



UNIT-3

UNIT3: Content:

- Pollution and their Effects;
- Public Health Aspects of Environmental;
- Water Pollution,
- Air Pollution,
- Soil Pollution,
- Noise Pollution,
- Solid waste management.

Environmental Pollution:

- **Definition:** Environmental pollution refers to the introduction of harmful substances or pollutants into the natural environment, resulting in adverse effects on the ecosystem, living organisms, and the overall balance of the environment.
- **Types of Pollution:** There are various types of pollution,
 1. Air pollution,
 2. Water pollution,
 3. Soil pollution,
 4. Noise pollution,
 5. Light pollution,
 6. Thermal pollution,
 7. Plastic pollution, and radioactive pollution.



- **Causes:** Pollution is primarily caused by human activities such as industrial processes, transportation, agricultural practices, improper waste disposal, deforestation, and the burning of fossil fuels. Natural events like volcanic eruptions and forest fires can also contribute to pollution to a certain extent.

- **Effects:** Environmental pollution has wide-ranging negative effects on both the environment and human health. It can lead to respiratory problems, cardiovascular diseases, impaired lung function, waterborne diseases, biodiversity loss, land degradation, climate change, disruption of ecosystems, and adverse impacts on wildlife and marine life.

- **Global Impact:** Pollution knows no boundaries and can have global consequences. Air pollutants can travel long distances through atmospheric circulation, leading to transboundary pollution and contributing to global warming and climate change. Water pollution can affect not only local water bodies but also downstream and coastal areas.

- **Prevention and Mitigation:** Pollution can be mitigated and prevented through various measures, including the adoption of cleaner technologies, stricter environmental regulations, sustainable waste management practices, conservation and restoration of ecosystems, promotion of renewable energy sources, and raising awareness about the importance of pollution control.



- **Individual Responsibility:** Individuals can play a crucial role in reducing pollution by practicing responsible consumption and waste management, conserving energy and water, using public transportation or carpooling, recycling and reusing materials, and supporting initiatives that promote a cleaner and healthier environment.
- **Government and International Efforts:** Governments, along with international organizations and agreements, have a vital role in addressing pollution. They establish and enforce environmental laws and regulations, promote sustainable development practices, invest in clean technologies, and work together to tackle global environmental challenges.

Public Health Aspects of Environmental:

Environmental pollution has significant public health implications. Here are some key points regarding the public health aspects of environmental pollution:

- **Respiratory Problems:** Air pollution, particularly the presence of pollutants such as particulate matter and harmful gases, can cause or worsen respiratory conditions such as asthma, bronchitis, and other chronic obstructive pulmonary diseases (COPD). Prolonged exposure to polluted air can lead to reduced lung function, respiratory infections, and increased susceptibility to respiratory illnesses.
- **Cardiovascular Diseases:** Certain air pollutants, including fine particulate matter (PM_{2.5}) and nitrogen dioxide (NO₂), are associated with an increased risk of cardiovascular diseases such as heart attacks, strokes, and high blood pressure. Long-term exposure to air pollution can contribute to the development and progression of cardiovascular conditions.



- **Waterborne Diseases:** Water pollution can contaminate drinking water sources, leading to the spread of waterborne diseases such as cholera, dysentery, typhoid, and hepatitis. Inadequate sanitation and improper disposal of sewage and industrial waste can contribute to the contamination of water bodies and pose a significant risk to public health.
- **Food Contamination:** Soil and water pollution can lead to the contamination of crops and the food chain. Chemical pollutants, pesticides, and heavy metals can accumulate in food, posing health risks to consumers. Consumption of contaminated food can lead to various health problems, including organ damage, developmental issues, and increased risk of certain cancers.
- **Increased Cancer Risk:** Exposure to certain pollutants, such as air pollutants (e.g., benzene, formaldehyde), water pollutants (e.g., arsenic), and soil pollutants (e.g., pesticides), can increase the risk of developing cancer. Prolonged exposure to carcinogens in the environment can contribute to the development of lung cancer, bladder cancer, liver cancer, and other forms of the disease.
- **Neurological Effects:** Some environmental pollutants, such as lead and mercury, can have detrimental effects on the nervous system. Lead exposure, especially in children, can lead to cognitive impairments, learning disabilities, and behavioral problems. Mercury exposure, primarily through contaminated fish consumption, can affect neurological development in fetuses and young children.
- **Reproductive Health:** Environmental pollution can have adverse effects on reproductive health. Exposure to certain chemicals and pollutants can lead to infertility, hormonal disruptions, birth defects, and complications during pregnancy. Persistent organic pollutants, like dioxins and PCBs, can accumulate in the body and have long-term effects on reproductive systems.
- **Mental Health Impact:** Living in highly polluted environments, characterized by poor air quality, noise pollution, and degraded surroundings, can contribute to stress, anxiety, and



negative mental health outcomes. The psychological impact of environmental pollution is an important consideration for public health, as it can affect overall well-being and quality of life.

Water Pollution

- Water pollution refers to the contamination of water bodies, such as rivers, lakes, oceans, and groundwater.
- It occurs when harmful substances or pollutants are introduced into water sources, making them unsuitable or unsafe for their intended use.
- Sources of water pollution include industrial activities, agricultural practices, municipal wastewater, oil spills, and improper waste disposal.
- Water pollution can harm aquatic life, disrupt ecosystems, and cause the accumulation of toxins in organisms.
- Contaminated water can pose significant health risks to humans, leading to waterborne diseases such as cholera and dysentery.
- It can also impact drinking water sources, requiring costly treatment processes to make it safe for consumption.
- Water pollution has economic consequences, including reduced agricultural productivity, loss of fisheries, and negative impacts on tourism.
- Prevention and mitigation measures include wastewater treatment, responsible agricultural practices, enforcement of pollution control regulations, and eco-friendly waste disposal methods.

Water pollution refers to the contamination of water bodies, including rivers, lakes, oceans, groundwater, and even smaller bodies of water like ponds and streams. It occurs when harmful



substances or pollutants are introduced into water sources, making them unsuitable or unsafe for their intended use, whether it's drinking, recreation, agriculture, or supporting aquatic life.

Water pollution sources

Water pollution can have various sources, both human-made and natural. Some common causes include:

- **Industrial Activities:** Industrial processes can release pollutants such as heavy metals, toxic chemicals, and industrial waste into water bodies. This includes the discharge of untreated or inadequately treated wastewater from factories and manufacturing plants.
- **Agricultural Practices:** The use of fertilizers, pesticides, and herbicides in agricultural activities can result in the contamination of water bodies through runoff. These chemicals can find their way into nearby rivers and lakes, causing water pollution.
- **Municipal Wastewater:** Improperly treated or untreated sewage and wastewater from households, commercial buildings, and sewage treatment plants can contain harmful pathogens, nutrients, and other pollutants that can contaminate water bodies.
- **Oil Spills:** Accidental or deliberate oil spills from oil tankers, pipelines, offshore drilling operations, or storage facilities can have severe impacts on water quality. Oil spills not only contaminate the water but also harm aquatic life and ecosystems.
- **Improper Waste Disposal:** Improper disposal of solid waste, including plastics, chemicals, and other hazardous materials, can lead to water pollution. When these substances leach into the soil or find their way into water bodies, they can contaminate the water and pose a risk to both human health and the environment.
- **The effects of water pollution are widespread and can have significant consequences:**
- **Harm to Aquatic Life:** Water pollution can disrupt ecosystems and harm aquatic organisms such as fish, amphibians, and marine life. The presence of pollutants in the water can lead to reduced oxygen levels, habitat destruction, and the accumulation of toxins in organisms, causing illness, reduced reproductive success, and even death.



- **Threat to Human Health:** Waterborne diseases are a major concern in areas affected by water pollution. Contaminated water can contain pathogenic bacteria, viruses, parasites, and other harmful microorganisms that can cause illnesses such as cholera, dysentery, typhoid, and hepatitis when ingested or used for hygiene purposes.
- **Impact on Drinking Water:** Water pollution can render drinking water sources unsafe, requiring costly treatment processes or alternative water sources. Contaminants like heavy metals, pesticides, and industrial chemicals can pose long-term health risks if consumed in contaminated drinking water.
- **Economic Impact:** Water pollution can have adverse economic consequences. Contaminated water sources can lead to reduced agricultural productivity, loss of fisheries, and a decline in tourism due to impaired water quality and aesthetics.
- **Preventing and mitigating water pollution** requires a combination of regulatory measures, sustainable practices, and public awareness. This includes implementing effective wastewater treatment systems, promoting responsible agricultural practices, enforcing pollution control regulations, and adopting eco-friendly approaches to waste disposal. Protecting water resources is essential for ensuring the availability of clean and safe water for both ecosystems and human needs.

Public Health Aspects of water pollution:

Water pollution has significant public health implications. Here are some key public health aspects related to water pollution:

1. **Waterborne Diseases:** Contaminated water sources can harbor various pathogenic microorganisms, including bacteria, viruses, and parasites, that can cause waterborne diseases. Examples include cholera, dysentery, typhoid fever, hepatitis A, and giardiasis. These diseases are transmitted through the ingestion of water contaminated with fecal matter or other sources of pathogens.



2. **Gastrointestinal Illnesses:** Consuming water contaminated with harmful bacteria or parasites can lead to gastrointestinal illnesses, causing symptoms such as diarrhea, vomiting, stomach cramps, and dehydration. These illnesses can be particularly severe in vulnerable populations such as children, the elderly, and individuals with weakened immune systems.
3. **Chemical Contaminants:** Water pollution can introduce various chemical pollutants into water sources. Industrial discharges, agricultural runoff, and improper waste disposal can contaminate water with heavy metals (e.g., lead, mercury), pesticides, fertilizers, industrial chemicals, and pharmaceuticals. Prolonged exposure to these contaminants through drinking water can lead to adverse health effects such as organ damage, developmental issues, and an increased risk of certain cancers.
4. **Nutrient Pollution:** Excessive nutrients, such as nitrogen and phosphorus, from sources like agricultural runoff and wastewater discharges, can cause harmful algal blooms in water bodies. These blooms can release toxins that contaminate the water, leading to illness or even death in humans and animals that come into contact with or ingest the water.
5. **Impact on Vulnerable Populations:** Water pollution disproportionately affects vulnerable populations, including low-income communities and marginalized groups. These populations may have limited access to clean and safe water sources, making them more susceptible to waterborne diseases and health risks associated with contaminated water.
6. **Environmental Justice:** Water pollution can contribute to environmental injustices, where communities with lower socioeconomic status and minority populations bear a disproportionate burden of exposure to contaminated water. These communities may have limited resources to address water pollution issues, leading to long-term health disparities.
7. **Long-Term Health Effects:** Chronic exposure to contaminated water sources can lead to long-term health effects, including developmental issues, organ damage, hormonal disruptions, and an increased risk of certain diseases. Prolonged exposure to specific contaminants, such as arsenic or lead, can have severe and lasting health consequences.



Control of Water pollution:

Controlling water pollution requires a combination of regulatory measures, technological advancements, and individual actions. Here are some key strategies and approaches for controlling water pollution:

1. **Regulatory Measures:** Implement and enforce water quality standards and pollution control regulations. Require industrial facilities to obtain permits and comply with pollution prevention and control measures. Set limits on pollutant discharges and impose penalties for non-compliance. Establish protected areas and buffer zones around water bodies to limit pollution sources.
2. **Wastewater Treatment:** Ensure the proper treatment of municipal and industrial wastewater before discharge. Upgrade and maintain wastewater treatment plants to effectively remove pollutants. Encourage the use of advanced treatment technologies to target specific contaminants. Promote the reuse and recycling of treated wastewater for non-potable purposes.
3. **Best Agricultural Practices:** Encourage farmers to adopt sustainable agricultural practices that minimize the use of fertilizers, pesticides, and herbicides. Promote precision farming techniques to reduce runoff and minimize nutrient and chemical losses. Implement soil and water conservation practices, such as contour ploughing, terracing, and cover cropping, to reduce erosion and runoff.
4. **Storm water Management:** Implement effective storm water management systems to control runoff from urban areas. Use green infrastructure techniques like permeable pavements, rain gardens, and constructed wetlands to capture and treat stormwater. Implement measures to prevent the discharge of pollutants from construction sites and urban runoff into water bodies.



5. Environmental Education and Awareness: Raise public awareness about the importance of water conservation and pollution prevention. Promote responsible behaviours such as proper waste disposal, reducing single-use plastics, and conserving water. Educate communities about the impacts of water pollution on human health and the environment.
6. Monitoring and Research: Conduct regular monitoring of water quality to identify pollution sources and assess the effectiveness of pollution control measures. Support research and development of new technologies and innovative solutions for water pollution control. Collaborate with scientific institutions, organizations, and stakeholders to gather data and share knowledge on water pollution control.
7. International Cooperation: Foster international collaboration and cooperation to address transboundary water pollution issues. Establish and enforce international agreements and protocols to protect shared water resources. Share best practices, technologies, and experiences in water pollution control among nations.

Air Pollution

- Air pollution **consists of chemicals or particles in the air that can harm the health of humans, animals, and plants.**
- **Air pollution** can be defined as the presence of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose a health risk.
- In an even broader sense, air pollution means the presence of chemicals or compounds in the air which are usually not present and which lower the quality of the air or cause detrimental changes to the quality of life (such as the damaging of the ozone layer or causing global warming).
- Air pollution is one of the greatest environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma.



Pollutants

1. Particulate matter (PM)

PM is a common proxy indicator for air pollution. There is strong evidence for the negative health impacts associated with exposure to this pollutant. The major components of PM are sulfates, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water.

2. Carbon monoxide (CO)

Carbon monoxide is a colourless, odourless and tasteless toxic gas produced by the incomplete combustion of carbonaceous fuels such as wood, petrol, charcoal, natural gas and kerosene.

3. Ozone (O₃)

Ozone at ground level – not to be confused with the ozone layer in the upper atmosphere – is one of the major constituents of photochemical smog and it is formed through the reaction with gases in the presence of sunlight.

4. Nitrogen dioxide (NO₂)

NO₂ is a gas that is commonly released from the combustion of fuels in the transportation and industrial sectors.

5. Sulfur dioxide (SO₂)

SO₂ is a colourless gas with a sharp odour. It is produced from the burning of fossil fuels (coal and oil) and the smelting of mineral ores that contain sulfur.

Causes of Air Pollution

Following are the important causes of air pollution:

1. Burning of Fossil Fuels

The combustion of fossil fuels emits a large amount of sulphur dioxide. Carbon monoxide released by incomplete combustion of fossil fuels also results in air pollution.



2. Automobiles

The gases emitted from vehicles such as jeeps, trucks, cars, buses, etc. pollute the environment. These are the major sources of greenhouse gases and also result in diseases among individuals.

3. Agricultural Activities

Ammonia is one of the most hazardous gases emitted during agricultural activities. The insecticides, pesticides and fertilisers emit harmful chemicals in the atmosphere and contaminate it.

4. Factories and Industries

Factories and industries are the main source of carbon monoxide, organic compounds, hydrocarbons and chemicals. These are released into the air, degrading its quality.

5. Mining Activities

In the mining process, the minerals below the earth are extracted using large pieces of equipment. The dust and chemicals released during the process not only pollute the air, but also deteriorate the health of the workers and people living in the nearby areas.

6. Domestic Sources

The household cleaning products and paints contain toxic chemicals that are released in the air. The smell from the newly painted walls is the smell of the chemicals present in the paints. It not only pollutes the air but also affects breathing.

Effects of Air Pollution

The hazardous effects of air pollution on the environment include:

➤ Diseases

Air pollution has resulted in several respiratory disorders and heart diseases among humans. The cases of lung cancer have increased in the last few decades. Children living near polluted areas are more prone to pneumonia and asthma. Many people die every year due to the direct or indirect effects of air pollution.



➤ **Global Warming**

Due to the emission of greenhouse gases, there is an imbalance in the gaseous composition of the air. This has led to an increase in the temperature of the earth.

This increase in earth's temperature is known as [global warming](#). This has resulted in the melting of glaciers and an increase in sea levels. Many areas are submerged underwater.

➤ **Acid Rain**

The burning of fossil fuels releases harmful gases such as nitrogen oxides and sulphur oxides in the air. The water droplets combine with these pollutants, become acidic and fall as acid rain which damages human, animal and plant life.

➤ **Ozone Layer Depletion**

The release of chlorofluorocarbons, halons, and hydrochlorofluorocarbons in the atmosphere is the major cause of depletion of the ozone layer. The depleting ozone layer does not prevent the harmful ultraviolet rays coming from the sun and causes skin diseases and eye problems among individuals.

➤ **Effect on Animals**

The air pollutants suspend in the water bodies and affect aquatic life. Pollution also compels the animals to leave their habitat and shift to a new place. This renders them stray and has also led to the extinction of a large number of animal species.

Air Pollution Control

Following are the measures one should adopt, to control air pollution:

1. Avoid Using Vehicles

People should avoid using vehicles for shorter distances. Rather, they should prefer public modes of transport to travel from one place to another. This not only prevents pollution, but also conserves energy.

2. Energy Conservation: A large number of fossil fuels are burnt to generate electricity.

Therefore, do not forget to switch off the electrical appliances when not in use. Thus, you



can save the environment at the individual level. Use of energy-efficient devices such as CFLs also controls pollution to a greater level.

3. Use of Clean Energy Resources

The use of solar, wind and geothermal energies reduce air pollution at a larger level. Various countries, including India, have implemented the use of these resources as a step towards a cleaner environment.

Other air pollution control measures include:

1. By minimizing and reducing the use of fire and fire products.
2. Since industrial emissions are one of the major causes of air pollution, the pollutants can be controlled or treated at the source itself to reduce its effects. For example, if the reactions of a certain raw material yield a pollutant, then the raw materials can be substituted with other less polluting materials.
3. Fuel substitution is another way of controlling air pollution. In many parts of India, petrol and diesel are being replaced by CNG – Compressed Natural Gas fueled vehicles. These are mostly adopted by vehicles that aren't fully operating with ideal emission engines.
4. Although there are many practices in India, which focus on repairing the quality of air, most of them are either forgotten or not being enforced properly. There are still a lot of vehicles on roads which haven't been tested for vehicle emissions.
5. Another way of controlling air pollution caused by industries is to modify and maintain existing pieces of equipment so that the emission of pollutants is minimised.
6. Sometimes controlling pollutants at the source is not possible. In that case, we can have process control equipment to control the pollution.
7. A very effective way of controlling air pollution is by diluting the air pollutants.
8. The last and the best way of reducing the ill effects of air pollution is tree plantation. Plants and trees reduce a large number of pollutants in the air. Ideally, planting trees in areas of high pollution levels will be extremely effective.



SOIL POLLUTION— CAUSES, TYPES, EFFECT AND CONTROL

MEASURES SOIL

Soil, the uppermost layer of the earth's crust is a mixture of many solid, liquid and gaseous substances having both living and non living matter such as mineral particles, decaying organic matter, microbes along with water and air contained in pore spaces. Formation of soil is a very slow process starting from weathering (Breakdown of bed rock into mineral particles) to soil development i.e. pedogenesis (modification of mineral matter through interactions between biological, topographic and climatic factors). It may take 200 to some thousand years to form an inch of top soil depending upon the local conditions of the area. Thus soil is an important natural resource, formed over the centuries that supports the variety of plants and provides habitat for various microscopic and macroscopic life-forms apart from other ecological functions. Composition of soil is listed below:

Components in Soil	Percentage
Organic mineral matter	45%
Organic matter	05%
Soil water	25%
Soil air	25%

SOIL POLLUTION

Soil pollution is the contamination of the soil with pollutants, toxic chemicals or any contaminant in such a quantity that reduces soil quality and makes it inhabitable to organisms such as insects and other microbes. Or it can be referred to as the addition of chemicals to the soil in quantities that are toxic to the environment and its residents. This addition is mostly by human activities such as mining, modern practices in agriculture, deforestation, indiscriminate dumping of human generated trash and unregulated disposal of untreated wastes of various industries.



Causes of Soil Pollution

1. Industrial and Mining Activities: Large numbers of Industries coming up since the dawn of industrial era without proper waste management systems are the biggest contributor to soil pollution. Also since the amount of mining and manufacturing has increased and most industries are dependent on extracting minerals from the Earth. Whether it is iron ore or coal, the by products are contaminated and they are not disposed off in a manner that can be considered safe. As a result, the industrial waste dumped on the soil surface for a long period of time degrades it.

2. Modern Agricultural Practices: To increase the yield from limited land area, in order to meet the increasing demand of food for ever increasing population, synthetic chemical pesticides and fertilizers are being used rampantly in last few decades leading to toxicity of the soil. They seep into the ground after they mix with water and slowly reduce the fertility of the soil. Other chemicals damage the composition of the soil and make it easier to erode by water and air. Plants absorb many of these pesticides and when they decompose, they cause soil pollution since they become a part of the land.

3. Lack of proper Waste Disposal: Modern lifestyle, urban as well as rural, produces huge amount of waste and lack of waste management procedures adds to the problem of soil pollution. Urban wastes comprise of both commercial and domestic wastes consisting of dried sludge and sewage, garbage and rubbish materials like plastics, glasses, metallic cans, fibres, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles and other discarded manufactured products. Plastic and other non biodegradable wastes are the major cause of concern.

4. Radioactive Pollutants: Radioactive substances resulting from explosions of nuclear testing laboratories, radioactive fallout and industries giving rise to nuclear dust and radioactive wastes penetrate the soil and accumulate giving rise to soil pollution. E.g. Nuclear reactors produce waste containing Ruthenium-106, Iodine-131, Barium-140, Cesium-144 and Lanthanum-140 along with primary nuclides Sr-90 with a half life 28 years and Cs-137 with a half life 30 years. Rain water carries Sr-90 and Cs-137 to be deposited on the soil where they



are held firmly with the soil particles by electrostatic forces. All the radio nuclides deposited on the soil emit gamma radiations.

5. Biological Agents: Soil gets a large amount of human, animal and bird excreta which constitute a major source of land pollution by biological agents. E.g. Heavy application of manures and digested sludge can cause serious damage to plants within a few years

4. Accidental Oil Spills: Oil leaks can happen during storage and transport of chemicals. This can be seen at most of the fuel stations. The chemical present in the fuel deteriorates the quality of soil and make them unsuitable for cultivation. These chemicals can enter into the groundwater through soil and make the water undrinkable.

5. Acid Rain: Acid rain is caused when pollutants present in the air mixes up with the rain and fall back on the ground. The polluted water could dissolve away some of the important nutrients found in soil and change the structure of the soil.

Effects of Soil Pollution

Impacts of soil pollution are not confined to soil and its biota but are carried over to every aspect of the environment and affect every organism from the earthworm to humans. Some of the adverse effects are as follows:

- Human health since we are dependent on the land for our food, pollution from the soil is transferred to us in this manner. Bio accumulation of toxins occurs in our bodies, causing chronic poisoning, and leading to various diseases. Reproductive health, birth and developmental defects, neurologic effects, malnutrition, and mutations in the cells of the body leading to cancers; all these are on the increase today.
- Growth of plants Plants will not be able to adapt to sudden changes occurring in the soil. Fungi and bacteria found in the soils cannot bind the soil due to chemical changes and this causes soil erosion. Large tracts of land become barren; unable to support any life on it. Even the plants that do grow on these lands will absorb the toxins and transfer to the food chain.



- Air pollution Toxic dust rises from landfills along with foul odour, pollutes the air and causes adverse effects to the people who live near them.
1. Effect on Human Health: Considering how soil is the reason we are able to sustain ourselves, the contamination of it has major consequences on our health. Crops and plants grown on polluted soil absorb much of the pollution and then pass these on to us. This could explain the sudden surge in small and terminal illnesses. Long term exposure to such soil can affect the genetic make-up of the body, causing congenital illnesses and chronic health problems that cannot be cured easily. In fact, it can sicken the livestock to a considerable extent and cause food poisoning over a long period of time. The soil pollution can even lead to widespread famines if the plants are unable to grow in it.
 2. Effect on Growth of Plants: The ecological balance of any system gets affected due to the widespread contamination of the soil. Most plants are unable to adapt when the chemistry of the soil changes so radically in a short period of time. Fungi and bacteria found in the soil that bind it together begin to decline, which creates an additional problem of soil erosion. The fertility slowly diminishes, making land unsuitable for agriculture and any local vegetation to survive. The soil pollution causes large tracts of land to become hazardous to health. Unlike deserts, which are suitable for its native vegetation, such land cannot support most forms of life.
 3. Decreased Soil Fertility: The toxic chemicals present in the soil can decrease soil fertility and therefore decrease in the soil yield. The contaminated soil is then used to produce fruits and vegetables which lacks quality nutrients and may contain some poisonous substance to cause serious health problems in people consuming them.
 4. Effect on landscape and Odour pollution: Huge piles of refuse and garbage being open dumped and littered over an area spoils the serenity of the



- landscape. The emission of toxic and foul gases from landfills pollutes the environment and causes serious effects on health of some people. The unpleasant smell causes inconvenience to other people.
5. **Changes in Soil Structure:** The death of many soil organisms (e.g. earthworms, insects and microbes) in the soil can lead to alteration in soil structure. Apart from that, it could also force their predators to move to other places in search of food.
 6. **Effect on Ecosystem and Biodiversity:** Soil pollution can lead to the lack of biodiversity in an ecosystem. The life of bird, insect, mammal and reptile species that live in the soil can get affected by pollution. The soil is an important habitat.
 7. **Contamination of Water Sources:** When it rains, surface run-off carries contaminated soil into water sources causing water pollution. Pollutants can also infiltrate down to contaminate ground water. The contaminated water is thus unfit for both animal and human consumption. It will also affect aquatic life since the organisms that live in these water bodies will find their habitats inhabitable.

Control Measures for soil degradation:

A. Prevention of soil erosion:

1. **Conservational till farming or no-till farming:** Traditionally, land is ploughed to make a planting surface. This disturbs the soil and makes it susceptible to erosion. The no-till farming method makes minimum disturbance to the top soil by making slits in the unploughed soil. Seeds, fertilizers and water are injected in these slits.

2. **Contour farming:** In this method, crops are planted in rows along contours of gently sloped land. Each row acts as a small dam to hold soil thereby slowing water runoff.



3. Terracing: In this method, steep slopes are converted into a series of broad terraces that run across the contour. This retains water for crops and reduces soil erosion by controlling runoff.
4. Alley cropping or Agro-forestry: This method involves planting crops in strips or alleys between rows of trees or shrubs that provide fruits and fuel wood. Hence, when the crop is harvested, the soil will not be eroded as the trees and shrubs remain on ground holding the soil particles.
5. Wind breaks or shelter belts: In this technique, trees are planted in long rows along the boundary of cultivated land which block the wind and reduce soil erosion. Wind breaks help in retaining soil moisture, supply wood for fuel and provide habitat for birds.

B. Ways to minimize the soil acidification process: The use of less acidifying farming practices: Retain crop residue, no nitrate• residue, less tillage etc. Applications of agricultural lime: The addition of lime raises the soil pH to• some prescribed value (pH 6.0 to 7.0).

C. Remedies to correct salt affected soil:

- Deep Tilling: Deep tilling can improve drainage for soils with high salt levels. This method works by breaking up hard soils or rocklike soil layers that prevent the downward flow of water. But is usually temporary, as some parts of the soil may harden and reseal.
- Flushing Soil and Preventing Evaporation: Flushing the soil is the process of irrigating the area with a low-salt water and washing the salt below the root zone; provided soils have good drainage. When water evaporates on a dry soil surface, it leaves salt behind. Mulching can help in retaining soil moisture.
- Chemical remediation: Modifying salty soils with sulphur, lime or calcium can help in removing or replacing the sodium in the soil. But several factors like area's groundwater, soil condition, geological factors etc. should be pondered before applying chemical remediation.
- Combination of methods: A combination approach can be more effective. Starting with correct amendment and working it in, using deep tilling. Then flushing the soil with water to leach the salt from the surface. Repeating this process, if needed.



- **Land reclamation:** Land reclamation incorporates activities centred towards restoring the previous organic matter and soil's vital minerals. This may include activities such as the addition of plant residues to degraded soils and improving range management. Salinized soils can be restored by salt level correction reclamation projects and salinity control. There is a project funded by the World Bank for reclaiming saline lands in Maharashtra, affecting 1,000 villages in the State. A significant percentage of the lands are in the farmer's suicide-prone Vidarbha region.

D. Sustainable Practices: Number of sustainable practices can be applied in order to prevent spreading of desertification. Such as following :

- **Checking overgrazing-** Fewer animals in the same area will allow plants to grow back.
- **Integrated farming -** Keep animals and grow crops. Use the manure from the animals to replace soil nutrients where the crops grow. Swap the place where the crops grow and the animals graze from time to time.
- **Plant more trees -** These will protect the soil surface from the impact of rain and the effects of wind. The roots will bind the soil together and trap water.
- **Build earth dams -** These are small dams which follow the contours of the soil. When it rains, the water does not run off the surface, but is trapped and infiltrates the soil

E. Production and use of natural fertilizers: To prevent harmful effects of chemical fertilizers, biological routes of soil fertility are being adopted. Organic farming should be practiced.

F. Education: Education is an important tool that needs to be utilized in order to help people to understand the best way to use the land. By educating them on sustainable practices, more land will be saved from being getting polluted.



Noise Pollution

Noise pollution: Causes, effects and control measures Sound is main means of communication in many animals, including humans. A low sound is pleasant and harmless. A loud, unpleasant or unwanted sound is called as noise. A given sound can appear music to some and noise to others. It depends upon loudness, duration and mood of a person. Noise (La. nausea=seasickness) is physical form of pollution. It is not harmful to air, soil and water but affects the animals including humans. Noise is unwanted sound, that is unpleasant, loud and disruptive. Humans have a hearing range called as audible range. Audible range depends upon frequency and loudness of sound. For a person with normal hearing, frequency ranges from 20 to 20,000 Hz and loudness ranges from 0 to 120 dB. Sound is measured in decibels (dB). A decibel value above 80 is considered to be noise pollution.

Sources of Noise Pollution

- 1. Industrialization:** Most of the industries use big machines which are capable of producing noise. Apart from that, various equipment's like compressors, generators, exhaust fans, grinding mills also participate in producing noise.
- 2. Poor Urban Planning:** In most of the developing countries, poor urban planning also play a vital role. Congested houses, large families sharing small space, parking lots, street noise, honking, commercial zone leads to noise pollution which disrupts the environment of society.
- 3. Social Events:** Noise is at its peak in most of the social events. Whether it is marriage, parties, pub, disc or place of worship, people normally defy rules set by the local administration and create nuisance in the area. People play songs on full volume and dance till midnight which makes the condition of people living nearby pretty worse.
- 4. Transportation:** Large number of vehicles on roads, aero planes, trains produce heavy noise. The high noise leads to a situation wherein a normal person lose the ability to hear properly.
- 5. Construction Activities:** Construction activities like mining, construction of bridges, dams, buildings, stations, roads, flyovers take place in almost every part of the world. These



construction activities have to be continued to meet the demand of ever increasing Population.

It also creates noise pollution.

6. Household Chores: We people are surrounded by gadgets and use them extensively in our daily life. Gadgets like TV, mobile, mixer grinder, pressure cooker, vacuum cleaners, washing machine and dryer, cooler, air conditioners are also contributors to the amount of noise that is produced and but many times it affects the quality of life of our neighborhood.

7. Fireworks: Firework is a common thing during various fairs, festivals and cultural ceremonies. Apart from air pollution, the intensity of their sound creates noise pollution.

8. Agricultural Machines: Tractors, thrashers, harvesters, tube wells, powered tillers etc. have all made agriculture highly mechanical but at the same time highly noisy.

9. Defence Equipment and launching of satellites: A lot of noise pollution is added to the atmosphere by artillery, tanks, launching of rockets, explosions, exercising of military airplanes and shooting practices. Screams of jet engines and launching of satellite, sonic booms have a deafening impact on the ears.

10. Miscellaneous Sources: The automobile repair shops, market places, schools, colleges, bus stands, and railway stations etc. are other sources of noise pollution.

Effects of noise pollution

Human response to noise varies from man to man according to age and temperament. It may vary even in the same individual from time to time because of change in health, fatigue and other conditions (Fig). The effects of noise on human beings are as under:-

1) **Auditory effects:** It includes deafness or auditory fatigue.

- **Deafness or impaired hearing:** Prolonged exposures to noise lead to gradual deterioration of internal ear and subsequently hearing loss or deafness. It may occur due to continuous exposure to noise level of more than 90 dB. It may be temporary or permanent. Explosions or other high intensity sounds can also cause immediate deafness by rupturing the ear drums or damaging the cochlea. Many times hearing loss is attributed to occupation.



- **Auditory fatigue:** It is defined as a temporary loss of hearing after exposure to sound. Continuous humming sound such as whistling and buzzing in the ears.

2) **Non auditory effects:** These are:-

- **Irritation and annoyance:** Noise, sometimes, leads to emotional disturbances and makes people lose their temper. It can interfere with proper rest and sleep. Annoyance seems to increase with the loudness of the sound.
- **Work efficiency:** It has been observed that noise reduces the efficiency of work.
- **Physiological effects:** It includes dilation of the pupils, paling of skin, tensing of voluntary muscles, diminishing of gastric secretions, increase in diastolic blood pressure and the sudden injection of adrenalins into blood stream which increases neuromuscular tension, nervousness, irritability and anxieties. It can adversely affect the development of unborn babies.
- **Other health effects:** Noise is also associated with headache, giddiness, sweating, nausea, fatigue, difficulty in breathing, disturbed sleep pattern, psychological stress.
- **Trouble Communicating:** High decibel noise can put trouble and may not allow people to communicate freely. Constant sharp noise can give you severe headache and disturb your emotional balance.
- **Effect on Animals:** Animals rely heavily on sounds to communicate, to find food, avoid predators etc. Pets react more aggressively due to exposure to constant noise. They become disoriented more easily and face many behavioural problems. Overexposure to high intensity of noise affects the hearing ability of many animals. Man-made noise affects mating calls and echolocation. This leads to reduction in survival and reproduction rates. At an ecosystem level, noise pollution could lead to migration of animals. Their migration can affect the crop production. Because many animals such as bats pollinate bananas, peaches, agave and other cash crops.
- **Effect on non-living things:** The noise booms cause cracks in walls of buildings as well as in hills. Sonic boom can break window panes and buildings.



Steps to Control Noise pollution

Noise pollution can be effectively controlled by taking the following measures:

(1) Control at receiver's end: For people working in noisy installations, ear-protection aids like ear-plugs, ear-muffs, noise helmets, headphones etc. must be provided to reduce occupational exposure.

(2) Suppression of noise at source: It can be achieved by following methods:

- a. Designing, fabricating and using quieter machines to replace the noisy ones.
- b. Proper lubrication and better maintenance of machines.
- c. Installing noisy machines in sound proof chambers.
- d. Covering noise-producing machine parts with sound-absorbing materials to check noise production.
- e. Reducing the noise produced from a vibrating machine by vibration damping i.e. making a layer of damping material (rubber, neoprene, cork or plastic) beneath the machine.
- f. Using silencers to control noise from automobiles, ducts, exhausts etc.

(3) Acoustic Zoning: There should be silence zones near the residential areas, educational institutions and above all, near hospitals. Zoning of noisy industrial areas, bus terminals and railway stations, aerodromes etc, away from the residential areas i.e. increasing the distance between source and receiver.

(4) Sound Insulation at Construction Stages: It reduces the chances of noise nuisance in future. Some of these measures could be:

- a) The space/cracks that get left between the door and the wall should be packed with sound absorbing material.



- b) Sound insulation can be done by constructing windows with double or triple panes of glass and filling the gaps with sound absorbing materials.
- c) Acoustical tiles, perforated plywood etc. can be fixed on walls, ceilings, floors etc. to reduce noise (especially for sound proof recording rooms etc.)

(5) Planting of Trees: Green muffler scheme involves planting green trees and shrubs along roads, hospitals, educational institutions etc. to reduce noise to a considerable extent. Trees like Ashoka, Neem, and Tamarind are good for this purpose.

(6) White noise:- It is a special type of sound signal which is used to mask background sounds. White noise helps to mask out sounds which might otherwise prevent one from either falling asleep or waking up whilst asleep.

(7) Legislative Measures: Strict legislative measures need to be enforced to curb the menace of noise pollution. Noise standards (Table) should be strictly followed. Minimum use of loudspeakers and amplifiers especially near silence zones. Banning pressure horns in automobiles. Albeit, noise has been considered as pollutant under Air act and The noise pollution (regulation and control) rules (2000) have been framed under Environment protection act. But still people need to be educated about harmful effects of noise.

Table : Ambient air quality standards in respect of noise

Area Code	Category of Area/Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
A	Industrial area	75	55
B	Commercial area	70	45
C	Residential area	65	50
D	Silence Zone	55	40

Source: CPCB



Note:

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones, which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four-abovementioned categories by the competent authority.

*dB (A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing. A "decibel" is a unit in which noise is measured. "A" in dB (A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

SOLID WASTE MANAGEMENT

Solid Waste Management: An Introduction

The term "solid waste management" refers to the collection, treatment, and disposal procedure for solid wastes. Wastes are gathered from various sources and are disposed of through the waste management process, which involves the collection, transportation, treatment, analysis, and disposal.

It is a serious worldwide problem as it causes both water and air pollution. It shows its direct effect on health, economic growth, and degradation of the environment. It can lead to pollution of the environment and outbreaks of vector-borne diseases (diseases spread by rodents and insects).

Solid waste is a non-liquid, non-soluble material ranging from municipal garbage to industrial waste that sometimes contains complex and hazardous substances. It includes domestic waste,



sanitary waste, commercial waste, institutional waste, catering and market waste, bio-medical waste, and e-waste. Several tonnes of garbage are left uncollected on the streets of most developing cities each day. It acts as a breeding ground for pests that spread disease, obstruct the sewers, and cause other infrastructural issues.

India produces 277.1 million tonnes of solid waste every year, which is likely to touch 387.8 million tonnes in 2030 and 543.3 million tonnes by 2050 due to 'rapid urbanisation, population growth, and economic development.'

Types of Solid Waste Management

- **Landfill:** It involves burying the waste in vacant locations around the city. The dumping site should be covered with soil to prevent contamination.

Benefits: A sanitary disposal method if managed effectively.

Limitations: A reasonably large area is required.

- **Incineration:** It is the controlled oxidation (burning/thermal treatment) of mostly organic compounds at high temperatures to produce thermal energy, CO₂, and water.

Benefits: Burning significantly reduces the volume of combustible waste.

Limitations: Smoke and fire hazards may exist.

- **Composting:** It is a natural process of recycling organic matter like leaves and food scraps into beneficial fertilizers that can benefit both soil and plants.

Benefits: It is beneficial for crops and is an environment-friendly method.

Limitations: Requires high-skilled labour for large-scale operation.

- **Recycling:** It is a process of converting waste material into new material. Examples: wood recycling, paper recycling, and glass recycling.

Benefits: It is environment-friendly.



Limitations: It is expensive to set up and not reliable in case of an emergency.

- **Vermicomposting:** Vermicomposting is a bio-conversion technique that is commonly used to handle solid waste. Earthworms feed on organic waste to reproduce and multiply in number, vermicompost, and vermiwash as products in this bio-conversion process.

Benefits: It reduces the need for chemical fertilizers and enhances plant growth.

Limitations: It is time-consuming, cost-ineffective, and requires extra care.

Harmful Effects of Solid Waste

- Bad odour of waste
- Production of toxic gases
- Degradation of natural beauty
- Air pollution
- Water pollution
- Soil pollution
- Spread of diseases
- Effect on biodiversity

Important Points about Solid Waste Management

- With rapid urbanization, industrialization, and an explosion in population in India, solid waste management will be a key challenge for state governments and local municipal bodies in the 21st century.
- Solid waste management is vital to the health and well-being of city dwellers.
- The urban poor is particularly vulnerable, as they generally live in informal settlements with little or no access to solid waste collection and in locations near open landfills.



- The 'Swachh Bharat Abhiyan' was created to tackle these issues related to waste management, and it created awareness among the people about the proper treatment of solid waste. Since the launch of this campaign, the waste management concept has started to gain momentum.