

# POLLUTION

AIR POLLUTANTS		
pollutant	sources	undesirable effects of pollutant on the environment
Sulfur dioxide	Burning fossil fuels	Cause of acid rain
Carbon dioxide	Burning fossil fuels	Enhances greenhouse effect
methane	Cattle and paddy fields for growing rice, coal and oil extraction	Enhances greenhouse effect
Nitrogen oxides	Motor vehicles, fertilizers	Cause of acid rain
Nuclear fall out (beta and gamma radiation)	Atomic bomb, accidents at nuclear power stations, nuclear tests	Death with high exposure, cancers in humans, mutations in non-human species
WATER POLLUTANTS		
Sewage	Human and livestock waste contains urea, ammonia, protein, carbohydrates, fats and pathogens	Reduces oxygen concentration in rivers, destruction of fresh water communities
Industrial chemical waste- includes variety of toxic substances including lead, mercury and cyanide	Factories	Can be fatal to wildlife and humans; can accumulate in organisms
Fertilisers (mostly N and P)	Arable agriculture	Eutrophication in fresh water (rivers, lakes)
Herbicides for killing weeds	Arable agriculture (capable of being ploughed)	Spray drift kills harmless plants, persist in the environment
Pesticides for killing pests and diseases	Arable and livestock agriculture	Accumulates in food chain, kills harmless (non-pest) species

**SOIL POLLUTION**

Solid waste (biodegradable and non-biodegradable rubbish)	Domestic and industrial waste	Buried in ground (landfill) or left on rubbish tips. Health hazard, leakage of toxic liquids and release of methane
Non-biodegradable plastics	Packaging	Buried in ground, does not decay so takes up space

## **Eutrophication:**

**Fertilisers** drain from the land into rivers and lakes. The result of either of these is that fertilisers can cause water pollution resulting in **eutrophication**, which means that the water is enriched with plant nutrients.

### **Eutrophication is the sequence of events stated below:**

- Fertilisers can be washed through the soil into rivers and streams –this is called **leaching**. The rivers may flow into a lake.
- There is an increased availability of nitrate and other ions
- This results in an increased growth of producers
- There is an increased decomposition after death of producers
- Hence there is increased aerobic respiration by decomposers
- Hence , there is a reduction in dissolved oxygen
- Eventually there occurs death of organisms requiring dissolved oxygen in water

The same chain of events can happen if sewage gets into waterways. Bacteria multiply quickly, use up oxygen in respiration, which can result in the death of fish.

The problems of eutrophication are caused by nitrate and phosphate. These ions are in short supply in most natural aquatic ecosystems, so they act as a limiting factor to the growth of plants. When they are added in the form of fertilisers, plant growth increases.

**Preventing eutrophication:**

Farmers are encouraged to reduce the fertilisers they apply and to make sure that they are applied at a time when crops will take them up.

Phosphate tends to remain in soils and much of the phosphate in water comes from domestic sources. Removing phosphate from detergents has helped to reduce this type of pollution. Similar events happen in the sea – nitrate in the sea causes growth of algae, many of which produce toxins and kill other marine life.

## **Effects of non-biodegradable plastics in the aquatic and terrestrial ecosystems:**

### **Waste plastics**

#### **Bio-degradable-Non-Biodegradable:**

Some materials we throw away are broken down in the environment by decomposers- these are called **biodegradable**. Some are not and these are called **non-biodegradable**.

#### **Disposing of plastics**

Most plastic waste goes into landfill sites or rubbish dumps where they take up a lot space. Biodegradable plastics are designed to break down more quickly than conventional non-biodegradable plastics once they are dumped. For example, some plastics now have starch incorporated into their structures which is digested by bacteria in the soil.

We can recycle many thermoplastics that we use by melting them and remoulding them into new shapes. Burning plastics in incinerators reduces the volume of waste, but many plastics produce toxic gases as they burn.

#### **Seas are polluted by non-biodegradable plastics. The following are the likely effects of this marine ( aquatic) pollution:**

These plastics do not decay and hence persist in the water bodies. They get eaten by the marine animals like the fish, turtle etc and suffocate then.

#### **People are advised to recycle plastics. The following are some of the advantages of doing this:**

- There will be less waste produced.
- Less waste burnt
- Less area will be consumed in the landfill sites

## **The greenhouse effect**

### **Greenhouse gases**

**Greenhouse gases** : carbon dioxide, water vapour and methane. Some man-made air pollutants, such as CFCs (chlorofluorocarbons), are greenhouse gases as well .

### **What the greenhouse gases do:**

These greenhouse gases allow solar energy to pass through to the Earth's surface. Some energy enters food chains and is eventually lost to the atmosphere as heat, which is radiated away from the Earth's surface.

Some heat energy escapes into space, but much is reflected back towards the Earth. Greenhouse gases keep our atmosphere at the temperatures that allow life to exist.

It is important to understand that the greenhouse effect is a natural process and without it the average temperature on the Earth would be about -17°C. however, over the last 100 years, there has been a build-up of greenhouse gases.

Power stations, factories, domestic heating and transport use fossil fuels and release huge amounts of carbon dioxide into the atmosphere. As we have seen, deforestation has resulted in large areas of forest being removed. When the trees are cleared for farming and are burnt, carbon dioxide enters the atmosphere. Roots and other remaining tree parts are decomposed by microbes in the soil, producing even more carbon dioxide.

There has also been a significant increase in methane (another greenhouse gas) due to the expansion of rice cultivation and cattle rearing. Methane is released by cattle and also by bacteria in the anaerobic conditions found in the flooded rice fields and natural wetlands. Rotting material in landfill sites and rubbish tips, as well as the extraction of oil and natural gas, are other sources of methane.

However, methane and CFCs cannot be ignored as they are much more effective greenhouse gases than carbon dioxide.

## **Global warming**

Human activities are causing an increase in the concentration of greenhouse gases so the atmosphere is getting warmer. This is causing the **enhanced greenhouse effect**.

### **Effects of enhanced greenhouse effect:**

- There could also be a change in wind patterns and the distribution of rainfall leading to more extreme weather. Some parts are expected to become very dry. Some of these are important agricultural areas, such as parts of the USA and Asia, so that warming of the climate could mean a massive reduction in the grain crops of Central Asia and North America. The pattern of the world's food distribution could be affected with economic and political consequences.

### **Methods to reduce global warming:**

- Measures to reduce the effects of global warming involve reducing carbon emissions. This may be done by encouraging public transport, using energy more efficiently, recycling and changing the diet of cattle to stop them releasing methane.

**Environmental effects of increase in carbon dioxide and methane concentration in the atmosphere:**

- Methane is a greenhouse gas. It traps the infra-red radiations. Thus the radiations are radiated back towards the earth. This leads to enhanced greenhouse effect and a global warming of the earth thereafter.
- The result can be rise in the sea-levels, melting of ice-caps, droughts, flooding, desertification, soil erosion etc.



## Acid rain

**Sulfur dioxide** ( $\text{SO}_2$ ) is released when fossil fuels are burnt. Together with nitrogen oxides ( $\text{NO}_x$ ) from exhaust fumes, they cause **acid rain**. Rain is naturally acidic as the water dissolves carbon dioxide. However, when sulfur dioxide and nitrogen oxides dissolve in water in the atmosphere and react with oxygen they produce sulfuric and nitric acids which lower the pH. In some places the pH of the rain may be as low as 0.3.

### Effects of acid rain:

- The acidic gases can be carried over large distances by winds before being deposited as dry particles or dissolved in the rain. The term 'acid rain' refers to both of these types of deposition.
- When acid rain falls on trees it kills the leaves and reduces their ability to resist disease. Many trees in central European forests have been killed by acid rain.
- Vegetation is affected by high concentrations of sulfur dioxide. Most sensitive are lichens, which are composed of algae and fungi living together. They absorb all their water and nutrients from the atmosphere. Some species are very sensitive to sulfur dioxide and only grow where the air is free of the gas and some can tolerate high concentrations. Others can tolerate intermediate concentrations. Lichens are useful indicators of pollution. By looking at the species growing in an area, you can deduce the average concentration of sulfur dioxide.
- When acid rain falls on soils on limestone or chalk there is little effect, because the soils are alkaline and this neutralises the acid. When it falls on hard rocks, such as granite, the soil is already acidic and there is nothing to neutralise the acid rain. Acid rain causes plant nutrients, such as potassium and calcium, to become soluble and wash out of soils leaving them infertile.
- Aluminium compounds in soils become soluble below pH 5.5. Acidified water that enters lakes, streams and rivers lowers the pH of these bodies of water. The aluminium concentration can increase considerably. Species of invertebrates and fish that live in these ecosystems cannot tolerate water with a low pH, and aluminium ions are toxic. Lakes in Canada, Scotland and Norway have been badly affected by acid rain and some have very few or no animals in them.

### **Use of technology to minimize acid rain:**

- **Lower sulfur fuels** could be used. Crushing coal and washing it with a solvent that dissolves its sulfur content.
- **Flue gas desulfurisation** removes the sulfur from power station chimneys by treating the waste gases with wet powdered limestone, neutralizing the acidic gases before they can escape.
- **Catalytic convertors** can be fitted to reduce the nitrogen oxides in the exhaust fumes of cars.

## **Negative effects of female contraceptives in water:**

### **Reduced sperm count in men**

- Falling sperm counts could be caused by traces of the contraceptive pill in drinking water, a new study has claimed.
- U.S. scientists say the sex hormone oestradiol - the birth control hormone that passes untreated through sewage plants - has an even larger effect on sperm than Bisphenol A or BPA, as it is widely known.
- BPA is found in some plastics used to make food containers, bottles and coatings in tin cans, and is also commonly used in thermal paper in cash register receipts.
- But researchers claim BPA can disrupt hormones, raising the risk of a wide number of health problems such as diabetes, obesity and cancer.

### **Feminisation of aquatic animals.**

A new doctoral thesis from Lund University in Sweden shows that hormones found in birth control pills alter the genes in fish, which can cause changes in their behaviour.