



SOIL POLLUTION

Environmental Studies

First Year-Environmental  
Studies

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**Subject:- Soil Pollution.**

## What is Soil..??

- Soil is the thin layer of organic and inorganic materials that covers the Earth's rocky surface.
- Soil is composed of particles of broken rock that have been altered by chemical and mechanical processes that include weathering and erosion.


## SOILPOLLUTION

- It is defined as the build-up in soils of persistent toxic compounds, chemicals, salts, radioactive materials, or disease causing agents, which have adverse effects on plant growth and animal health.
- Soil pollution is also caused by means other than the direct addition of xenobiotic (man-made) chemicals such as agricultural runoff waters, industrial waste materials, acidic precipitates, and radioactive fallout.

## SOURCES OF SOIL POLLUTION

The major sources of soil pollution are as follow:

- **Industrial Wastes:** Disposal of industrial wastes is the important source of soil pollution. Industrial pollutants are mainly discharged from chemical industries, sugar factories, tanneries, textile mills, steel industries, distilleries, pulp and paper mills, oil refineries, petroleum industries etc. Thermal and atomic power plants also add pollutants to the soil.
- **Agricultural Wastes:** Agricultural wastes are the common pollutants of soil pollution. Fertilizers, pesticides, insecticides, weedicides etc. cause soil pollution and adversely affect

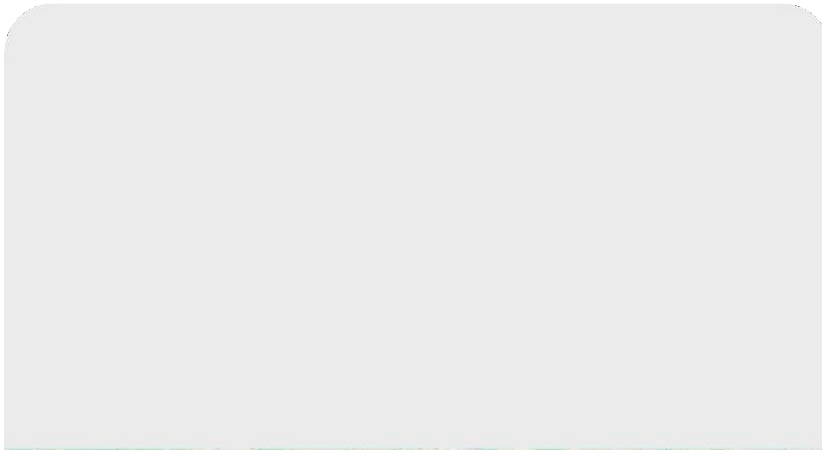


the physical, chemical and biological properties of soil.

- Urban Wastes: Urban wastes consist of both commercial as well as domestic wastes which include plastics, glass, metallic cans, fibers, paper, street sweepings, leaves, rubbles etc. and contribute to soil pollution.
- Radioactive Materials: Radioactive materials resulting from explosion in nuclear devices penetrate into soil and enter the food chain which cause detrimental effect on the body tissues. Hiroshima and Nagasaki, which were bombarded in Second World War, are good examples of radioactive soil pollution.
- Biological Agents : Other important soil pollutants are biological agents which include biological organisms from human and animal excreta. In addition to this, faulty sanitation and disposal of waste water cause soil pollution.



➤ Excess application of pesticides  
etc.



➤ Industrial seepage



➤ Solid waste seepage





## Solid waste

- Solid waste or refuse is the solid and semi solid waste arising from human and animal activities except human excreta and sullage (i.e. liquid waste from bath rooms, kitchens etc.) discarded as useless. Higher standards of living of ever increasing population has resulted in the increase in quantity of solid waste. Solid waste has a great impact on the environment. Solid waste management aims at minimizing the adverse effect of solid waste.
- Pathogenic Organisms Excreted by Man: Human excreta includes pathogens such as enteric bacteria and parasitic by animals like earth worms, millipedes, dipterous larvae, snails including higher animals carry fungal and bacteria spores. The disease producing organisms are transmitted from animals to soil and then from soil to man.
- Sediments or suspended Solids: Soil sand and other solids washed into water bodies due to soil erosion (by natural processes, mining, agricultural and constructional activities, etc.) and disposal of sewage and industrial effluents into water bodies result in contaminating the water with suspended solids as well as

sediments. These solids are in the form of organic or inorganic particles or of immiscible liquids (oils and greases). The presence of these solids increases the turbidity in water; thereby, reducing the amount of sunlight available for photosynthesis of the aquatic plants. Other effects include suffocation of the aquatic habitats (fishes, etc.) silting of rivers and reservoirs, erosion of pumping equipment and power turbines, etc.

## CLASSIFICATION OF SOLID WASTE

Solid waste may be classified on the following basis :

**1. Types of waste:**

- (i) Bio-degradable solid waste,
- (ii) Non bio-degradable solid

**2. Source of waste:**

- (i) Municipal solid waste,
- (ii) Industrial solid waste,
- (iii) Bio- medical solid waste.

## 1. On the Basis of types of waste :

- (i) **Bio-degradable solid waste:** The waste which can be broken down into harmless or non-poisonous substances by action of micro-organisms is called bio degradable solid waste.
- (ii) **Non Bio-degradable Solid Waste :** The waste which cannot be broken down by the action of micro-organism is called non bio-degradable solid waste.

## 2. On the Basis of sources of Waste:


- (i) **Municipal Solid Waste:** Municipal solid waste consists of household waste, waste from streets and roads, sanitation residue, construction and demolition debris etc. With rising urbanization and standards of living, the amount of municipal solid waste is increasing rapidly. More than 70% of Indian cities lack adequate capacity to transport municipal solid waste and there are no sanitary landfills to dispose of the waste. The existing landfills are neither well managed nor well equipped and are not lined properly to protect against contamination of soil and ground water.
- (ii) Certain types of household wastes are hazardous which include expired medicines, medicine bottles, shoe polish, old batteries, paint tins etc.

- (iii) **Industrial Solid Waste** : Industrial solid waste may be defined as the solid waste generated by manufacturing processes. Industrial waste is generally considered hazardous as it may contain toxic substances. The major sources of industrial waste are thermal power plants which produce coal ash, sugar industries which produce mud, pulp and paper, industries producing lime and fertilizer, integrated iron and steel mills, metal industries etc.
- (iv) **Biomedical Solid Waste** : Biomedical solid waste consists of waste released by hospitals, clinics, diagnostic centers etc. in the diagnosis and treatment of human beings. This type of waste includes cotton, syringes, bandage, glass bottles, plastic bottles, discarded medicines, anatomical and pathological waste etc.

#### EFFECTS OF SOLID WASTE

Improper handling and transfer of solid waste cause ill effects on the environment and human health which are as follow:

1. Flies breed on the refuse dump and solid waste which contaminate water and food. Contaminated water and food cause diseases like diarrhea bacillary dysentery etc.
2. Depending upon the solid wastes, rats may cause diseases like plague, trichinosis, salmonellosis, endemic typhus etc.

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1. Perlocation of decomposed garbage dumps into soil cause pollution of land and underground water.
  2. Smoke due to the burning of waste pollutes air.
  3. Bad odour due to the decomposition of organic solid waste pollutes air.
  4. Contaminated water supply may spread large scale epidemic of jaundice, cholera, gastro-intestinal diseases etc.

## E-WASTE

E-waste means discarded electronic products such as computers, televisions, stereos, copiers, fax machines, cell phones etc. E-waste, if not disposed off properly, can leach lead and other substances into soil and ground water. Many of these products can be reused, refurbished or recycled in an environmental friendly manner so that they are less harmful to the eco-system. Disposal of e-waste is a big problem across the globe.

### Effect of E-waste on Human Health

Source of E-waste	Constituent	Health Effect
Mother-board Computer housing	Beryllium (Be) PVC	Lung, cancer, skin diseases such as warts.
Relays and switches, PCBs	Mercury (Hg) Cadmium (Cd)	Damage of immune system, reproductive and developmental
Chip resistors and semi-conductors		problems, interference with regulatory hormones.
Solder in PCBs, glass panels and gaskets in computer monitors	Lead (Pb)	Chronic damage to brain, respiratory and skin disorders. Toxic irreversible effect on human health, damage to

		kidney and liver.
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## CONTROL OF SOLID WASTE

The main objective of solid waste control is to minimize the adverse effects of solid waste on the environment. The various steps involved are as follow:

- A. **Collection of solid waste,**
- B. **Disposal of solid waste,**
- C. **Utilization of solid waste**

1. **Collection of solid waste** : Collection of waste includes collection the waste, transporting it centralized location and then moving it to the of disposal.

2. **Disposal of solid waste:** Before the final disposal of the solid waste, it is processed to

3 recover the usable material and to improve the efficiency of the solid waste disposal system.

Utilization of Solid Waste : The solid waste can be properly utilized to obtain the benefits

such as :-

- (i) Conservation of natural resources.
- (ii) Economic development.
- (iii) Control of air pollution

### METHODS OF SOLID WASTE DISPOSAL

The following methods may be adopted for disposing of the solid waste:

1. Landfilling,
2. Incineration,
3. Composting,
4. Pulverization,
5. Pyrolysis
6. Disposal into sea.

1. **Landfilling**: Landfilling is the most popular solid waste disposal method used today. Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam.



### **Advantages**

- (i) It is simple and economical. Segregation of waste is not required.
- (ii) Landfilled areas can be reclaimed and used for other purpose.

### **Disadvantages**

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- (i) Large area is required.
- (ii) Land availability is away from town, therefore, transportation costs are high. It causes fire hazard due to formation of methane in wet weather.

**2. Incineration** : In this method, solid waste is burnt in a furnace called incinerator.

- (i) Residue is only 20-25% of the original solid waste and can be used as clinker after treatment. It requires very little space.
- (ii) An incinerator plant of 3000 tonnes capacity per day can generate 3MW of power.

### **Disadvantages:**

- (i) Its capital and operating cost is high.
- (ii) Operation needs skilled personnel.

(iii) Formation of smoke, dust and ashes needs further disposal and that may cause air pollution.

3. **Composting:** Due to lack of adequate space for landfills, bio-degradable waste is allowed to decompose in a medium designed for the purpose. Only bio-degradable waste materials are used in composting.

**Advantages:**

(i) Manure added to soil increases water retention and ion-exchange capacity of soil.

(ii) This method can be used to treat several industrial solid wastes.

**Disadvantages:**


(i) Non- consumable materials have to be disposed off separately

(ii) The technology has not caught farmers and hence does not have an assured market.

1. **Pulverisation:** In this method, solid waste is pulverized in grinding machine to reduce its volume and physical character.

2. **Pyrolysis :** In pyrolysis, chemical energy of some organic wastes is recovered by destructive distillation.

3. **Disposal into Sea :** This method is used in coastal areas having deep sea water (>30m) at a reasonable distance (<10 to 20 km). It is a simple and cheap method , but has following disadvantages:

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- (i) Light components of solid waste float on the water surface and tend to return to shores during high tides.
  - (ii) Some portion of solid waste may return to the beaches despite all necessary precautions.



The most common chemicals involved in causing soil pollution are:

- Petroleum hydrocarbons
- Heavy metals
- Pesticides
- Solvents

## Types of Soil Pollution

- Agricultural Soil Pollution
  - i) pollution of surface soil
  - ii) pollution of underground soil
- Soil pollution by industrial effluents and solid wastes
  - i) pollution of surface soil
  - ii) disturbances in soil profile
- Pollution due to urban activities
  - i) pollution of surface soil
  - ii) pollution of underground soil

## Agricultural Soil Pollution

- Plants on which we depend for food are under attack from insects, fungi, bacteria, viruses, rodents and other animals, and must compete with weeds for nutrients.
- To kill unwanted populations living in or on their crops, farmers use pesticides.
- The remnants of such pesticides used on pests may get adsorbed by the soil particles and contaminate root crops grown in that soil.
- The consumption of such crops causes the pesticides remnants to enter human biological systems, affecting them adversely.

# Agricultural effects:

- Reduced soil fertility
- Reduced nitrogen fixation
- Increased erodibility
- Larger loss of soil and nutrients
- Deposition of silt in tanks and reservoirs
- Reduced crop yield
- Imbalance in soil fauna and flora

# Agricultural effects:





# Industrial Soil Pollution

- Large quantity of solid wastes like unused and rejected chemicals (like sludge, press mud, saw dust, bottles, plastic materials etc.), unwanted industrial wastes generated during manufacturing processes are dumped over on the surface of soil by almost all industries with difference in the degree.
- Larger the production base, larger is the generation of wastes.
- Traditionally, these materials have been dumped around the factory site or around the entire city. Rarely, they are

# Industrial Soil Pollution





### Industrial effects:

- Dangerous chemicals entering underground water.
- Ecological imbalance.
- Release of pollutant gases.
- Increased salinity.
- Reduced vegetation.

Industrial  
Effects:



Polluted land with dangerous  
chemicals



Soil pollution due to industrial  
waste

## Soil Pollution due to Urbanization

- Urban activities generate large quantities of city wastes including several Biodegradable materials (like vegetables, animal wastes, papers, wooden pieces, carcasses, plant twigs, leaves, cloth wastes as well as sweepings) and many non-biodegradable materials (such as plastic bags, plastic bottles, plastic wastes, glass bottles, glass pieces, stone / cement pieces).
- On a rough estimate Indian cities are producing solid city wastes to the tune of 50,000 - 80,000 metric tons every day.
- If left uncollected and decomposed, they are a cause of several problems.

# Urbanization effects:

- Clogging of drains
- Inundation of areas
- Public health problems
- Pollution of drinking water sources
- Foul smell and release of gases
- Waste management problems

# Urbanization



### Some more effects of soil pollution:

- Pollution runs off into rivers and kills the fish, plants and other aquatic life.
- Crops and fodder grown on polluted soil may pass the pollutants on to the consumers.
- Polluted soil may no longer grow crops and fodder
- Soil structure is damaged (clay ionic structure impaired.)
- Corrosion of foundations and pipelines
- May release vapors' and hydrocarbon into buildings and cellars
- May create toxic dusts
- May poison children playing in the area



Some more effects of soil pollution:



# Methods to control Soil Pollution

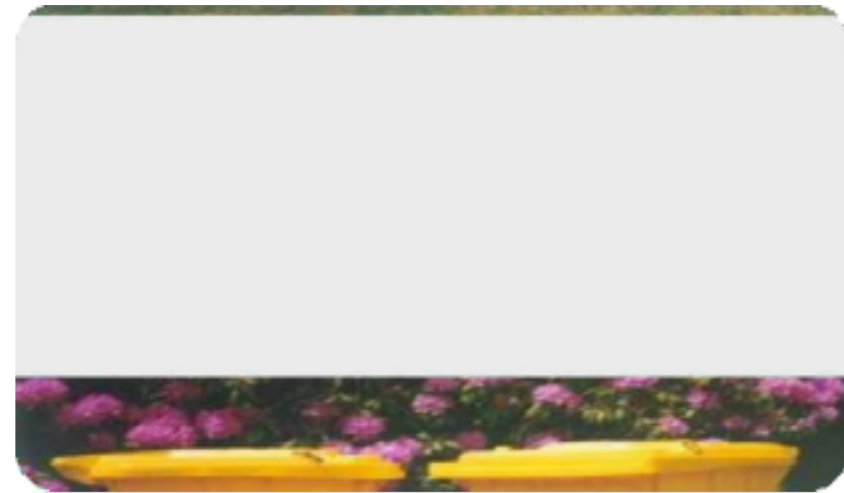
- **Reducing** chemical fertilizer and pesticide use.
- **Recycling** is another way to reduce and control soil pollution. Recycling paper, plastics and other materials reduces the volume of refuse in landfills, another common cause of soil pollution.
- **Reusing** of materials
- **De-forestation**, the cutting down of trees, causes erosion, pollution and the loss of fertility in the topsoil. Planting trees--or re-forestation--helps prevent soil

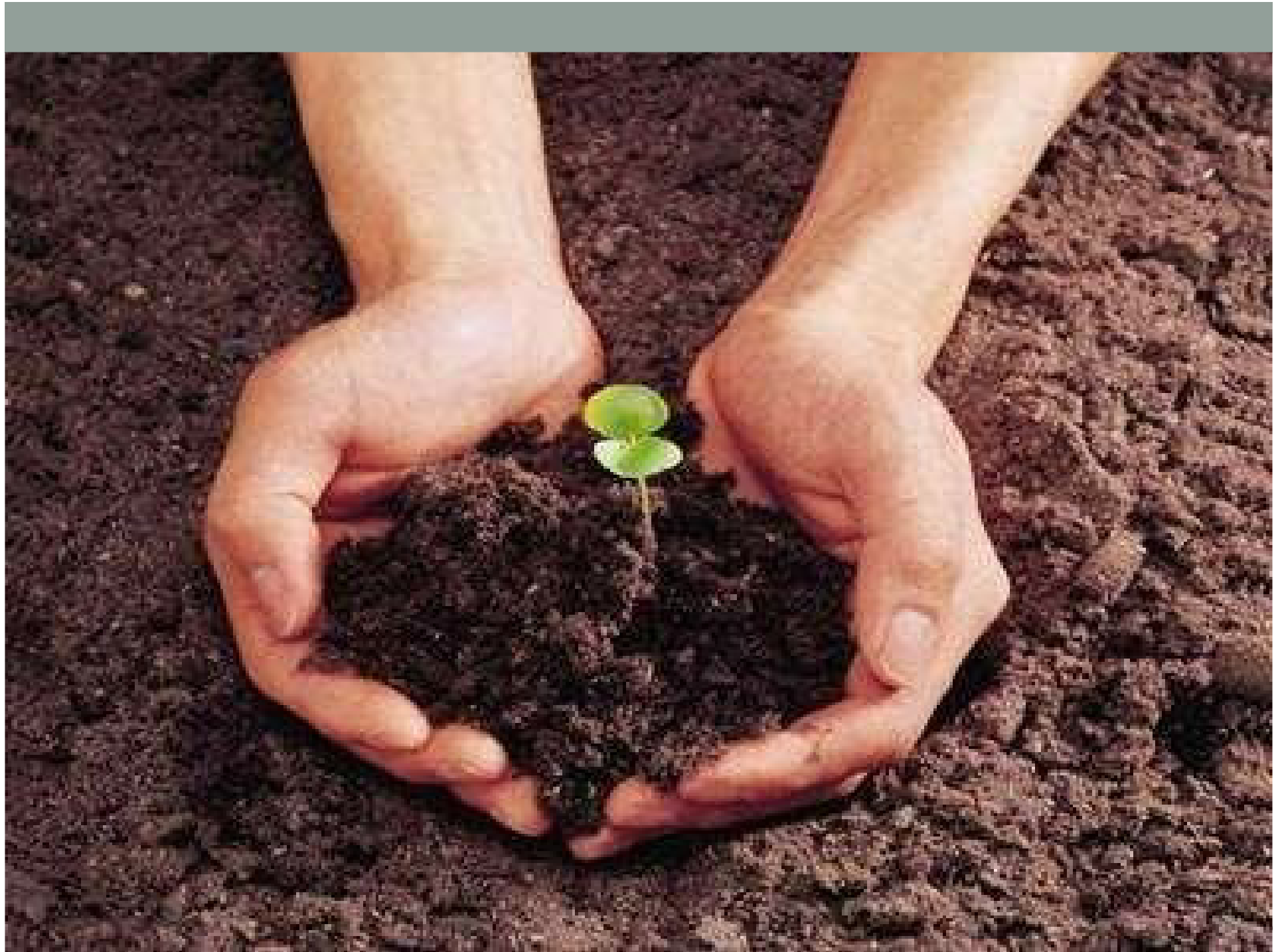
erosion and pollution.

# Methods to control SoilPollution

- Weeds soak up minerals in the soil. Reducing weed growth helps reduce soil pollution. One of the more common methods of reducing weed growth is covering the soil with numerous layers of wet newspapers or a plastic sheet for several weeks before cultivation. This prevents light from reaching the weeds, which kills them.
- Designated pits should be used for the dumping of soil wastes. These wastes should be treated chemically and biologically to make them less toxic and hazardous.

# Methods to control SoilPollution








Questions:-

- 1.What is soil pollution ?
- 2.How is it caused ?
- 3.Types of soil pollution .
- 4.What are the effects of soil pollution ?
- 5.How can we control soil pollution ?

LONG ANSWER TYPE QUESTIONS:

1. What do you mean by solid waste?
2. Explain the causes of rapid growth of solid waste.  
Give its Classification.



3. Explain different methods of solid

waste disposal.

4. What do you mean by E-waste?

What are the effects of E-waste on human health? Explain.

5. Explain E-waste management.



THANK YOU