top solar panels to massive solar farms that can attain the same generating capacity as a conventional power plant, it is clear that there is a renewable energy revolution happening in the world — and it is powered by the sun.

A solar farm can reduce 94% of the emissions that a coal power plant emits. It also eliminates noxious pollutants like sulphur nitrous oxides and mercury which are major contributors to the air pollution responsible for millions of premature deaths every year. Solar technology is getting cheaper and is now cost competitive or less costly than conventional power generation in many parts of the world.

According to the International Renewable Energy Agency, currently 220 million to 330 million tons of annual carbon dioxide are saved due to solar photovoltaics. With solar still making up less than 2% of the global energy mix, this shows the great potential for the growth of solar in the future.

### 3. Crop Rotation

Currently we produce the bulk of our food through industrial agriculture. A system which relies on large farms that monocrop and use enormous amounts of fertilizer and chemical pesticides. Industrial agriculture is immensely damaging to soils, water, air and the climate.

Crop rotation, in contrast, is defined as “the successive planting of different crops on the same land to improve soil fertility and help control insects and diseases.” This way of farming is not a new practice, but rather a more ancient way of farming chemical-free, whilst maximizing the long-term growth potential of land.

An ongoing study at Iowa State University’s Marsden Farm research centre has shown that complex crop rotation systems can outperform conventional monoculture in both yield and profitability. It is also a practice that produces a diverse range of foods, can be adapted to different local conditions, causes less erosion and stores more carbon in soils assisting with carbon sequestration.

### 4. Water efficient fixtures

Many countries in the world are becoming water stressed and we are beginning to understand that water is not as unlimited as we once believed. In most buildings around the world, essential water usage such as showering, washing hands and sewage conveyance is unavoidable.

However, the amount of water used for these essential services can be drastically reduced by more than 50% with the use of water-saving fittings and fixtures. Some examples of water-efficient fixtures include: low-flow taps and shower heads, dual flush toilets and toilet stops. These fixtures can be retrofitted easily and affordably into existing buildings or specified for new building projects.

### 5. Green Spaces

Green spaces such as parks, wetlands, lakes, forests or other eco systems are fundamental to sustainably developed urban areas. These areas are essential for cooling cities while trees produce oxygen and filter out air pollution. Well-designed green spaces also play a critical role in providing safer routes for those commuting by foot or bicycle and providing safer spaces for physical activity and recreation.According to the World Health Organisation, “recent estimates show that physical inactivity, linked to poor walkability and lack of access to recreational areas, accounts for 3.3% of global deaths.” Thus having access to green spaces can improve health and well-being and even aid in the treatment of mental illness.

These examples are only a few of the many types of sustainable development that have the potential to perpetuate positive global change. The world is faced with a crossroad whereby we have the power now (and only now) to shift global development to be more sustainable before it is too late. As such, changes to regulations and incentives that govern development need to happen. This will make sustainable development, not only the best and most affordable option, but also the most obvious one to choose.

Unit 2: Natural Resources

Natural Resources

Life on this planet earth depends upon a large number of things and services provided by the nature, which are known as Natural resources. Thus water, air, soil, minerals, coal, forests, crops and wild life are all examples of natural resources.

The natural resources are of two kinds:

● Renewable resources which are in exhaustive and can be regenerated within a given span of time

E.g. forests, wildlife, wind energy, biomass energy, tidal energy, hydro power etc. Solar energy is also a renewable form of energy as it is an inexhaustible source of energy.

● Non-renewable resources which cannot be regenerated e.g. Fossil fuels like coal, petroleum, minerals

Etc.Once we exhaust these reserves, the same cannot be replenished.

The major natural resources:

(1) Forest resources (2) Water resources (3) Mineral resources (4) Food resources

(5) Energy resources (6) Land resources.

FOREST RESOURCES

Forests are one of the most important natural resources on this earth. Covering the earth like a green blanket these forests not only produce innumerable material goods, but also provide several environmental services which are essential for life.

About 1/3rd of the world3s land area is forested which includes closed as well as open forests.

**Significance of Forest resources**

***Commercial values***

* Forests are main source of many commercial products such as wood, timber, pulpwood etc. About 1.5 billion people depend upon fuel wood as an energy source. Timber obtained from the forest can used to make plywood, board, doors and windows, furniture, and agriculture implements and sports goods. Timber is also a raw material for preparation of paper, rayon and film.
* Forest can provide food , fibre, edible oils and drugs.
* Forest lands are also used for agriculture and grazing.
* Forest is important source of development of dams, recreation and mining.
* **Timber**  
  More than 1500 species of trees are commercially exploited for timber in different parts of India. It is used in timber-based industries such as plywood, saw milling, paper and pulp, and particle boards.
* **Bamboo**  
  These are common in the north-eastern and the south-western parts of India, growing along with deciduous or evergreen forest. The main commercial uses of bamboo are as timber substitutes, fodder, and raw material for basket, paper and pulp, and other small-scale industries.
* **Cane**  
  Cane or rattan are the stems of a climber plant and are used for a large number of household items. It is used to make walking sticks, polo sticks, baskets, picture frames, screens, and mats.
* **Grasses**  
  There are hundreds of varieties of grasses in the country that are used for a number of purposes. Lemon grass, palmrose grass, bhabbhar, and khus grass are some of them.
* **Fruit**  
  Fruit trees are an important source of income and food for the rural household. In some areas fruit trees are commonly planted along the field borders and around the wells. Mango, coconut, orange, pear, jackfruit and many others grow wild in the forest.
* **Medicinal use**  
  Since time immemorial humans have been depending on the forest to cure them of various ailments. Even today man is dependent on the forest for herbs and plants to fight against disease. Of all the medicinal trees found in India, the neem is the most important. Leaves, bark, and other parts of many other trees also have medicinal value and are used to make various ayurvedic medicines.
* **Fibre**  
  Plant fibre has many different uses. Soft fibres such as jute are derived from the stems of the plant. Hard fibre from the leaves of hemp and sisal are used to make fabrics for various applications. Coir, another form of fibre from the fruit of the coconut, is used to make ropes.
* **Floss**  
  The fruits of many species of Indian trees produce a silky floss. The most common of these is simal. It is used to made cotton wool, mattresses, and pillows.
* **Essential oils**  
  Tropical grasses such as lemon grass, citronella, and khus are the source of essential oils. Oil is distilled from the wood of various species such as sandalwood, agar, and pine. Oil is also derived from the leaves of certain plants and trees such as eucalyptus, camphor, wintergreen, and pine. These oils are used for making soaps, cosmetics, incense, pharmaceuticals, and confectionery.

Ecological uses: While a typical tree produces commercial goods worth about $ 790 it provides

environmental services worth nearly

$ 196, 270.

The ecological services provided by our forests may be summed up as follows:

● **Production of oxygen:** The trees produce oxygen by photo- synthesis which is so vital for life on this earth. They are rightly called as earth3s lungs.

● Reducing global warming: The main greenhouse gas car- bon dioxide (CO2) is absorbed by the forests as a raw material for photosynthesis. Thus forest canopy acts as a sink for CO2 thereby reducing the problem of global warming caused by greenhouse gas CO2

● wild life habitat: Forests are the homes of millions of wild animals and plants. About 7 million

species are found in the tropical forests alone.

● Regulation of hydrological cycle : Forested watersheds act like giant sponges, absorbing the rainfall, slowing down the runoff and slowly releasing the water for recharge of springs. About 70-80 %of the moisture in the air above tropical forests comes from their transpiration which helps in bringing rains.

● Soi1 Conservation: Forests bind the soil particles tightly in their roots and prevent soil erosion.

They also act as wind- breaks.

● Pollution moderators: Forests can absorb many toxic gases and can help in keeping the air pure.

They have also been reported to absorb noise and thus help in preventing air and noise pollution.

Deforestation

* **Deforestation**, **clearance**, [**clearcutting**](https://en.wikipedia.org/wiki/Clearcutting) or [**clearing**](https://en.wikipedia.org/wiki/Clearing_(geography)) is the removal of a [forest](https://en.wikipedia.org/wiki/Forest) or stand of trees from land which is then [converted](https://en.wikipedia.org/wiki/Land_conversion) to a non-forest use.

Major Causes of Deforestation

(¿) Shifting cn1tiration: There are an estimated 300 million people living as shifting cultivators who practice slash and burn agriculture and are supposed to clear more than 7 lakh ha of forests for shifting cultivation annually. En India, we have this practice in North- East and to some extent in Andhra Pradesh, Bihar and M.P which contribute to nearly half of the forest clearing annually.

(¿¿) Fne1 requirements: Increasing demands for fuel wood by the growing population in India alone has shooted up to 300-700 million tons in 2001 as compared to just 67 million tons during independence, thereby increasing the pressure on forests.

(¿¿¿) Raw materia1s for indnstria1 use: Wood for making boxes, furniture, railway-sleepers, plywood, match-boxes, pulp for paper in- dustryetc. have exerted tremendous pressure on forests. Plywood is in great demand for packing tea for Tea industry of Assam while fir tree wood is exploited greatly for packing apples in J&K.

(¿v) Dere1opment projects: Massive destruction of forests occur for various development projects like hydroelectric projects, big dams, road construction, mining etc.

(v) Growing food needs: En developing countries this is the main reason for deforestation. To meet the demands of rapidly growing population, agricultural lands and settlements are created permanently by clearing forests.

(v¿) Overgrazing: The poor in the tropics mainly rely on wood as a source of fuel leading to loss of tree cover and the cleared lands are turned into the grazing lands. Overgrazing by the cattle leads to further degradation of these lands.

## ****Preventive Measures of Deforestation****

Let’s not lose hope; we can still protect our earth by applying possible preventive measures or solutions to deforestation –

* **Educational campaigns**

It is possible to combat deforestation through awareness. Educational campaigns can only be a good example of awareness about deforestation. Awareness helps to find out the solution to tackle deforestation.

* **Reforestation**

Reforestation is a process of planting trees in a forest land where the trees have been cut for some reasons. We all need to understand the [importance of reforestation](https://www.earthreminder.com/importance-of-reforestation-with-advantages/) and implement it to save the environment.

Planting of trees can reduce various causes and effects of deforestation, global warming, greenhouse effect, pollution, etc.

* **Following the rules & regulations**

There should be strict rules & regulations against those who are involved in the deforestation activities in anyways. The people also need to be dedicated to following these rules & regulations because it is everyone’s responsibility to save the environment.

* **Use of renewable forest resources**

We can grow trees as a source of wood from secondary growth forests. The use of sustainable local wood sources and charcoal for cooking or heating is an excellent alternative of [fossil fuels](https://www.earthreminder.com/fossil-fuels-types-uses-pros-cons/) (provided it comes from local sources).

* **Reduce the consumption of paper**

Choose recyclable paper products, such as printing paper, notebooks, napkins, toilet paper, etc. To reduce the wastage of paper we can make a habit of taking a print out on both the side of a paper and even write on both the side of your notebook.

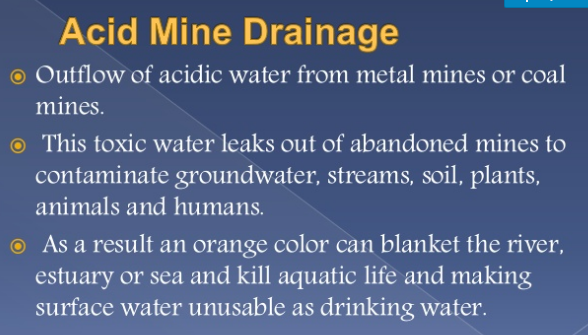
If we can limit the use of paper products, we can reduce the reasons of deforestation to some extent.

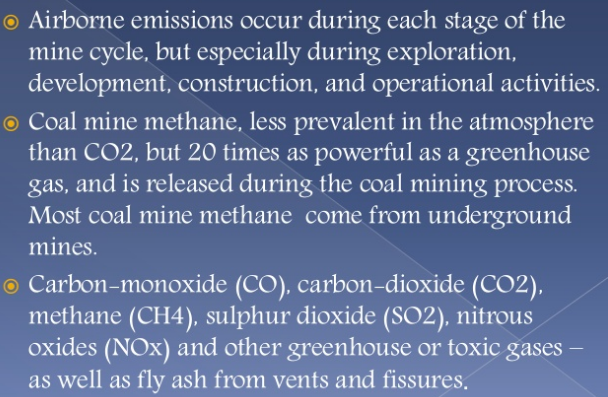
**Other measures to stop deforestation are:**

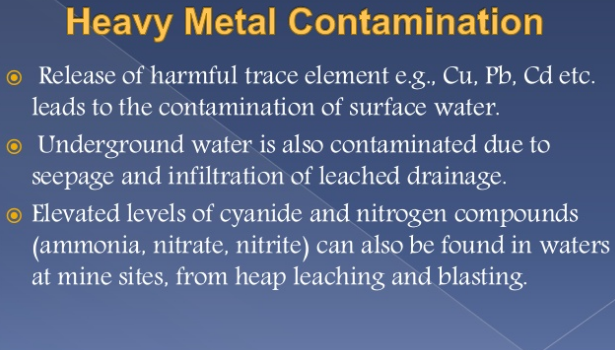
* Prefer to buy products from sustainable companies like Asian pulp & paper, Hershey, Wilmar international, Loreal, Unilever, Disney, etc. These companies are committed to minimizing deforestation.
* If we can minimize our consumption, we will be able to treat the deforestation problem to some extent. For example- reduce the use of products that contain palm oil, etc.
* Implement the [process of recycling](https://www.earthreminder.com/3rs-of-environment-reduce-reuse-recycle/) or prefer to buy recycled products.
* We should Prefer to consume vegetarian food whenever possible.
* Prefer to purchase certified wood products. Make sure you check the labels & FSC (Forest Stewardship Council) mark before purchasing any wood product.
* Prefer to buy Eco-friendly products.

Mineral resources

Minerals provide the material used to make most of the things of industrial- based society; roads, cars, computers, fertilizers, etc. Demand for minerals is increasing world wide as the population increases and the consumption demands of individual people increase. The mining of earth’s natural resources is, there­fore accelerating, and it has accompanying environmental consequences.

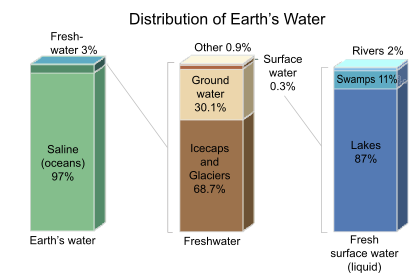








Global water distribution



The distribution of water on the Earth’s surface is extremely uneven. Only 3% of water on the surface is fresh; the remaining 97% resides in the ocean. Of freshwater, 69% resides in glaciers, 30% underground, and less than 1% is located in lakes, rivers, and swamps. Looked at another way, only one percent of the water on the Earth’s surface is usable by humans, and 99% of the usable quantity is situated underground.

All one needs to do is study rainfall maps to appreciate how uneven the distribution of water really is. The white areas on the map below had annual rainfall under 400 mm for the last year, which makes them semi-arid or arid. And, remember, projections are for significant aridification to occur in many dry regions and for more severe rainfall events to characterize wet regions.

Environmental impacts of mining

1. Air pollution by the emission of Sulphur Dioxide and Nitrogen Monoxide (SO2 and NO) during the mining process.
2. Various types of diseases arises due to air pollution.
3. Possibility of Acid Rain due to Toxic substances in the air.
4. Increase in Noise pollution due to the use of Heavy machineries in mining process.
5. Emission of Radon and Thorone in the Uranium Mines.
6. When water flows from mines, there will be Water

Pollution.

1. Polluted water obtained from the Natural oil wells may create Land pollution.

**Effects of Modern Agriculture**

**Soil Erosion**

* The top fertile soil of the farmland is removed due to the excessive water supply.
* This leads to the loss of nutrient rich soil that hampered the productivity.
* It also causes the global warming because the silt of water bodies induces the release of soil carbon from the particulate organic material.

**Contamination of ground water**

* The ground water is one of the important sources of water for irrigation. From agricultural fields nitrogenous fertilizers leach into the soil and finally contaminate groundwater.
* When the nitrate level of groundwater exceeds 25 mg/l, they can cause a serious health hazard known as “Blue Baby Syndrome”, which affects mostly infants even leading to their death.

**Water-logging and salinity**

* The salinity of the soil is one of the reasons of low productivity just because of the improper management of farm drainage.
* In this situation, the roots of plants do not get enough air to respiration then it leads to low crop yield as well as low mechanical strength.

**Eutrophication**

* It refers to the addition of artificial or non-artificial substances such as nitrates and phosphate, through fertilizers or sewage, to a fresh water system. It leads to increase in the primary productivity of the water body or 'bloom' of phytoplankton.
* Excessive use of fertilizers that consists of nitrogen and phosphorus leads to over nourishment of the lakes/waterbodies and gives rise to the phenomenon of eutrophication

**FERTILIZERS**

* The substance which brings an improvement in the productivity of the land and which is also helpful in bringing up vegetation is called fertilizer.
* The Fertilizers can be divided in to two parts

1. Chemical or mineral Fertilizers
2. Biological or Natural Fertilizers

**Chemical or mineral Fertilizers**

The continuous crop yield will exhaust the level of minerals (nitrogen, phosphorus, calcium and potassium). To regain the minerals chemical fertilizers are used.

* Characteristics of Chemical Fertilizers:

1. It is soluble in water.
2. It is durable.
3. It should not be harmful to the plants.

* Types of Chemical Fertilizers:

1. Phosphatic
2. Nitrogenous
3. Phospho-nitrous

**Biological Fertilizers**

* Classification of Biological Fertilizers:

1. Manures:

* It is obtained by decomposition of organic substances
* and bacteria.

1. Bio Fertilizers:

* It includes the micro living organisms in the land which is used to increase the fertility of the land. It provides the nitrogenous elements to the plants and vegetation.
* The main resource of bio fertilizers are; bacteria, algae and fungus.

**Forms of Manure**

* **Farmyard manures:** Mixture of crop residues and excreta of animals. It has all maintenance elements of land and makes the land fertile.
* **Compost:** Decomposition of organic matter by the micro- organisms: like fungi and bacteria. To prepare the compost, layers of plant materials, cattle dung and soil are arranged and water is sprinkled to keep it moisted.
* **Green manures:** It consists of fast growing green plant materials. The leguminous and the non leguminous plants are planted on the same land. The process is called green manuring.

**Problems using fertilizers**

* **Micronutrient imbalance**: Chemical fertilizers used in modern agriculture contain Nitrogen, Phosphorus and Potassium (N,P,K) which are macronutrients. Excess use of fertilizers in fields causes micronutrient imbalance. Ex: Excessive use of fertilizers in Punjab and Haryana caused deficiency of micronutrient Zinc thereby affecting productivity of soil.
* **Nitrate pollution:** Excess Nitrogenous fertilizers applied in fields leach deep into the soil contaminating the groundwater. If the concentration of nitrate in drinking water exceeds 25 mg/L it leads to a fatal condition in new-born babies. This condition is termed "Blue Baby Syndrome"
* **Eutrophication:** The application of excess fertilizers in fields leads to wash off of the nutrient loaded water into nearby lakes causing over-nourishment. This is called "Eutrophication". Eutrophication causes the lakes to be attacked by "algal blooms". Algal blooms use nutrients rapidly and grow fast. Their life is short, they die and pollute water thereby affecting aquatic life in the lake.

**Problems in using Pesticides:**

In order to improve crop yield, pesticides are used indiscriminately in agriculture. Pesticides are of two types:

First generation pesticides that use Sulphur, Arsenic, Lead or Mercury to kill pests

Second generation pesticides such as  Dichloro Diphenyl Trichloroethane (DDT) used to kill pests. These pesticides are organic in nature. Although these pesticides protect our crops from severe losses due to pests, they have several side-effects as listed below:

**Death of non-target organisms:** Several insecticides kill not only the target species but also several beneficial not target organisms

**Pesticide resistance**: Some pests that survive the pesticide generate highly resistant generations that are immune to all kinds of pesticides. These pests are called "superpests"

**Bio-magnification:** Most pesticides are non-biodegradable and accumulis ate in the food chain. This is called bio-accumulation or bio-magnification. These pesticides in a bio-magnified form are harmful to human beings.

**Risk of cancer**: Pesticide enhances the risk of cancer in two ways (i) It acts as a carcinogen and (ii) It indirectly suppresses the immune system.

**WATER LOGGING**

If water stands on land for most of the year, it is called water logging.

In water logged conditions, pore-voids in the soil get filled with water and soil-air gets depleted. In such a condition the roots of plants do not get enough air for respiration. Water logging also leads to low mechanical strength of soil and low crop yield.

Water logging occurs when there is too much water in a plant’s root zone, which decreases the oxygen available to roots. Water logging can be a major constraint to plant growth and production and, under certain conditions, will cause plant death. This constraint may not be apparent until the whole soil profile is saturated and water appears on the surface. The department provides landholders with technical information and support on management options to recognize and reduce the impacts of water logging.

CAUSES OF WATER LOGGING

Excessive water supply to the croplands

Heavy rain

Poor drainage

**MEASURES TO PREVENT WATER LOGGING**

Avoid and prevent excessive irrigation

Sub-surface drainage technology

Bio-drainage by trees like Eucalyptus

**SALINITY**

Water not absorbed by soil, is evaporated leaving behind a thin layer of dissolved salts in the top soil. This is called salinity of the soil. Saline soils are characterized by accumulation of soluble salts like sodium chloride, calcium chloride, magnesium chloride, sodium sulphate, sodium carbonate and sodium bicarbonates. Saline conditions are exhibited when pH is greater than 8.0

**PROBLEMS IN SALINITY**

Saline soils yield less crop

In order to remedy the condition of saline soils the following two techniques may be used:

Salt deposit is removed by flushing with good quality water

By using a sub-surface drainage system, the salt water is flushed out slowly.

z

LAND RESOURCES

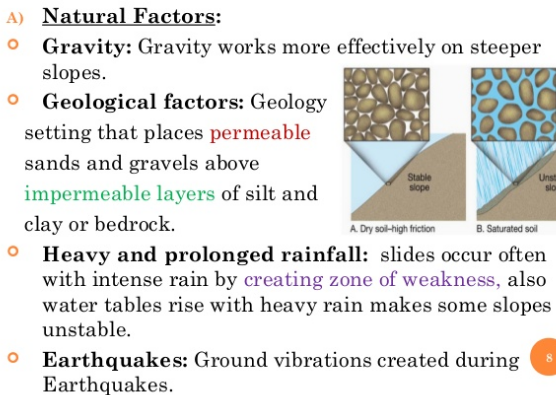
Land is an essential natural resource, both for the survival and prosperity of humanity, and for the maintenance of all terrestrial ecosystems. Over millennia, people have become progressively more expert in exploiting land resources for their own ends. The limits on these resources are finite while human demands on them are not. Increased demand, or pressure on land resources, shows up as declining crop production, degradation of land quality and quantity, and competition for land. Attention should now be focused on the role of humankind as stewards rather than exploiters, charged with the responsibility of safeguarding the rights of unborn generations and of conserving land as the basis of the global ecosystem.

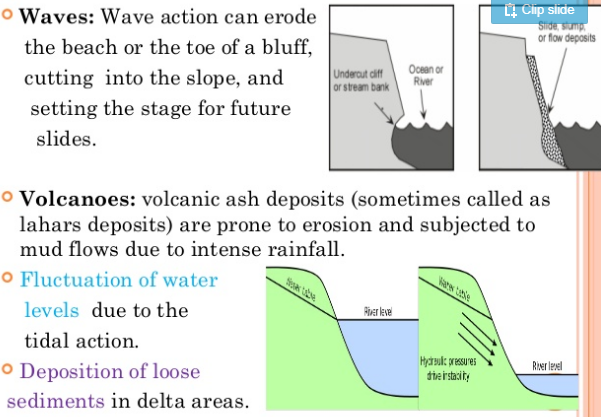
LAND SLIDES

* A landslide is defined as the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of "mass wasting," which denotes any down-slope movement of soil and rock under the direct influence of gravity.
* It refers to the sliding or dislodging of a large mas s of rocks materials , soils etc… down the side of amount a inorcliff landslides represent the most extreme hazards , especially in terms of loss of life Overpopulation and socio-economic pressures have forced some of the most vulnerable populations into areas of high risk (hill sides)

Causes of Landslides

* Climate
* Earthquake
* Weathering
* Erosion
* Volcanoes
* Forest fire
* Gravity
* Mining





Effects of Land slides

* Lead to economic decline
* Decimation of infrastructure
* Loss of life
* Affects beauty of landscapes
* Impacts river ecosystems

## Various Causes of Desertification

### 1. Overgrazing

[Animal grazing](https://www.conserve-energy-future.com/causes-effects-solutions-overgrazing.php) is a huge problem for many areas that are starting to become desert biomes. If there are too many animals that are overgrazing in certain spots, it makes it difficult for the plants to grow back, which hurts the [biome](https://www.conserve-energy-future.com/major-biomes-of-the-world.php) and makes it lose its former green glory.

### 2. Deforestation

When people are looking to move into an area, or they need trees in order to make houses and do other tasks, then they are contributing to the problems related to desertification. Without the plants ([especially the trees](https://www.conserve-energy-future.com/types-of-cedar-trees.php)) around, the [rest of the biome](https://www.conserve-energy-future.com/what-is-a-biome.php) cannot thrive.

### 3. Farming Practices

Some farmers do not know how to use the land effectively. They may essentially strip the land of everything that it has before moving on to another plot of land. By stripping the [soil of its nutrients](https://www.conserve-energy-future.com/causes-and-effects-of-soil-pollution.php), desertification becomes more of a reality for the area that is being used for farming.

**[READ](https://www.conserve-energy-future.com/oxygen-levels-oceans-decreasing-alarming-rate.php" \t "_blank)****[Oxygen Levels of Oceans Are Decreasing At An Alarming Rate [Recent Study]](https://www.conserve-energy-future.com/oxygen-levels-oceans-decreasing-alarming-rate.php" \t "_blank)**

### 4. Excessive Use of Fertilizers and Pesticides

The use of excessive amounts of fertilizers and pesticides to maximize their crop yields in the short term often leads to significant damages for the soil.

In the long run, this may turn from arable into arid land over time, and it will no longer be suitable for farming purposes after a few years of excessive farming since the soil has been damaged too much over time.

### 5. Overdrafting of groundwater

Groundwater is the freshwater found underground and also one of the largest water sources. [Over drafting](https://en.wikipedia.org/wiki/Overdrafting) is the process in which groundwater is extracted in excess of the equilibrium yield of the aquifer that is pumping or the excessive pulling up of groundwater from underground aquifers. Its depletion causes desertification.

### 6. Urbanization and Other Types of Land Development

As mentioned above, development can cause people to go through and kill plant life. It can also cause issues with the soil due to chemicals and other things that may harm the ground. As areas become [more urbanized](https://www.conserve-energy-future.com/urbanization-and-urban-growth.php), there are fewer places for plants to grow, thus causing desertification.

### 7. Climate Change

[Climate change](https://www.conserve-energy-future.com/ClimateChangeEffects.php) plays a huge role in desertification. As the days get warmer and periods of drought become more frequent, desertification becomes more and more eminent.

Unless climate change is slowed down, huge areas of land will become desert; some of those areas may even become uninhabitable as time goes on.

### 8. Stripping the Land of Resources

If an area of land has [natural resources](https://www.conserve-energy-future.com/list-10-natural-resources.php) like natural gas, oil, or minerals, people will come and mine it or take it out. This usually strips the soil of nutrients, which in turn kills the plant life, and eventually leads to the process of becoming a desert biome as time goes on.

### 9. Natural Disasters

There are some cases where the land gets damaged because of [natural disasters](https://www.conserve-energy-future.com/10-worst-natural-disasters.php), including drought. In those cases, there isn’t a lot that people can do except work to try and help rehabilitate the land after it has already been damaged by nature.

### 10. Soil Pollution

[Soil pollution](https://www.conserve-energy-future.com/causes-and-effects-of-soil-pollution.php) is a significant cause of desertification. Most plants are quite sensitive to their natural living conditions. When soil becomes polluted due to various human activities, the respective area of land may suffer from desertification in the long run. Higher the level of pollution more will be the degradation of soil over time.

### 11. Overpopulation and excessive consumption

Since our [world population](https://www.conserve-energy-future.com/causes-effects-solutions-of-overpopulation.php) is continuously growing, the demand for food and material goods is also increasing at an alarming rate. Our overall level of consumption is also increasing at a steady rate.

Thus to fulfill our demand, we have to optimize our farming processes to harvest even higher crop yields. However, this excessive optimization of farming will hurt the soil and will eventually turn into the desertification of land in the long run.

### 12. Mining

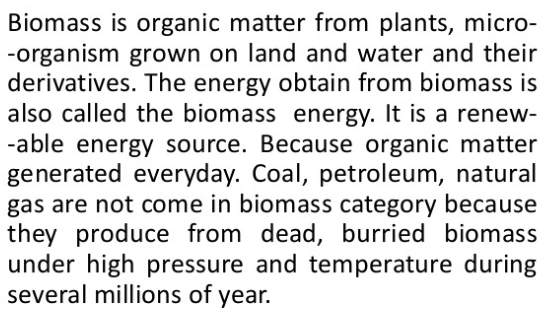
[Mining is another big reason](https://www.conserve-energy-future.com/causes-effects-mining-human-health-environment.php) for desertification. Large amounts of resources have to be extracted by industries to meet our demand for material goods. For mining, large areas of land have to be used, which causes deforestation as well as pollution of the nearby areas.

By the time most of the natural resources have been extracted, and mining practices are no more profitable, the soil gets damaged significantly, and the land becomes arid, which may not be recoverable, and desertification occurs.

Unit 3

Environmental impacts of use of fossil fuels

1. **Carbon fuels** such as wood, coal, petroleum release unburnt carbon particles in the environment. These particles are very dangerous pollutants and cause respiratory diseases for example asthma.
2. When fuels are incompletely burnt, they release carbon monoxide gas into the atmosphere. This gas is very dangerous as it is poisonous in nature. If we burn coal in a closed room, then the person sleeping in that room will be killed by the action of carbon monoxide.
3. The combustion of fossil fuels also releases a large amount of carbon dioxide into the atmosphere. Carbon dioxide is a greenhouse gas which is responsible for [global warming](https://byjus.com/chemistry/global-warming-due-greenhouse-effect/). Global warming is a rise in the overall temperature of the earth’s surface. This leads to the melting of polar caps and rise in the sea level and further results in flooding of coastal regions.
4. Burning of coal and diesel releases [sulphur dioxide](https://byjus.com/chemistry/sulphur-dioxide/) gas. This gas is extremely corrosive and suffocating in nature. Petrol gives off oxides of nitrogen. The oxides of sulphur and nitrogen get dissolved in rainwater and form acids. This is known as acid rain. This water is very harmful to plants, animals, and various monuments.



Some of the advantages of biomass energy are:

**1.    Biomass is always and widely available as a renewable source of energy.**  
The organic materials used to produce biomass are infinite, since our society consistently produces waste such as garbage, wood and manure.

**2.    It is carbon neutral.**  
As a natural part of photosynthesis, biomass fuels only release the same amount of carbon into the atmosphere as was absorbed by plants in the course of their life cycle.

**3.    It reduces the overreliance of fossil fuels.**

Not only is there is a limited supply of fossil fuels, but fossil fuels come with environmental baggage, including the release of large amounts of carbon dioxide into the atmosphere and the pollutants that result from removal, transportation and production.

**4.    Is less expensive than fossil fuels.**

While fossil fuel production requires a heavy outlay of capital, such as oil drills, gas pipelines and fuel collection, biomass technology is much cheaper. Manufacturers and producers are able to generate higher profits from a lower output.

**5.    Biomass production adds a revenue source for manufacturers.**  
Producers of waste can add value by channeling their garbage to create a more profitable use in the form biomass energy.

**6.    Less garbage in landfills.**   
By burning solid waste, the amount of garbage dumped in landfills is reduced by 60 to 90 percent, and reduces the cost of landfill disposal and amount of land required for landfill.

While the advantages of biomass energy are plenty, there are also some shortcomings, including:

**1.    Biomass energy is not as efficient as fossil fuels**

Some biofuels, like Ethanol, is relatively inefficient as compared to gasoline. In fact, it has to be fortified with fossil fuels to increase its efficiency.

2.    **It is not entirely clean**  
While biomass is carbon neutral, the use of animal and human waste escalates the amount of methane gases, which are also damaging to the environment. Additionally, the pollution created from burning wood and other natural materials can be considered just as bad as that resulting from burning coal and other types of energy resources.

**3.    Can lead to deforestation.**

Since wood is one of the most used source of biomass energy, vast amounts of wood and other waste products have to be burned to produce the desired amount of power. While currently there is enough wood waste already, there is a risk of deforestation in the future.

1. **Biomass plants require a lot of space.**  
   While it’s difficult to find a plant that is in a convenient place in an urban area, utilizing onsite hardware like the [BioMax® technology,](https://www.syntechbioenergy.com/biomax/) companies can create biomass energy at a fraction of the space of a large facility.

**Ethanol**

## Advantages of Ethanol Fuel

### 1. Ethanol Fuel is Cost-effective Compared to Other Biofuels

Ethanol fuel is the least expensive energy source since virtually every country has the capability to produce it. Corn, sugar cane or grain grows in almost every country which makes the production economical compared to [fossil fuels](https://www.conserve-energy-future.com/pros-and-cons-of-fossil-fuels.php).

Fossil fuels can play against the economy of most countries, especially, developing countries that have no capacity to explore them. It, thus, makes sense for these growing economies to dwell on the production of ethanol fuel to dial back on the dependence of fossil fuel in order to save revenue.

### ****2. Ecologically Effective****

One striking advantage of ethanol over [other fuel sources](https://www.conserve-energy-future.com/energysources.php) is that it does not cause pollution to the environment. Using ethanol fuel to power automobiles results in significantly low levels of toxins in the environment. On numerous occasions, ethanol is converted to fuel by blending with gasoline.

Specifically, ethanol to gasoline ration of 85:15. The little composition of gasoline acts as an igniter, while ethanol takes up the rest of the tasks. This ratio of ethanol to gasoline minimizes the [emission of greenhouse gases](https://www.conserve-energy-future.com/15-wonderful-ways-reduce-greenhouse-gases.php) to the environment since it burns cleanly compared to pure gasoline.

### ****3. Helps Reduce Global warming****

Global warming is caused by the relentless emission of dangerous greenhouse gases from the use of fossil fuels (oil, natural gas, and [coal](https://www.conserve-energy-future.com/coalasfossilfuel.php)). The effects of global warming are catastrophic including changes in weather patterns, rising sea levels, and excessive heat. The combustion of ethanol fuel only releases carbon dioxide and water. The carbon dioxide released is ineffective regarding [environmental degradation](https://www.conserve-energy-future.com/causes-and-effects-of-environmental-degradation.php).

### ****4. Easily Accessible****

Since ethanol is a biofuel, it is easily accessible to virtually everyone. Biofuel means energy derived from plants like sugarcane, grains, and corn. All tropical climates support the growth of sugarcane. Grain and corn grow in every country. In fact, corn is a staple food in most countries in Africa.

### ****5. Minimizes Dependence on Fossil Fuels****

Harnessing of fuel from corn or biomass is an economical way to sustain any economy and prevent it from over-reliance on the importation of fossil fuels like oil, and gas. Embracing ethanol fuel can save a country a lot of money that can be plowed back into the economy.

Since ethanol is domestically produced, from domestically grown crops, it helps reduce dependence on foreign oil and [greenhouse gas emissions](https://www.conserve-energy-future.com/greenhouse-gases.php). If we could run our vehicles on 100% ethanol, the difference would be noticeable.

### ****6. Contributes to Creation of Employment to the Country****

When the use of ethanol fuel increases, it means more plantations of sugarcane, corn, and grains. It also means more ethanol fuel processing plants and that translates to job opportunities. Ethanol can also be branched out to produce alcoholic beverages leading to the creation of job opportunities in the hospitality industry.

### ****7. Opens up Untapped Agricultural Sector****

The fact that ethanol fuel production relies mainly on agricultural produce, individuals will be shoved into the untapped agricultural sector, and this will uplift a countries economy. This act will guarantee ethanol fuel availability for many years. The need for increased production of corn and grains has set the farming industry booming.

### ****8. Ethanol Fuel is a Source of Hydrogen****

Although ethanol fuel is not perfect, researchers are working around the clock to beef up its efficiency to make it a reliable energy source by getting rid of its disadvantages.

One disadvantage of ethanol fuel is that it has been reported to cause engine burns and corrosion. To be able to utilize it in a more productive way, researchers are looking to convert it into hydrogen form, which should uplift it as a formidable [alternative source of fuel](https://www.conserve-energy-future.com/alternativeenergysources.php).

### ****9. Variety of Sources of Raw Material****

Although corn and sugarcane are the chief raw material for producing ethanol fuel, pretty much every crop or plant containing starch and sugar can be used.

## Disadvantages of Ethanol Fuel

### ****1. Requires a Large Piece of Land****

We’ve learned that ethanol is produced from corn, sugarcane, and grains. All these are crops that need to be grown in farms. For ethanol to meet the growing demand, it must be produced on a large scale. This, essentially, means that these very crops will have to be grown on a large scale, which requires vast acres of land.

The problem is that not everyone has that kind of land, so the only option is renting or leasing, which might add expenses to the budget. This aspect could also lead to the destruction of natural habitats for most [plants and animals](https://www.conserve-energy-future.com/what-are-flora-and-fauna.php).

### ****2. The Distillation Process is Not Good For the Environment****

The process of distilling fermented corn or grain takes a long time and involves a lot of heat expenditure. The source of heat for distillation is mostly fossil fuel, and fossil fuels emit a lot of greenhouse gas, which is detrimental to the environment.

**[READ](https://www.conserve-energy-future.com/howhydropowerplantsworks.php" \t "_blank)****[How Hydropower Plants Work and Types of Hydropower Plants](https://www.conserve-energy-future.com/howhydropowerplantsworks.php" \t "_blank)**

### ****3. Spike in Food Prices****

The chief ingredient in making ethanol is corn. If the demand for ethanol fuel skyrockets, the price of corn would also shoot up, and that would affect the cost of ethanol production. Other users of corn other than for fuel will also suffer, for example, those utilizing corn as an animal feed.

Also, the lucrative prices of ethanol fuel could trigger most farmers to abandon food crops for ethanol production, which might also lead to an increase in food prices.

### ****4. Affinity For Water****

Pure ethanol has a high affinity for water, and it’s able to absorb any trace around it or from the atmosphere. This fact is also true for those blends of gasoline and ethanol used to power vehicles. The fact that ethanol has high water attraction capabilities means that it’s difficult to obtain it in its purest form since there will somehow be a trace of water. In fact, manufacturers normally indicate 99.8% pure ethanol. This is especially dangerous for marine users than regular road car users.

### ****5. Difficult to Vaporize****

Pure ethanol is hard to vaporize. This makes starting a car in cold conditions almost difficult, which is why a number of vehicle owners make a point to retain a little petrol, for instance, E85 cars that use 15% petroleum and 85% ethanol.

A common blend used these days is E85 i.e. 85% Ethanol and 15% gasoline. The mileage provided by this blend is lesser than that of pure gasoline or the E10 (10% Ethanol) blend. However, the benefit of using the E85 blend is that the [oil](https://www.conserve-energy-future.com/effects-of-oil-spills.php) remains clean for a longer time, there is lesser stress on the engine and the overall engine maintenance reduces. The cost of lower mileage gets covered up thanks to these small benefits. Not to mention, the overall reduction of your [carbon footprint](https://www.conserve-energy-future.com/StepsReduceCarbonFootPrint.php), which is the one benefit from the use of Ethanol fuel that everybody should aspire for.

### Hydrogen Fuel Cell

### A fuel cell works much like an electric battery, converting chemical energy into electrical energy using the movement of charged hydrogen ions across an electrolyte membrane to generate current.

### Advantages of Hydrogen Fuel Cells

### 1. Zero-emission power

Hydrogen fuel cells (HFCs) produce no harmful emissions, eliminating the costs associated with handling and storing toxic materials like battery acid or diesel fuel. In fact, when fueled with pure hydrogen, the only by-products are heat and water, making our products a zero-emission, sustainable power source. Hydrogen fuel cells are part of many well-planned corporate sustainability programs.

### ROBUST RELIABILITY

Hydrogen fuel cell technology has proven itself against tough conditions, including cold environments as low as -40 degrees F/C, weather environments like hurricanes, deserts, and winter storms, and even the hard-working business environments of material handling warehouses.

### IMPROVED EFFICIENCY

According to the U.S. Department of Energy, hydrogen fuel cells are generally between 40-60% energy efficient. This range compares to the typical internal combustion engine of a car which is about 25% energy efficient. Hydrogen fuel cell efficiency is put to work to improve warehouse productivity by up to 15% using fuel cell forklifts to extend the mileage range for electric vehicles.

### SCALABLE

The advantages of using a modular product are profound: greater reliability and easier serviceability. But most important of the fuel cell benefits may be scalability – and the savings provided when purchasing and using fuel cells. These products may be engineered precisely to meet a variety of customer power needs – whether for on-road electric vehicles, material handling fleets, or stationary power. Paying only for what you need just makes sense.

### LOWER OPERATIONAL COSTS

Compared to batteries and internal combustion generators, fuel cells save money. They eliminate the need to change, charge, and manage batteries, subsequently reducing labor, time, space, and peak power demands. The units run longer than lead-acid batteries and can be fueled in as little as two minutes, substantially reducing vehicle and personnel downtime. Additionally, simple maintenance and fewer site visits mean up to 84% lower operational costs when compared to combustion generators for stationary power. Robust reliability eliminates the need for quarterly site maintenance visits, keeping site personnel focused on their critical tasks.

### It’s a Renewable Energy Source and Bountiful in Supply

Hydrogen is a rich source of energy for many reasons, the main being that it’s bountiful in supply. While it may take a lot of resources to harness it, no other energy source is infinite as hydrogen. That essentially means there is no possibility of it running out like other sources of energy.

### 2. Numerous Sources to Produce Hydrogen Locally

Hydrogen can be produced either onsite where it will be used or centrally and then distributed. Hydrogen gas can be produced from methane, gasoline, biomass, coal or water. The factors like amounts of pollution, technical challenges, and energy requirements vary depending on the sources used.

### 3. It is Practically a Clean Energy Source

When hydrogen is burnt to produce fuel, the byproducts are totally safe, which means they have no known side effects. Aeronautical companies actually use hydrogen as a source of [drinking water](https://www.conserve-energy-future.com/benefits-of-drinking-water.php). After hydrogen is utilized, it is normally converted to drinking water for astronauts on ship or space stations.

### 4. Hydrogen Energy is Non-toxic

It is a non-toxic substance that is rare for a fuel source. This means that it is friendly towards the environment and does not cause any harm or destruction to human health.

This aspect makes it preferred compared to other sources of fuel like [nuclear energy](https://www.conserve-energy-future.com/various-nuclear-energy-facts.php), [natural gas](https://www.conserve-energy-future.com/pros-and-cons-of-natural-gas.php), which are extremely hazardous or daunting to harness safely. It also allows hydrogen to be used in places where other forms of fuel may not be allowed.

### 5. The Use of Hydrogen Greatly Reduces Pollution

When hydrogen is combined with oxygen in a fuel cell, electricity is produced, which can be used to power vehicles or drive an electric motor as a heat source and for many other uses. When it combines with oxygen, the only byproducts are water and heat, which is the advantage of using hydrogen as an energy carrier.

The use of hydrogen fuel cells does not release carbon dioxide and other greenhouse gasses or other particulates when renewable sources such as water or solar energy are used in the production process.

### 6. It’s Far More Efficient Than Other Sources of energy

Hydrogen is an efficient energy type since it has the ability to convey a lot of energy for every pound of fuel compared to diesel or gas. This categorically means that an automobile that utilizes hydrogen energy will travel more miles than one with an equal amount of gasoline.

**[READ](https://www.conserve-energy-future.com/the-explosion-of-renewable-energy-industry.php" \t "_blank)****[The Explosion of Renewable Energy Industry](https://www.conserve-energy-future.com/the-explosion-of-renewable-energy-industry.php" \t "_blank)**

For example, compared to a conventional combustion-based power plant that usually generates electricity between 33 to 35% efficiency, hydrogen fuel cells are capable of generating electricity of up to 65% efficiency, having capacity about three times more.

### 7. Used For Powering Space Ships

Hydrogen energy’s efficiency and power make it an ideal fuel source for spaceships.  Its power is so high that it’s able to quickly rocket spaceships to exploration missions.

It’s also the safest form of energy to perform such an energy-intensive task. Hydrogen energy is, in fact, 3 times more potent than gasoline and other fossil-based sources of fuel. This ideally means that you need less hydrogen to complete an enormous task.

It also offers motive power for airplanes, boats, cars, and both portable and stationary fuel cell applications. The downside to using hydrogen in cars is that it’s practically difficult to store in cryogenic or high-pressure tanks.

### 8. A Sustainable Production System

Electrolysis is a method in which water is separated into hydrogen and oxygen. In this case, renewable energy can be used to power electrolyzers to produce hydrogen from water that provides a sustainable system independent of petroleum products and is also nonpolluting, producing no emissions. Some of the renewable sources used to power electrolyzers are wind, hydro, solar and tidal energy.

After the hydrogen is produced in an electrolyzer, it can be used in a fuel cell to produce electricity. The byproducts generated in the fuel cell process are water and heat. If fuel cells operate at high temperatures, the system can be set up as a co-generator, with the waste energy used for heating.

Disadvantages of Hydrogen fuel cells

### 1. Hydrogen Energy is Expensive

Electrolysis and steam reforming, the two main processes of hydrogen extraction, are extremely expensive. This is the real reason it’s not heavily used across the world. Today, hydrogen energy is chiefly used to power most [hybrid vehicles](https://www.conserve-energy-future.com/advantages-and-disadvantages-of-hybrid-cars.php).

A lot of research and [innovation is required to discover cheap and sustainable ways](https://www.conserve-energy-future.com/innovative-ways-to-build-sustainable-house.php) to harness this form of energy. Until then, hydrogen energy would remain exclusively for the rich.

### 2. Storage Complications

One of the hydrogen properties is that it has a lower density. In fact, it is a lot less dense than gasoline. This means that it has to be compressed to a liquid state and stored the same way at lower temperatures to guarantee its effectiveness and efficiency as an [energy source](https://www.conserve-energy-future.com/energysources.php).

This reason also explains why hydrogen must at all times be stored and transported under high pressure, which is why transportation and common use is far from feasible.

### 3. It’s Not the Safest Source of Energy

The power of hydrogen should not be underestimated at all. Although gasoline is a little more dangerous than hydrogen, hydrogen is a highly flammable and volatile substance that frequently makes headlines for its potential dangers. Compared to gas, hydrogen lacks smell, which makes any leak detection almost impossible. To detect leaks, one must install sensors.

### 4. Tricky to Move Around

It’s a daunting task to transport hydrogen brilliantly due to its lightness. Oil can be transported safely because it’s mostly pushed through pipes.

Coal can conveniently be transported in dump trucks. Hydrogen also presents challenges when considering moving it in large quantities, which is why it’s mostly transported in small batches only.

### 5. It is Dependent on Fossil fuels

Hydrogen energy is renewable and has a minimal environmental impact, but its separation from oxygen requires other non-renewable sources such as coal, oil and natural gas. Fossil fuels are still needed to produce hydrogen fuel.

### 6. Hydrogen Energy Cannot Sustain the Population

Despite the fact that hydrogen is bountiful in supply, the cost of harnessing it limits extensive utilization. As you realize, it’s quite challenging to disrupt the status quo.

Energy from fossil fuels still rules the world. There is also no framework put in place to ensure cheap and sustainable hydrogen energy for the normal car owner in the future.

Even if hydrogen were to become cheap right now, it would take years to become the most used source of energy since vehicles themselves and service stations would need to be customized to conform to hydrogen requirements. This would require massive capital outlay.

It’s a fact that hydrogen energy is a [renewable resource](https://www.conserve-energy-future.com/various-renewable-energy-sources.php) because it’s abundantly available, and its impacts hugely neglected. However, hydrogen companies will, in a real sense, need other forms of non-renewable energy such as fossil (coal, natural gas, and oil) to separate it from oxygen. We may be able to minimize over-reliance on fossil fuels when we embrace hydrogen energy, but it will be daunting to get rid of it from the system.

**Nuclear Energy**

**Nuclear energy**, also called **atomic energy**, [energy](https://www.britannica.com/science/energy) that is released in significant amounts in processes that affect atomic nuclei, the dense cores of [atoms](https://www.britannica.com/science/atom). It is distinct from the energy of other atomic phenomena such as ordinary [chemical reactions](https://www.britannica.com/science/chemical-reaction), which involve only the orbital [electrons](https://www.britannica.com/science/electron) of atoms.

## Pros of Nuclear Energy (Advantages)

### 1. Low Pollution

Nuclear power also has a lot fewer greenhouse emissions. It has been determined that the number of [greenhouse gases](https://www.conserve-energy-future.com/15-wonderful-ways-reduce-greenhouse-gases.php) have decreased by almost half because of the prevalence in the utilization of nuclear power.

This avoids [more than 470 million metric tons](https://www.facebook.com/NuclearEnergyGov/photos/a.202159030360188/666072310635522/?type=3) of carbon each year, which is the equivalent of removing 100 million cars off of the road. The thermal energy from nuclear reactors may also be used to[decarbonize other energy-intensive sectors](https://www.energy.gov/ne/articles/5-problems-you-didn-t-know-nuclear-could-solve) such as transportation, the largest contributor to carbon pollution.

Nuclear energy has the least effect on nature since it doesn’t discharge any gasses like methane and carbon dioxide, which are the primary “greenhouse gasses.” There is no unfavorable impact on water, land or any territories because of the utilization of nuclear power, except in times where transportation is utilized.

Nuclear advocacy group [the World Nuclear Association](http://www.world-nuclear.org/uploadedFiles/org/WNA/Publications/Working_Group_Reports/comparison_of_lifecycle.pdf) found that the average emissions for nuclear are 29 tonnes of CO2 per gigawatt-hour (GWh) of energy produces. This compares favorably with renewable sources like solar (85 tonnes per GWh) and wind (26 tonnes per GWh) and even more favorably with fossil fuels like lignite (1,054 tonnes per GWh) and coal (888 tonnes per GWh).

### 2. High Power Output

The fuel to power output ratio for nuclear energy is incredibly high. It has the capacity to meet city and industrial needs with just one reactor, let alone multiple. A relatively small amount of uranium can be used to fuel a 1000 Megawatts electric plant, thus providing enough electricity to power a city of about half a million people.

Renewable sources, such as solar and wind, provide only enough power to meet residential or office needs. They don’t yet have the capacity of nuclear to handle large-scale power needs, especially in the manufacturing world.

### 3. Stable Base Load Energy

Nuclear power plants provide a stable baseload of energy. Nuclear energy is widely used in America and makes up around 20% of all electricity generated in the United States. This efficient energy source comes from the 98 nuclear power reactors dotted around 30 different states in the US.

The stable production of power created by nuclear power plants means that it can ideally be used in conjunction with other forms of renewable energy. For example, when the wind is blowing, [nuclear plants](https://www.conserve-energy-future.com/dangers-and-effects-of-nuclear-waste-disposal.php) can adjust energy output to be lower.

Conversely, when the wind is not blowing, and greater energy is needed, nuclear energy can be adjusted to compensate for the lack of wind (or solar) generated power.

### 4. Low Operating Costs

Nuclear power produces very inexpensive electricity and cheaper than gas, coal, or any other fossil fuel plants. The cost of the uranium, which is utilized as a fuel in this process, is low, and it is needed very little to produce massive power. Also, even though the expense of setting up nuclear [power plants](https://www.conserve-energy-future.com/geothermalpowerplanttypes.php) is moderately high, the expense of running them is quite low.

It has been [estimated](http://www.world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power.aspx) that even factoring in costs such as managing radioactive fuel and disposal nuclear plants cost between 33 to 50 percent of a coal plant and 20 to 25 percent of a gas combined-cycle plant.

The normal life of a nuclear reactor is anywhere from 40-60 years, depending on how often it is used and how it is being used. These variables, when consolidated, make the expense of delivering power low. Even if the cost of uranium goes up, the impact on the cost of power will be that much lower.

The [US Department of Energy (DOE) estimates](https://www.energy.gov/ne/articles/nuclear-power-most-reliable-energy-source-and-its-not-even-close) that to replace a 1GW nuclear power plant would require 2GW of coal or 3GW to 4GW from renewable sources to generate the same amount of electricity. Also, the impact on the cost of power will be that much lower.

### 5. Reliability

It is estimated that with the current rate of consumption of uranium, we have enough uranium for another 70-80 years. A nuclear power plant when in the mode of producing energy can run uninterrupted for even a year and more without interruptions or maintenance, making it a more reliable source of energy.

As solar and wind energy are dependent upon weather conditions, the nuclear power plant has no such constraints and can run without disruption in any climatic condition. The consistent criticism of renewable energies, e.g., wind and solar energy are that they only produce power when the wind is blowing, or the sun is shining.

There are sure monetary focal points in setting up nuclear power plants and utilizing nuclear energy in place of traditional energy. It is one of the significant sources of power all through the country.

The best part is that this energy has a persistent supply. It is broadly accessible, there is a lot in storage, and it is believed that the supply is going to last much, much longer than that of [fossil fuels](https://www.conserve-energy-future.com/fossil-fuels-formation.php) that are used in the same capacity.

### 6. More Proficient Than Fossil Fuels

The other primary point of interest in utilizing nuclear energy is that it is more compelling and more proficient than other [energy sources](https://www.conserve-energy-future.com/energysources.php). A number of [nuclear energy](https://www.conserve-energy-future.com/various-nuclear-energy-facts.php) innovations have made it a much more feasible choice than others.

They have high energy density as compared to fossil fuels. The amount of fuel required by the nuclear power plant is comparatively less than what is required by other power plants as the energy released by nuclear fission is approximately ten million times greater than the amount of energy released by fossil fuel atom.

### 7. It Doesn’t Rely on Fossil Fuels

This is one of the reasons that numerous nations are putting a lot of time and money into nuclear power. So what’s nuclear power’s greatest benefit, above any other benefit that we may explore? It doesn’t rely on [fo](https://www.conserve-energy-future.com/Disadvantages_FossilFuels.php)ssil fuels and isn’t influenced by fluctuating oil and gas costs.

Coal and natural gas power plants discharge carbon dioxide into the air, which causes a number of [environmental issues](https://www.conserve-energy-future.com/15-current-environmental-problems.php). With nuclear power plants, carbon emissions are insignificant.

### 8. Renewable?

Nuclear energy is not a renewable resource. Uranium, the nuclear fuel that is used to produce nuclear energy, is limited and cannot be produced again and again on demand.

However, uranium reserves are estimated to last another 80 years, whereas fossil fuels have a much more limited lifespan. Since the Industrial Revolution, humans have been consistently and constantly depleting our fossil fuel reserves. If we continue consuming fossil fuels and keep increasing our consumption as the [world population grows](https://www.conserve-energy-future.com/amazing-overpopulation-facts.php), the world is estimated to run out of oil by 2052, gas in 2060, and coal by 2088.

On the other hand, by using breeder and fusion reactors, we can produce other fissionable elements. One such element is called plutonium that is produced by the by-products of chain-reaction. Also, if we know how to control atomic fusion, the same reactions that fuel the sun, we can have almost unlimited energy.

Thorium is a [greener alternative](https://www.conserve-energy-future.com/green-web-hosting-companies.php) that has lately been come to notice. China, Russia and India already have plans to start using thorium to fuel their reactors in the near future.

### 9. Economic Impact

Nuclear power provides many benefits to the economy with the number of jobs and prosperity a new plant brings.

According to the NEI, a new nuclear plant creates 400 to 700 permanent jobs and also thousands of others during its construction. Most nuclear sites have at least 2 plants. Whereas jobs created elsewhere is just 90 jobs for a coal plant, and 50 for a natural gas plant.

Each facility generates close to $500 million annually in sales of goods and services. More workers at plants mean more people who need lunches and more people with money to spend.

## Cons of Nuclear Energy (Disadvantages)

### 1. Environmental Impact

One of the biggest issues is the [environmental impact](https://www.conserve-energy-future.com/current-environmental-issues.php) in relation to uranium. The process of mining and refining uranium hasn’t been clean. Actually transporting nuclear fuel to and from plants involves a [pollution hazard](https://www.conserve-energy-future.com/PollutionTypes.php). Also, once the fuel is used, you can’t simply take it to the landfill – it’s radioactive and dangerous.

### 2. Radioactive Waste Disposal

As a rule, a [nuclear power plant](https://www.conserve-energy-future.com/nuclear-waste-disposal-methods.php) creates 20 metric tons of nuclear fuel per year, and with that comes a lot of nuclear waste. When you consider each nuclear plant on Earth, you will find that number jumps to approximately 2,000 metric tons a year.

The greater part of this waste transmits radiation and high temperature, implying that it will inevitably consume any compartment that holds it. It can also cause damage to living things in and around the plants.

Nuclear power plants create a lot of low-level radioactive waste as transmitted parts and supplies. Over time, used nuclear fuel decays to safe radioactive levels, however, this takes a countless number of years. Even low-level [radioactive waste](https://www.conserve-energy-future.com/types-of-radioactive-waste.php) takes hundreds of years to achieve adequate levels of safety.

Anti-nuclear environmental group Greenpeace released a  [report](https://cdn.greenpeace.fr/site/uploads/2019/01/REPORT_NUCLEAR_WASTE_CRISIS_ENG_BD-2.pdf?_ga=2.176858277.1849088914.1549876351-1635765717.1507707309) in January 2019 that detailed what it called a nuclear waste ‘crisis’ for which there is ‘no solution on the horizon.’ One such solution was a [concrete nuclear waste ‘coffin’ on Runit Island](https://www.washingtonpost.com/nation/2019/05/20/us-put-nuclear-waste-under-dome-pacific-island-now-its-cracking-open/?noredirect=on&utm_term=.b99b8744c448), which has begun to crack open and potentially release radioactive material.

### 3. Nuclear Accidents

The accident in [Three Mile Island](https://www.power-technology.com/news/three-mile-island-nuclear-plant-close/) in 1979, the Chernobyl accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in Ukraine, was the worst nuclear accident in history. Then there was another accident that happened recently in Fukushima in Japan in 2011. Although the casualties were not that high, it caused serious environmental concerns. Its [harmful effects](https://www.conserve-energy-future.com/effects-solutions-open-drains.php) on humans and ecology can still be seen today.

Despite all the safety measures in place in these nuclear plants, different factors caused them to go into meltdown causing [devastating effects](https://www.conserve-energy-future.com/causes-effects-solutions-cultural-eutrophication.php) for the environment and for local inhabitants who had to leave the affected areas. The radioactive waste produced can pose serious health effects on the lives of people as well as the environment.

### 4. High Cost

The initial costs for building a nuclear power plant are steep. A recent virtual test reactor in the US estimate rose from $3.5bn to $6bn alongside huge extra costs to maintain the facility. South Africa scrapped plans to add 9.6GW of nuclear power to its energy mix due to the cost, which was estimated anywhere between $34-84bn.

At present, the nuclear business let waste cool for a considerable length of time before blending it with glass and putting it away in enormous cooled, solid structures. This waste must be kept up, observed and watched to keep the materials from falling into the wrong hands and [causing problems](https://www.conserve-energy-future.com/causes-problems-solutions-littering.php).

These administrations and included materials cost cash and on top of the high expenses needed to put together a plant, which may make it less desirable to invest in. It requires permission from several international authorities, and it is normally opposed by the people who live in that region.

The nuclear plants are cheap to run and produce inexpensive fuel, but the initial costs are huge.

### 5. Uranium is Finite

Typical renewable energy sources such as solar and wind are in infinite supply. Nuclear energy is not a [renewable fuel](https://www.conserve-energy-future.com/renewable-energy-facts.php) source. Just like other sources of fuel, uranium is also finite and exists in a few of the countries. Uranium is in limited supply although currently abundant. There is still the risk of running out eventually.

Uranium has to be mined, synthesized, then activated to produce energy, and it’s very expensive to go through this process. It produces a considerable amount of waste during all these [activities and can result in environmental](https://www.conserve-energy-future.com/importance-types-examples-environmental-activism.php) contamination and serious health effects, if not handled properly.

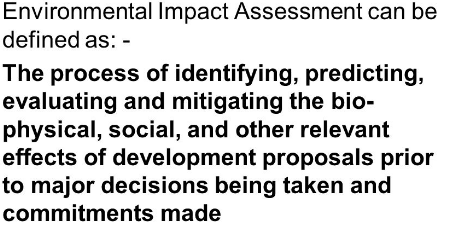
### 6. Hot Target for Militants

Nuclear energy has immense power. Today, [nuclear energy](https://www.conserve-energy-future.com/nuclearenergy.php) is used to make weapons. If these weapons go into the wrong hands, that could be the end of this world. Nuclear power plants are a prime target for terrorism activities. Little lax in security can be brutal for humankind.

### 7. Fuel Availability

Unlike [fossil fuels](https://www.conserve-energy-future.com/HowFossilFuelsWork.php) that are available to most of the countries, uranium is a very scarce resource and exists in only a few of the countries. Permissions of several international authorities are required before someone can even think of building a nuclear power plant.

DOE and its national labs are working with industry to develop new reactors and fuels that will increase the overall performance of these technologies and reduce the amount of nuclear waste that is produced. It also works to provide accurate, fact-based information about nuclear energy through its social media and STEM outreach efforts to educate the public on the benefits of nuclear energy.



Objectives of EIA

(i) to describe the proposed project and associated works together with the requirements for carrying out the proposed developments;

(ii) to identify and describe elements of community and environment likely to be affected by the proposed developments and/or likely to cause adverse impacts to the proposed project, including natural and man-made environment;

(iii) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;

(iv) to identify and quantify any potential losses or damage to flora, fauna and natural habitats;

(v) to identify any negative impacts on sites of cultural heritage and to propose measures to mitigate these impacts;

(vi) to identify, describe and quantify any potential landscape and visual impacts and evaluate the significance of impacts on sensitive receivers;

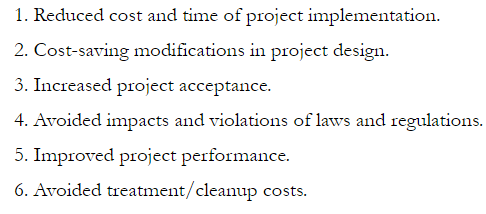
(vii) to identify the negative impacts and propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the developments arising from the Study;

(viii)to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the proposed developments in relation to the sensitive receivers and potential affected uses;

(ix) to identify, assesses and specify methods, measures and standards, to be included in the detailed design, construction and operation of the proposed developments which are necessary to mitigate these environmental impacts and reducing them to acceptable levels;

(x) to investigate the extent of side effects of proposed mitigation measures that may lead to other forms of impacts;

Benefits of EIA



Step BY step Procedure of EIA

**Screening**

The EIA process begins from the very start of a project. Once a developer has identified a need and assessed all the possible alternatives of project design and sites to select a **preferred alternative**, two important questions must be asked: 'What will be the effects of this development on the environment? Are those effects significant?' If the answer to the second question is 'yes', an EIA may be required. Answering this question is a process known as **screening** and can be an essential first step into a formal EIA.

The EIA process is, it must be stressed, iterative. This is demonstrated at this early stage of screening where the requirement for a formal EIA and its associated cost implications can lead the developer to reassess the project design with a view to reducing the significant impacts to a level where an EIA is not legally required (Nielsen *et al* 2005).

**Scoping**

Where it is decided that a formal EIA is required, the next stage is to define the issues that need to be addressed, that is, those impacts that have a significant effect on the environment. This is known as **scoping** and is essential for focusing the available resources on the relevant issues.

**Baseline study**

Following on from scoping, it is essential to collect all relevant information on the current status of the environment. This study is referred to as a **baseline study** as it provides a baseline against which change due to a development can be measured.

**Impact prediction**

Once the baseline study information is available, the important task of **impact prediction** can begin. Impact prediction involves forecasting the likely changes in the environment that will occur as a result of the development.

**Impact assessment**

The next phase involves the assessment of the identified impacts - **impact assessment**. This requires interpretation of the importance or **significance** of the impacts to provide a conclusion, which can ultimately be used by decision-makers in determining the fate of the project application.

**Mitigation**

Frequently, the assessment of impacts will reveal damaging effects upon the environment. These may be alleviated by **mitigation** measures*.*Mitigation involves taking measures to reduce or remove environmental impacts and it can be seen that the iterative nature of the EIA process is well demonstrated here. For example, successful design of mitigation measures could possibly result in the removal of all significant impacts; hence a new screening exercise would reveal that there might have been no need to carry out a formal EIA had the mitigation measures been included from the start.

**Producing the environmental impact statement**

The outcome of an EIA is usually a formal document, known as an **environmental impact statement** (**EIS**), which sets out factual information relating to the development, and all the information gathered relating to screening, scoping, baseline study, impact prediction and assessment, mitigation, and monitoring measures. It is quite common that a requirement of an EIS is that it also produces a non-technical summary*.*This is a summary of the information contained within the EIS, presented in a concise non-technical format, for those who do not wish to read the detailed documents. This is very important, as EISs are public documents intended to inform the public of the nature and likely consequences of a development in time to comment and/or participate in the final project design.

**EIS review**

Once the EIA is complete, the EIS is submitted to the **competent authority***.*This is the body with the authority to permit or refuse development applications. The competent authorities are often in a position of having very little time to make a decision and have a detailed and lengthy EIS to read through which may contain errors, omissions, and developer bias. It is essential, therefore, that they **review** the document. Review can take a number of forms: it may be purely an ad hoc process whereby the document is read and commented on by decision-makers; it can be more formalised and expert opinion is sought; or it can be through the use of formal review methods designed specifically for the purpose. Basically, the review process should enable the decision-maker to decide whether the EIS is adequate (eg whether it is legally compliant), whether the information is correct, and whether it is unbiased. If it is, they are then in a position to use the EIS as information to be considered in determining whether the project should receive consent. This issue of review is discussed in more detail elsewhere in this module.

The competent authority is now in possession of the information they require about the possible effects of the development on the environment. They will use this information, in combination with all of the other details and representations they have received, to help them come to a decision.

**Follow up**

**Follow up** relates to the post-approval phase of EIA and encompasses monitoring of impacts, the continued environmental management of a project, and impact auditing. Without any form of follow up EIA would operate as a linear rather than an iterative process, and an important step towards achieving environmental protection will also have been omitted.

Follow up presents an opportunity both to control environmental effects and to learn from the process and cause-effect relationships. Ideally, data generated by monitoring and other aspects of follow up should be compared with the original predictions and mitigation measures in the EIS to determine

1. the accuracy of the original predictions
2. the degree of the deviation from the predictions
3. the possible reasons for any deviation
4. whether mitigation measures have achieved their objective of reducing or eliminating impacts

Information generated by this process can contribute to the improvement of future EIA practice, for example, by enabling more accurate predictions to be made.