# GLocal Module - Pollution

Eruditus Language School

# 1. Introduction

Nowadays pollution represents one of the biggest concerns of our time and requires an urgent reaction from all relevant parts of our society.
This module will show to what extent pollution is related to human activities, its effects on the planet and climate change. It attempts to offer solutions in terms of behavioural change and actions we can take (especially at individual level) to reduce pollution.

# 2. Learning objectives

At the end of this course, the learner will:

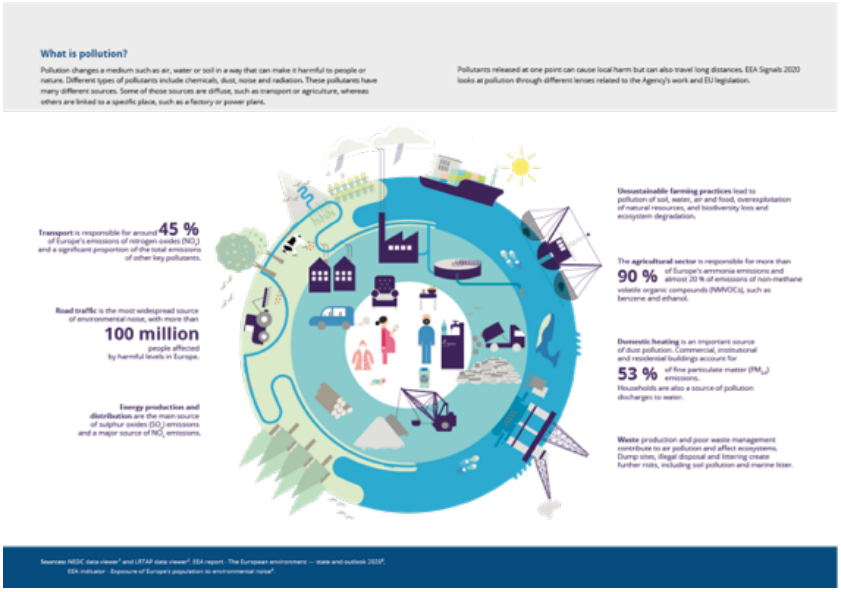
- have gained awareness of current forms of pollution and an overview of both their causes and consequences to natural, economic and social systems.
- understand environmental problems, looking at causal linkages between pollution sources and impacts to environmental quality and human health
- differentiate between different types of pollutants.
- realize that everyday decisions have an impact on the environment
- have been exposed to learning examples of good practice of technologies and options used to remediate and reduce pollution of the environment

# 3. Pollution

## 3.1 Definition of Pollution

Pollution is the introduction of contaminants into the natural environment that causes adverse change. It can take the form of chemical substances or energy, such as noise, heat, or light. The components of pollution - called **pollutants** - can be either foreign substances/energies or naturally occurring contaminants.

Although pollution can be caused by natural events, the word pollution generally implies that the contaminants have an **anthropogenic** source – that is, a source created by **human activities.**



Source: What Is Pollution? www.eea.europa.eu

## 3.2 Types of pollution

When we think of pollution, we often think of it as a visible problem. This notion usually conjures up images of rubbish dumps, smoke clouds and oil slicks. And yet, most forms of pollution are invisible to the human eye and come in a variety of different forms: air, water, soil, radioactive, noise, heat/ thermal, and light.

# 4. Major Types of Pollution

## 4.1 Soil/Land Pollution

Soil pollution also called soil contamination, is caused by the presence of xenobiotics (human-made), by the presence of toxic chemicals (pollutants or contaminants), by their unnatural high concentrations, (exceeding the levels that should naturally be present), their unnatural existence, or other alteration in the natural soil environment, that pose a risk to human health and/or the ecosystem. It is typically caused by industrial activity, agricultural chemicals, or improper disposal of waste.

### 4.1.1 Causes of Soil Pollution

**What are Soil Pollution Causes?**

There are two main causes for soil pollution

A. **Anthropogenic (man-made) causes**
B. **Natural causes**

### A. Anthropogenic/Man-Made Pollutants

Anthropogenic (man-made) soil pollution originates in several types of processes, some deliberate (industrial) and some accidental. Human-caused soil pollution can work in conjunction with natural processes to increase the toxic contamination levels in the soil.

- Accidental spills and leaks during storage, transport or use of chemicals (e.g. leaks and spills of gasoline and diesel at gas stations);
- Foundry activities and manufacturing processes that involve furnaces or other processes resulting in the possible dispersion of contaminants in the environment;
- Mining activities involving the crushing and processing of raw materials, for instance, heavy metals, emitting toxic substances;
- Construction activities : Urbanization and Construction
  While urbanization is not in itself littering, large quantities of people living, producing trash, and littering in a dense area does inevitably lead to land pollution. To accommodate this increased population, construction activities also occur, which result in large waste materials, such as metal, plastic, wood, and bricks. When these materials are not properly disposed of, it contributes to the land pollution of that area.
  To help reduce the environmental impact of construction sites, it is important to work with partners that offer comprehensive builder solutions to achieve cost-effective construction recycling and waste disposal plans.
- Agricultural activities involving the diffusion of herbicides, pesticides and/or insecticides and fertilizers;
- Transportation activities, releasing toxic vehicle emissions
- Chemical waste dumping, whether accidental or deliberate – such as illegal dumping;
- The storage of waste in landfills, as the waste products may leak into groundwater or generate polluted vapors
- Cracked paint chips falling from building walls, especially lead-based paint.

Construction sites are the most important triggers of soil pollution in urban areas, due to their almost ubiquitous nature. Almost any chemical substance handled at construction sites may pollute the soil. However, the higher risk comes from those chemicals that can travel more easily through the air as fine particulate matter. The chemicals that travel as particulate matter are more resistant to degradation and bioaccumulate in living organisms, such as PAHs.
Additionally, construction dust may easily spread around through the air and is especially dangerous because of its lower particle size (less than 10 microns). Such construction dust can trigger respiratory illnesses such as asthma and bronchitis, and even cancer. Moreover, the sites that involve the demolition of older buildings can release asbestos, a toxic mineral that can act as a poison in soil. Asbestos particles can be redistributed by the wind.

### B. Natural Pollutants

Apart from the rare cases when a natural accumulation of chemicals leads to soil pollution, natural processes may also have an influence on the human released toxic chemicals into the soil, overall decreasing or increasing the pollutant toxicity and/or the level of contamination of the soil. This is possible due to the complex soil environment, involving the

presence of other chemicals and natural conditions which may interact with the released pollutants.
Natural processes leading to soil pollution:

- **Natural accumulation of compounds** in soil due to imbalances between atmospheric deposition and leaking away with precipitation water (e.g., concentration and accumulation of perchlorate in soils in arid environments)
- **Natural production** in soil under certain environmental conditions (e.g., natural formation of perchlorate in soil in the presence of a chlorine source, metallic object and using the energy generated by a thunderstorm)
- **Leaks from sewer lines** into subsurface (e.g., adding chlorine which could generate trihalomethanes such as chloroform).

**The pollutants may enter the soil/land via:**

- waste disposal (e.g. landfills);
- air deposition, either dry (e.g. from mining and smelting activities, foundries etc.) or wet (e.g. acid rain);
- contact with contaminated surface or ground waters.

Soil pollutants, including chemicals and pathogens, have interchangeable liquid, solid or gaseous forms that mix until an equilibrium is reached between the three. The solid forms are absorbed or mixed with soil particles, liquids fill the voids made of pores between soil particles, and the gaseous forms surround the air between soil particles. This means that we can be exposed to gaseous, liquid and solid forms of soil pollution separately or together at the same time.

## 4.1.2 Consequences of Soil Pollution

Soil pollution affects plants, animals, and humans alike. It may enter our bodies directly - through the inhalation of soil dust or soil particles, or through skin contact, or indirectly - through the consumption of food, especially vegetables grown in contaminated soil, or by inhaling the toxic vapours of volatile chemicals polluting the soil.

**Soil pollution touches essentially every area of the living world, including:**

- Water that isn't safe to drink
- Polluted soil, which leads to a loss of fertile land for agriculture
- Climate change, which causes an onslaught of disastrous problems, including flash floods and irregular rainfalls
- The endangerment and extinction of species in wildlife
- Habitat shifting, where some animals are forced to flee where they live in order to survive
- An increase in wildfires, due to polluted areas often becoming very dry
- Increased air pollution, which burning waste contributes to

**Direct Exposure**
Soil pollution effects may vary based on age, general health status and other factors, such as the type of pollutant or contaminant inhaled or ingested. However, children are usually more susceptible to exposure to contaminants, because they come in close contact with the

soil by playing in the ground; combined with lower thresholds for disease, this triggers higher risks than for adults.

**Agriculture**
Crops or plants grown on such contaminated soil absorbs toxic material from the soil and will decrease the agricultural output of a land. When animals or human beings consume these crops or plants the toxic material can pass into their body.

**Toxic gases**
Humans can be affected by soil pollution through the inhalation of gases emitted from soils moving upward, or through the inhalation of matter that is disturbed and transported by the wind because of the various human activities on the ground.

**Diseases**
Soil pollution may cause a variety of health problems, starting with short terms problems:

- headaches
- nausea
- fatigue
- skin rash
- eye irritation

Long term diseases due to the inhalation of soil particulate matter and the ingestion of contaminated food can potentially result in serious conditions, of which the most common include:

- **Cancer, including leukaemia** – caused by the contact with soils contaminated with chemicals (e.g. gasoline, benzene)
- Asthma and bronchitis
- **Nervous system damage** – caused especially by the presence of lead (Pb) in soil, and affecting especially children
- **Neuromuscular blockage and depression of the central nervous system**
- **Kidney and liver damage** – caused by chemicals such as mercury (Hg)

### 4.1.3 Pollutants and Contaminants

Soil pollution consists of pollutants and contaminants. The main pollutants of the soil are the biological agents and some of the human activities. Soil contaminants are all products of soil pollutants that contaminate the soil. Human activities that pollute the soil range from agricultural practices that infest the crops with pesticide chemicals to urban or industrial wastes or radioactive emissions that contaminate the soil with various toxic substances.

- **Biological Agents:** Biological agents work inside the soil to introduce manures and digested sludge (coming from the human, bird and animal excreta) into the soil.
- **Agricultural Practices:** The soil of the crops is polluted to a large extent with pesticides, fertilizers, herbicides, slurry, debris, and manure.
- **Radioactive Pollutants:** Radioactive substances such as Radium, Thorium, Uranium, Nitrogen, etc. can infiltrate the soil and create toxic effects.
- **Urban Waste:** Urban waste consists of garbage and rubbish materials, dried sludge and sewage from domestic and commercial waste.

- **Industrial Waste:** Steel, pesticides, textiles, drugs, glass, cement, petroleum, etc. are produced by paper mills, oil refineries, sugar factories, petroleum industries and others as such.

Tiny amounts of contaminants accumulate in the soil and - depending on the environmental conditions (including soil types) and the degradability of the released contaminant - can reach high levels and pollute the soil. If the soil is contaminated, home-grown vegetables and fruits may become polluted too.

**Examples of Soil Contaminants**
There is a large variety of pollutants that could poison the soil. Examples of the most common and problematic soil pollutants can be found below.

- Lead (Pb): Potential sources: lead paint, mining, foundry activities, vehicle exhaust, construction activities, agriculture activities.
- Copper (Cu): Potential sources: mining, foundry activities; construction activities
- Zinc (Zn): Potential sources: mining; foundry activities; construction activities
- Arsenic (As): Potential sources: mining, coal-fired power plants, lumber facilities, electronics industry, foundry activities, agriculture, natural accumulation
- Herbicides/Insecticides: Potential sources: agricultural activities; gardening
- PAHs (polyaromatic hydrocarbons): Potential sources: coal burning, vehicle emissions, accumulation in plants & vegetables grown on polluted soils; cigarette smoke; wildfires, agricultural burning; wood burning, constructions

## 4.1.4 How to prevent Soil Pollution on a personal level

Given the disastrous effects of soil pollution, taking preventive measures to reduce its impact moving forward is crucial.

- **Using Fewer Pesticides and Chemicals in Gardening**
  Given that the use of pesticides and chemicals in gardening, farming and agriculture greatly contribute to land pollution, finding alternatives will help to reduce the environmental impact. Farmers, for instance, can use natural ingredients by switching from bio-fertilizers to manure.
  On the individual level, supporting environmentally conscious, local farmers at your closest farmer's market or local grocery store can help to build up business for farmers with more sustainable farming practices. Another option is to contribute to or volunteer in an urban garden in your neighbourhood.
- **Reduce, Reuse and Recycle**
  At the individual level, there are many things we can do to reduce our contribution to land pollution. One of the simplest ways to do this is to reuse or recycle items so that you aren't creating waste out of a material or item that still has a purpose. With the growing awareness around what can be recycled and an increase in recycling bins in many cities, it has never been easier to recycle.
- **Reforestation activities**
  Reforestation involves replanting an area with trees. This can be needed for areas that have experienced wildfires, for instance, or where trees had been chopped down and milled. This process helps to bind the soil, which helps to protect it from land pollution and prevents soil erosion and flooding.

## 4.2 Water Pollution

The World Health Organisation (WHO) says that polluted water is water whose composition has been changed to the extent that it is unusable. In other words, it is toxic water that cannot be drunk or used for essential purposes like agriculture, and which also causes diseases like diarrhoea, cholera, dysentery, typhoid and poliomyelitis that kill more than 500,000 people worldwide every year.
The main water pollutants include bacteria, viruses, parasites, fertilisers, pesticides, pharmaceutical products, nitrates, phosphates, plastics, faecal waste and even radioactive substances. These substances do not always change the colour of the water, meaning that they are often invisible pollutants.
Like soil and air pollution, water pollution is one of the most harmful types of pollution. A major volume of the pollutants produced on land end up in water bodies. Toxic wastes released by industries, pathogens released in sewage, harmful chemicals present in agricultural runoffs, etc., are some of the top water pollutants. The contamination of water can lead to epidemics and even pandemics that can wipe out the population of an entire species or even more than one species.

### 4.2.1 Causes of Water Pollution

Water Pollution is sometimes caused by nature, such as when mercury filters from the Earth's crust, polluting oceans, rivers, lakes, canals, and reservoirs. However, **the most common cause is human activity** and its consequences:

- **Industrial Waste**

Industries and industrial sites across the world are a major contributor to water pollution. Many industrial sites produce waste in the form of toxic chemicals and pollutants, and though regulated, some still do not have proper waste management systems in place. In those rare cases, industrial waste is dumped into nearby freshwater systems. When industrial waste is not treated properly (or worse, not treated at all), it can very easily pollute the freshwater systems that it comes into contact with.
Industrial waste from agricultural sites, mines and manufacturing plants can make its way into rivers, streams and other bodies of water that lead directly to the sea. The toxic chemicals in the waste produced by these industries not only have the potential to make water unsafe for human consumption, they can also cause the temperature in freshwater systems to change, making them dangerous for many water dwelling organisms.

- **Marine Dumping**

The process of marine dumping is exactly what it sounds like, dumping garbage into the waters of the ocean. It might seem crazy, but household garbage is still collected and dumped into oceans by many countries across the world. Most of these items can take anywhere from two to 200 years to decompose completely.

- **Sewage and Wastewater**

Harmful chemicals, bacteria and pathogens can be found in sewage and wastewater even when it's been treated. Sewage and wastewater from each household is released into the sea with fresh water. The pathogens and bacteria found in that wastewater breed disease, and therefore are a cause of health-related issues in humans and animals alike.

- **Oil Leaks and Spills**

The age-old phrase "like water and oil" is used when describing two things that do not mix easily or at all. Just as the saying states, water and oil do not mix, and oil does not dissolve in water. Large oil spills and oil leaks, while often accidental, are a major cause of water pollution. Leaks and spills often are caused by oil drilling operations in the ocean or ships that transport oil.

- **Agriculture**

In order to protect their crops from bacteria and insects, farmers often use chemicals and pesticides. When these substances seep into the groundwater, they can harm animals, plants and humans. Additionally, when it rains, the chemicals mix with rainwater, which then flows into rivers and streams that filter into the ocean, causing further water pollution.

- **Global Warming**

Rising temperatures due to global warming are a major concern in terms of water pollution. Global warming causes water temperatures to rise, which can kill water-dwelling animals. When large die-offs occur, it further pollutes the water supply, exacerbating the issue.
There are many everyday ways you can help reduce global warming, which will in turn help lower water pollution. These methods include recycling, carpooling and using CFL bulbs in your home.

- **Radioactive Waste**

Radioactive waste from facilities that create nuclear energy can be extremely hazardous to the environment and must be disposed of properly. This is because uranium, the element used in the creation of nuclear energy, is a highly toxic chemical.
Unfortunately, accidents still occur at these facilities, and toxic waste is released into the environment. The coal and gas industries are, in many ways, no better. This is one of the major impetuses behind the development of alternative, clean sources of energy, including solar and wind.

- **Deforestation**

Felling forests can exhaust water resources and generate organic residue which becomes a breeding ground for harmful bacteria.

- **Rubbish and faecal water dumping**

The UN says that more than 80% of the world's sewage finds its way into seas and rivers untreated.

- **Maritime traffic**

Much of the plastic pollution in the ocean comes from fishing boats, tankers and cargo shipping.

- **Household pollutants**

They are contaminants that are released during the use of various products in daily life. Many commonly used household products release toxic chemicals. As an alternative, manufacturers are introducing products, often referred to as green products, whose manufacture, use, and disposal do not become a burden on the environment.

## 4.2.2 Household products and their potential health effects

**Examples of hazardous household products:**

- common household cleaners
- detergents from washing your car
- fertilizers
- improper disposal of paint, oil, or other chemicals
- insecticides, and fungicides
- loose grass clippings and leaves
- pet droppings
- poorly maintained septic systems
- soil from exposed areas in the yard
- weed killer
- pool chemicals
- health and beauty aids

| Product Type | Harmful Ingredients | Potential Health Hazards |
|---|---|---|
| SOURCE: Compiled by author. | | |
| Air fresheners & deodorizers | Formaldehyde | Toxic in nature; carcinogen; irritates eyes, nose, throat and skin; nervous, digestive, respiratory system damage |
| Bleach | Sodium hypochlorite | Corrosive; irritates and burns skin and eyes; nervous, respiratory, digestive system damage |
| Disinfectants | Sodium hypochlorite | Corrosive; irritates and burns skin and eyes; nervous, respiratory, digestive system damage |
| | Phenols | Ignitable; very toxic in nature; respiratory and circulatory system damage |
| | Ammonia | Toxic in nature; vapor irritates skin, eyes and respiratory tract |
| Drain cleaner | Sodium/potassium hydroxide (lye) | Corrosive; burns skin and eyes; toxic in nature; nervous, digestive and urinary system damage |
| Flea powder | Carbaryl | Very toxic in nature; irritates skin; causes nervous, respiratory and circulatory system damage |
| | Dichlorophene | Toxic in nature; irritates skin; causes nervous and digestive system damage |

| Product Type | Harmful Ingredients | Potential Health Hazards |
|---|---|---|
| | Chlordane and other chlorinated hydrocarbons | Toxic in nature; irritates eyes and skin; cause respiratory, digestive and urinary system damage |
| Floor cleaner/wax | Diethylene glycol | Toxic in nature; causes nervous, digestive and urinary system damage |
| | Petroleum solvents | Highly ignitable; carcinogenic; irritate skin, eyes, throat, nose and lungs |
| | Ammonia | Toxic in nature; vapor irritates skin, eyes and respiratory tract |
| Furniture polish | Petroleum distillates or mineral spirits | Highly ignitable; toxic in nature; carcinogen; irritate skin, eyes, nose, throat and lungs |
| Oven cleaner | Sodium/potassium hydroxide (lye) | Corrosive; burns skin, eyes; toxic in nature; causes nervous and digestive system damage |
| Paint thinner | Chlorinated aliphatic hydrocarbons | Toxic in nature; cause digestive and urinary system damage |
| | Esters | Toxic in nature; irritate eyes, nose and throat |
| | Alcohols | Ignitable; cause nervous system damage; irritate eyes, nose and throat |
| | Chlorinated aromatic hydrocarbons | Ignitable; toxic in nature; digestive system damage |
| | Ketones | Ignitable; toxic in nature; respiratory system damage |
| Paints | Aromatic hydrocarbon thinners | Ignitable; toxic in nature; carcinogenic; irritates skin, eyes, nose and throat; respiratory system damage |
| | Mineral spirits | Highly ignitable; toxic in nature; irritates skin, eyes, nose and throat; respiratory system damage |
| Pool sanitizers | Calcium hypochlorite | Corrosive; irritates skin, eyes, and throat; if ingested cause severe burns to the digestive tract |
| | Ethylene (algaecides) | Irritation of eyes, mucous membrane and skin; effects reproductive system; probable human carcinogen of medium carcinogenic hazard |
| Toilet bowl cleaner | Sodium acid sulfate or oxalate or hypochloric acid | Corrosive; toxic in nature; burns skin; causes digestive and respiratory system damage |
| | Chlorinated phenols | Ignitable; very toxic in nature; cause respiratory and circulatory system damage |
| Window cleaners | Diethylene glycol | Toxic in nature; cause nervous, urinary and digestive system damage |
| | Ammonia | Toxic in nature; vapor irritates skin, eyes and respiratory tract |

### 4.2.3 Consequences of Water Pollution

When discussing the issues that can arise due to water pollution, there are three major areas to consider:

- **Health:** According to the United Nations, every year there are more deaths caused by polluted water than all types of violence combined, including war. Waste from humans and animals that contaminates water carries bacteria and viruses that cause the spread of diseases such as typhoid, cholera, giardia, diarrhoea, dysentery, hepatitis A, typhoid, and polio. Absent, inadequate, or inappropriately managed water and sanitation services expose individuals to preventable health risks. Exposure occurs through ingestion, inhalation, or direct contact with contaminated drinking or recreational water and through consumption of contaminated fish and shellfish.
- **Environment:** All the species in an ecosystem rely on each other in order to survive. Outside substances, such as pollutants found in wastewater, can disrupt the complicated relationships between species that an ecosystem needs in order to thrive.
- **Economy:** Polluted water can have many negative effects on the economy. It directly impacts sectors such as commercial fishing, recreational businesses, tourism and even property values, all of which rely heavily on clean water. Polluted drinking water can also cause treatment costs to rise, which in turn makes the cost of drinking water rise as well.

### 4.2.4 Household Water Pollution

Safe and readily available water is important for public health, whether it is used for drinking, domestic use, food production or recreational purposes. In 2010, the UN General Assembly explicitly recognized the human right to water and sanitation. Everyone has the right to sufficient, continuous, safe, acceptable, physically accessible, and affordable water for personal and domestic use.
Unfortunately, the world faces an invisible crisis of water quality. Poor water quality threatens growth, harms public health, and imperils food security. Its impacts are wider, deeper, and more uncertain than previously thought and require urgent attention.

Key facts

- In 2017, 71% of the global population (5.3 billion people) used a safely managed drinking-water service – that is, one located on premises, available when needed, and free from contamination.
- 90% of the global population (6.8 billion people) used at least a basic service. A basic service is an improved drinking-water source within a round trip of 30 minutes to collect water.
- 785 million people lack even a basic drinking-water service, including 144 million people who are dependent on surface water.
- Globally, at least 2 billion people use a drinking water source contaminated with faeces.
- Contaminated water can transmit diseases such diarrhoea, cholera, dysentery, typhoid, and polio. Contaminated drinking water is estimated to cause 485 000 diarrhoeal deaths each year.

- By 2025, half of the world's population will be living in water-stressed areas.
- In least developed countries, 22% of health care facilities have no water service, 21% no sanitation service, and 22% no waste management service.

## 4.2.5 How to prevent Water Pollution on a personal level

As the international authority on public health and water quality, WHO leads global efforts to prevent transmission of waterborne disease, advising governments on the development of health-based targets and regulations. WHO produces a series of water quality guidelines, including on drinking-water, safe use of wastewater, and safe recreational water environment.
Aside from international response from organizations such as WHO, there are numerous ways that each of us can use to reduce water pollution. The Natural Resources Defense Council has outlined a few:

1. Don't flush trash. Being mindful not to flush non-degradable products, such as plastic, down your toilet is one small but great way to stop contributing to the problem and start becoming part of the solution.
2. Pick up after your pets. Waste from animals is full of bacteria, and if not disposed of properly, that bacteria can find its way into the water supply through storm drains and runoff. The recommended disposal method is to use a bag made from recycled plastic to throw it in the trash. Never wash pet waste out into the street or into the storm drain.
3. Maintain your car. Antifreeze, oil, coolant, and other chemicals can leak out of your car if it's not properly cared for. Then, rainwater washes those chemicals into the groundwater supply. Regular maintenance can reduce the amount of pollutants emitted by your car, and it enhances the vehicle's performance as well. Also, wash vehicles at car washes that have water reclamation systems.
4. Surround your garden with native plants and use natural fertilisers. As native plants require less water, they could withstand drought conditions and extreme weather situations. They would cost less to maintain, as you can even use natural fertilisers, such as compost, peat, and bone meal. This would eliminate the need for artificial fertilisers that aggravate water pollution. This inclination to use natural products would help you retain the soil's moisture and divert waste from landfills.
5. Adjust sprinklers to minimize water from entering the gutter. When possible, use drip irrigation. This will also reduce water usage.
6. Don't use the hose to clean walkways, driveways, or gutters. Whenever possible, use a rake or broom to clean the yard, driveway, and gutters. Use leaf blowers responsibly and never blow debris into the gutter or storm drain.
7. Closely follow manufacture instructions when applying fertilizer, pesticide, or herbicide. Do not apply material onto sidewalks, curbs, streets, or other non-porous surfaces.

## 4.2.6 Alternatives to Common Household Products

| Product | Alternative(s) |
|---|---|
| SOURCE: Based on information available from various sources including the Website of Air and Waste Management Association | |
| Air refresher | Open windows to ventilate. To scent air, use herbal bouquets, pure vanilla on a cotton ball, or simmer cinnamon and cloves. |
| All-purpose cleaner | Mix ⅔ cup baking soda, ¼ cup ammonia and ¼ cup vinegar in a gallon of hot water. Doubling all the ingredients except the water can make stronger solution. |
| Brass polish | Use paste made from equal parts vinegar, salt, and flour. Be sure to rinse completely afterward to prevent corrosion. |
| Carpet/rug cleaner | Sprinkle corn starch/baking soda on carpets and vacuum. |
| Dishwashing liquid | Wash dishes with hand using a liquid soap or a mild detergent. |
| Drain opener | Add 1 tablespoon baking soda into drain and then slowly pour ⅓ cup white vinegar to loosen clogs. Use a plunger to get rid of the loosened clog. Prevent clogs by pouring boiling water down drains once a week, using drain strainers, and not pouring grease down drains. |
| Fabric softener | Use ¼ to ½ cup of baking soda during rinse cycle. |
| Fertilizer | Use compost and organic fertilizers. |
| Floor cleaner | Mix 1 cup vinegar in 2 gallons of water. For unfinished wood floors, add 1 cup linseed oil. To remove wax build-up, scrub in club soda, let soak and wipe clean. |
| Floor polish | Polish floors with club soda. |
| Furniture polish | Mix 1 teaspoon lemon oil and 1 pint mineral oil. Also, use damp rag. |
| Insecticides | Wipe houseplant leaves with soapy water. |
| Laundry bleach | Use borax on all clothes or ½ cup white vinegar in rinse water to brighten dark clothing. Nonchlorinated bleach also works well. |
| Methylene chloride paint stripper | Use nontoxic products. |
| Mothballs | Place cedar chips or blocks in closets and drawers. |
| Oil-based paint, thinner | Use water-based products. |
| Oven cleaner | Wash the oven with a mixture of warm water and baking soda. Soften burned-on spills by placing a small pan of ammonia in the oven overnight. Sprinkle salt onto fresh grease spills and then wipe clean. |
| Pesticide | Use physical and biological controls. |
| Silver cleaner | Add 1 teaspoon baking soda, 1 teaspoon salt and a 2" x 2" piece of aluminium foil to a small pan of warm water. Soak silverware overnight. |
| Toilet cleaner | Use baking soda, a mild detergent, and a toilet brush. |
| Window cleaner | Mix ¼ cup ammonia with 1 quart water. |

## 4.3 Air Pollution

Air pollution occurs when any chemical, physical, or biological factor contaminates the indoor or outdoor environment, altering the natural characteristics of the atmosphere.
Air pollution caused by Particulate matter and gas is a public health concern. Air pollution, both outdoor and indoor, causes respiratory and other illnesses and is a significant cause of morbidity and mortality, especially in developing countries. Each year, air pollution is predicted to kill seven million people worldwide (4.3 million deaths/year from exposure to the household (indoor) air pollution and 3.7 million deaths/year are attributable to ambient (outdoor) air pollution).

### 4.3.1 Causes of Air Pollution

Air pollution is caused by:

- Fine particles: Microscopic dust particles (PM10 and PM2.5)

These particles occur in a variety of sizes and forms and can be composed of a wide variety of substances. Certain types of pollutants are emitted directly from sources such as construction sites, unpaved roads, fields, smokestacks, or fires.

- Ozone O3

Ozone is produced as a by-product of pollutants generated by automobiles, power plants, industrial boilers, refineries, and chemical facilities, as well as paints, cleaners, solvents, and motorized lawn equipment.

- Nitrogen compounds

NO2 is predominantly released into the air as a result of fuel combustion, automobile, truck, and bus emissions, power plants, and off-road equipment.
Agriculture is the primary source of NH3 emissions, including animal husbandry and NH3-based fertilizer applications. Additionally, industrial operations, vehicular emissions, and volatilization from soils and oceans are all sources of NH3.

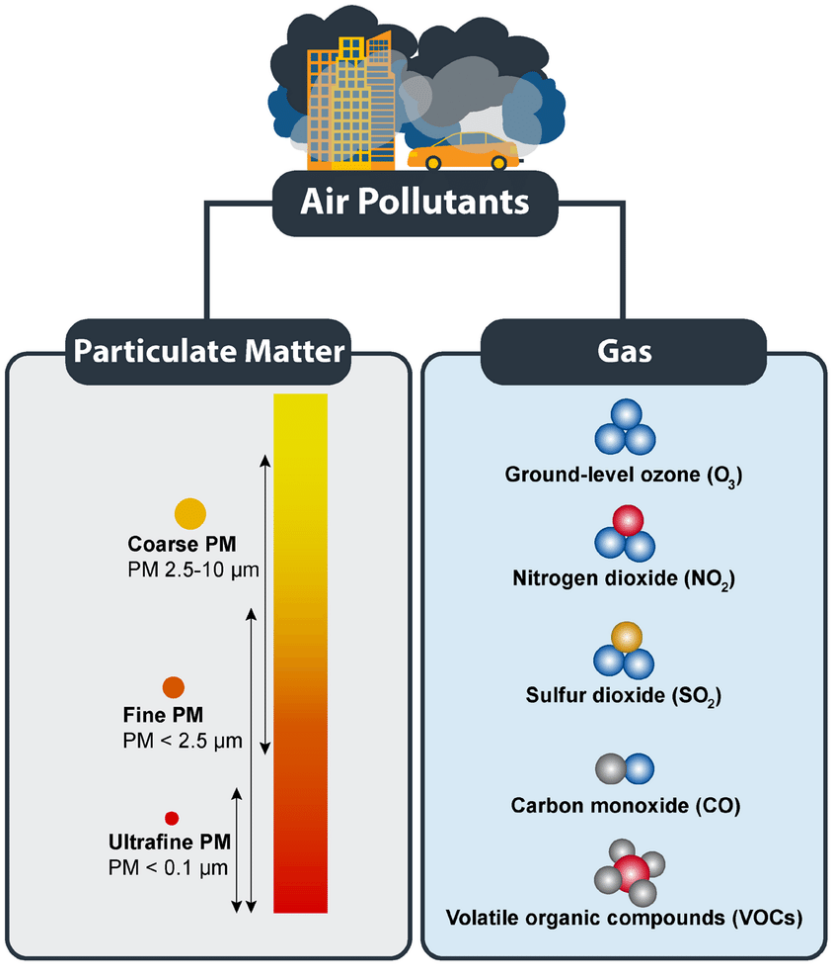
- Carbon monoxide

The primary sources of CO in outdoor air are automobiles, trucks, and other fossil-fuel-powered vehicles and machinery. Devices used in homes, including unvented kerosene and gas space heaters, leaking chimneys and furnaces, and gas stoves, all emit CO.

- Sulphur dioxide

The primary source of SO2 in the atmosphere is the combustion of fossil fuels by power plants, other industrial facilities, industrial processes such as metal extraction from ore; natural sources such as volcanoes; and locomotives, ships, and other vehicles and heavy equipment that run on sulphur-containing fuel.

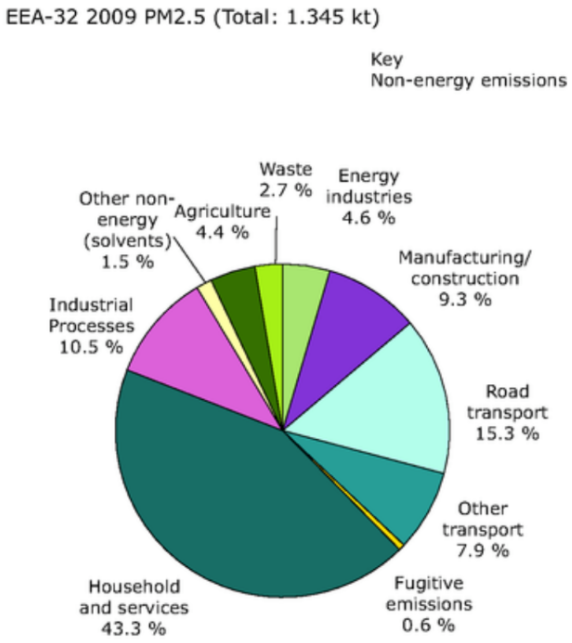
Below is a graphic illustrating the various forms of air pollution found around the world.




Source: Sompornrattanaphan, Mongkhon & Thongngarm, Torpong & Ratanawatkul, Pailin & Wongsa, Chamard & Swigris, Jeff. (2020). The contribution of particulate matter to respiratory allergy: A review of current evidence. Asian Pacific journal of allergy and immunology. 38. 10.12932/AP-100619-0579.

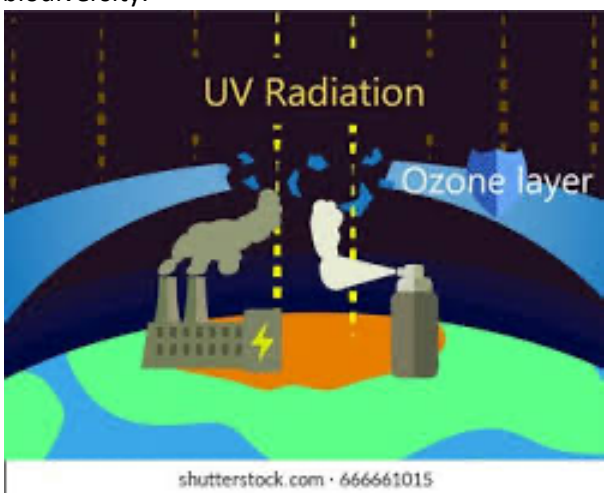
## 4.3.2 Consequences of Air Pollution

Air pollution caused by microscopic dust particles (PM10 and PM2.5) **(fine particles)** has a significant impact on human health and is a source of contention for air pollution management policies. High quantities of particulate matter, particularly in winter, can occur in weather conditions with a limited exchange.
This graphic shows the percentage of non-energy atmosphere types of emissions of PM2.5.




Source: European environment agency

Summer days without a breeze result in an increase in **ozone** concentrations. This pollution has a detrimental influence on human health, the environment, buildings, materials, and the climate. The confederation's policy aims to permanently reduce precursor chemicals (nitrogen oxides and volatile organic compounds). Air pollution containing nitrogen has an effect on biodiversity.

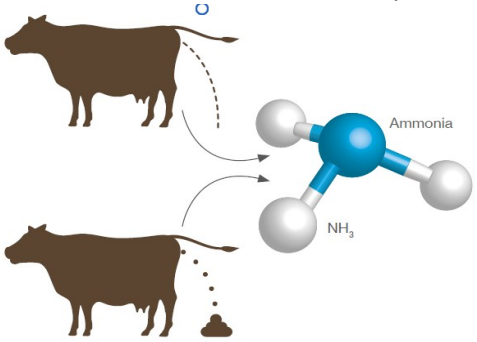


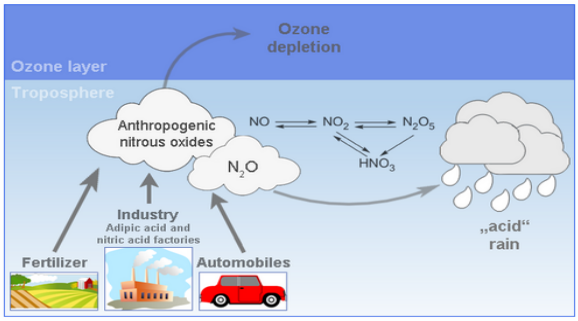

Source: Google images

This illustration depicts what occurs when the Ozone layer deteriorates as a result of gas emissions and UV radiation entering the atmosphere.
Increased **nitrogen** inputs have a damaging effect on nitrogen-sensitive ecosystems because they result in over-fertilization. Ammonia emissions from agriculture contribute to around two-thirds of total nitrogen inputs, whereas nitrogen oxide emissions from combustion processes account for approximately one-third. Specifically, air pollutants can travel long distances to end up in sensitive aquatic and terrestrial ecosystems due to dry and wet deposition. Nitrogen and sulphur deposition cause acidification and over-fertilization of

sensitive ecosystems. For example, in alpine lakes and streams, acidification affects also higher altitudes and forest soils. Overfertilization also adversely affects many nitrogen-sensitive ecosystems such as forests, species-rich natural pastures and dry grassland, alpine heathland, raised bogs, and fens. Consequences of the nitrogen overload in the forest are nitrogen leaching from the forest floor into the groundwater and changes in biodiversity.
Air pollution's human health effects are principally on the body's respiratory system and the cardiovascular system, ophthalmologic, dermatologic, neuropsychiatric, hematologic, immunologic, and reproductive systems. However, the molecular and cell toxicity may also induce a variety of cancers in the long term.

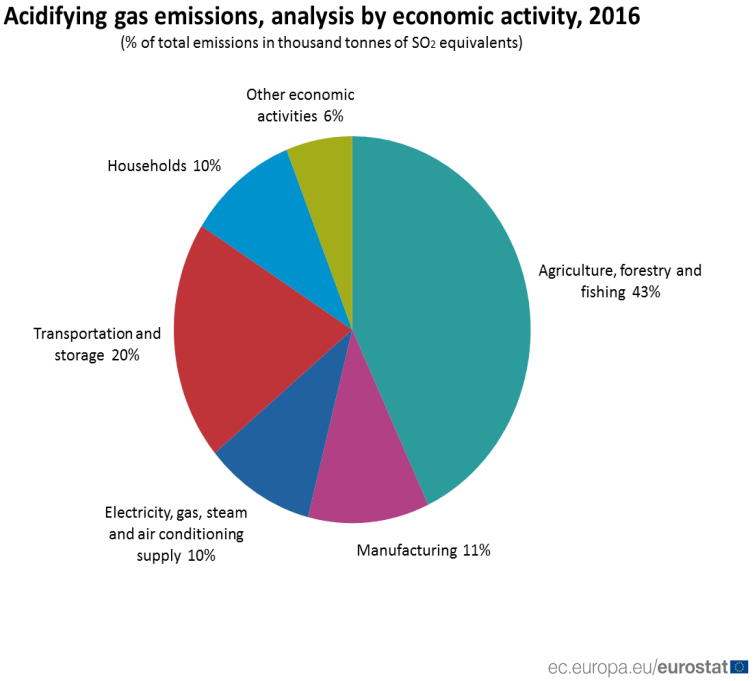
The pictures below show the effect of ruminant animals' dejections, agriculture, industry, and automobile emissions on the atmosphere leading to cause acid rain.




Source: Google images

Air pollution comes from different industries, specifically, SO4 gas emissions mainly come from Agriculture, forestry, and fishing (43%), and transportation and storage (20%) as it shown in the graphics below.




Source: ec.europa.eu/eurostat

## 4.3.3 Measures for Air Protection

**Energy:** ensuring affordable, sustainable energy alternatives for cooking, heating, and lighting in the household.

**Transport:** transition to cleaner energy sources; prioritizing rapid urban transit, walking and cycling networks in cities, as well as intercity rail freight and passenger travel;
shifting to cleaner heavy-duty diesel vehicles and low-emission vehicles and fuels, including those with reduced sulphur content.

**Urban planning:** enhancing building energy efficiency and making cities greener and more compact, hence increasing their energy efficiency.

**Power generation:** Increased use of low-emission fuels and combustion-free renewable energy sources (such as solar, wind, and hydropower);
cogeneration of heat and electricity; and distributed energy generation (e.g. mini-grids and rooftop solar power generation).

**Municipal and agricultural waste management:** waste reduction, waste separation, recycling, and reuse, or waste reprocessing, as well as improved biological waste management techniques such as anaerobic waste digestion to generate biogas, are viable, low-cost alternatives to open incineration of solid waste. Where incineration is necessary, it is vital to use combustion systems that have rigorous emission controls.

## 4.3.4 How to prevent Air Pollution on a personal level

- Basically, try to conserve energy as much as possible – at home, at work, everywhere.
- Check to make sure that your tires are properly inflated.
- Mulch or compost your leaves and yard waste.
- Use low energy labels when purchasing personal or business equipment.
- Carpool, take trains and busses, bike, or walk when they are available.
- Keep your car, boat, and other engines properly tuned up.
- Don’t burn smoky things in your fireplace.
- Don’t burn leaves, trash, and other smoky materials.
- Don’t use gas-powered lawn and garden equipment like blowers.
- Delay the number of trips you take in your car or motorcycle.
- Lessen your fireplace and wood stove usage.
- Don’t barbeque in your grill.
- Reduce idling of your automobile and motorcycle.
- Conserve your electricity and make shorter excursions.
- Instead of driving alone consider sharing a ride to work or use public transportation.
- Combine errands by careful planning with less trips.
- Walk whenever possible or ride a bike.
- Reduce hair sprays and spray deodorants.

# 5. Evaluation

1. Scientists use the word "*anthropogenic*" in referring to environmental change caused or influenced by humans, either directly or indirectly.
a. true
b. false
(a)

2. What is the definition of the word pollutant?
a. dark and muddy
b. toxin or chemical
c. flow or stream
d. a type of living organism
(b)

3. Which of the following are **major** types of pollution?
a. air pollution, water pollution, radioactive pollution
b. soil pollution, water pollution, air pollution
c. noise pollution, air pollution, and light pollution
(b)

4. Soil Pollution is caused by
a. industrial activity
b. agricultural chemicals
c. improper waste disposal
d. all the above
(d)

5. Soil pollution affects …
a. plants and animals.
b. plants, animals, and humans alike.
c. only humans.
(b)

6. When animals or human beings consume contaminated crops or plants then the toxic material can pass into their body.
a. true
b. false
(a)

7. Soil pollution may cause the following long term health problems:
a. cancer, asthma, nervous system, kidney and liver damage
b. flue, toothache, and broken legs
c. indigestion, depression, and bulimia
(a)

8. Soil Pollution can be prevented by:

a. using fewer pesticides and chemicals in gardening
b. supporting environmentally conscious, local farmers
c. reducing, Reusing and Recycling
d. replanting an area with trees
e. all the above
(e)

9. Polluted water …
a. is toxic and cannot be drunk or used for essential purposes like agriculture.
b. can cause diseases like diarrhoea, cholera, dysentery, typhoid and poliomyelitis.
c. kills more than 500,000 people worldwide every year.
d. all the above
(d)

10. Water Pollution is sometimes caused by nature.
a. True
b. False
(a)

11. The most common cause of water pollution is not human activity.
a. True
b. False
(b)

12. Water Pollution is caused by
a. industrial waste, marine dumping
b. agricultural
c. oil leaks and spills
d. all the above
(d)

13. When it rains, the chemicals used in agriculture mix with rainwater and flow into rivers and streams that filter into the ocean. But luckily this causes no water pollution.
a. True
b. False
(b)

14. Deforestation can exhaust water resources and generate organic residue which becomes a breeding ground for …
a. water-dwelling animals
b. exotic plants
c. harmful bacteria.

15. According to UN, more than 80% of the world's sewage **(which includes rubbish and faecal water dumping)** finds its way into seas and rivers untreated.
a. true
b. false
(a)

16. Household products are not dangerous for the human health.
a. true
b. false
(b)

17. Examples of hazardous household products include:

a. common household cleaners
b. detergents from the car washing
c. improper disposal of paint, oil, or other chemicals
d. all the above
(d)

18. Globally, at least 2 billion people use a drinking water source contaminated with faeces.
a. true
b. false
(a)

19. We can use natural alternatives to common Household Products which can reduce water pollution.
a. true
b. false
(a)
20. A natural alternative to cleaning household products is …
a. baking soda
b. flour
c. milk
d. sugar
(a)

21. What is an example of natural air pollution?
a. Car exhaust
b. Industrial emissions
c. Volcanic ash
d. Cigarette smoke
(c)

22. Air Pollution kills about 7 million people per year.
a. true
b. false
(a)

23. Which of these can be caused by air pollution?
a. respiratory illnesses
b. food waste
c. decrease in global temperature
(a)

24. What can we do to reduce air pollution?
a. overheat our home
b. use less, energy, use the bike, walk
c. eat more beef meat
(b)

25. Two of the following elements cause air pollution. Which ones?
a. Nitrogen Dioxide (NO2)
b. Oxygen
c. Hydrogen
d. Particles (PM)
(a & d)

26. Which form of air pollution is estimated to kill 3.7 million people per year, almost half of them children under 5 years old?
a. Acid rain
b Smoke from forest fires
c.Indoor, household air pollution
d. Ozone depletion
(c)

27. Hair sprays, shaving cream, spray deodorants are harmless for the environment.
a. true
b. false
(b)

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