AIR POLLUTION: CAUSES, EFFECTS AND SOLUTION

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ENVIRONMENTAL GEOGRAPHY

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INTRODUCTION

- **Air pollution** is one of the biggest threats for the environment and affects everyone: humans, animals, crops, cities, forests, aquatic ecosystems..
- **Air pollution** is a mixture of solid particles and gases in the **air**. Car emissions, chemicals from factories, dust, pollen and mold spores may be suspended as particles. Ozone, a gas, is a major part of **air pollution** in cities. When ozone forms **air pollution**, it's also called smog. Some **air pollutants** are poisonous.

AIR POLLUTION

- Air pollution can be defined as an alteration of air quality that can be characterized by measurements of chemical, biological or physical pollutants in the air. Therefore, air pollution means the undesirable presence of impurities or the abnormal rise in the proportion of some constituents of the atmosphere. It can be classified in 2 sections: **visible** and **invisible** air pollution.

AIR POLLUTION– LEVELS

- **Local**
- this concerns the quality of ambient air within a radius of a few kilometers
- **Regional**
- pollution like acid rain, photochemical reactions and degradation of water quality at distances of a few kilometers to a thousand kilometers
- **Global**
- depletion of the ozone layer and global warming caused by the emission of greenhouse gases, mainly carbon dioxide (CO_2)

Air pollutioncauses

- Air pollution is caused by the presence in the atmosphere of toxic substances, mainly produced by human activities, even though sometimes it can result from natural phenomena such as volcanic eruptions, dust storms and wildfires, also depleting the air quality.
- Air pollution is a mix of hazardous substances from both human-made and natural sources.
- Vehicle emissions, fuel oils and natural gas to heat homes, by-products of manufacturing and power generation, particularly coal-fueled power plants, and fumes from chemical production are the primary sources of human-made air pollution.
- Nature releases hazardous substances into the air, such as smoke from wildfires, which are often caused by people; ash and gases from volcanic eruptions; and gases, like methane, which are emitted from decomposing organic matter in soils.

- Traffic-Related Air Pollution (TRAP), from motor vehicle emissions, may be the most recognizable form of air pollution. It contains most of the elements of human-made air pollution: ground-level ozone, various forms of carbon, nitrogen oxides, sulfur oxides, volatile organic compounds, polycyclic aromatic hydrocarbons, and fine particulate matter.
- Ozone, an atmospheric gas, is often called smog when at ground level. It is created when pollutants emitted by cars, power plants, industrial boilers, refineries, and other sources chemically react in the presence of sunlight.
- **Noxious gases**, which include carbon dioxide, carbon monoxide, nitrogen oxides (NOx), and sulfur oxides (SOx), are components of motor vehicle emissions and byproducts of industrial processes.

- **Particulate matter** (PM) is composed of chemicals such as sulfates, nitrates, carbon, or mineral dusts. Vehicle and industrial emissions from fossil fuel combustion, cigarette smoke, and burning organic matter, such as wildfires, all contain PM.
- A subset of PM, fine particulate matter (PM 2.5) is 30 times thinner than a human hair. It can be inhaled deeply into lung tissue and contribute to serious health problems. PM 2.5 accounts for most health effects due to air pollution in the U.S.
- **Volatile organic compounds** (VOC) vaporize at or near room temperature—hence, the designation volatile. They are called organic because they contain carbon. VOCs are given off by paints, cleaning supplies, pesticides, some furnishings, and even craft materials like glue. Gasoline and natural gas are major sources of VOCs, which are released during combustion.
- Polycyclic aromatic hydrocarbons (PAH) are organic compounds containing carbon and hydrogen. Of more than 100 PAHs known to be widespread in the environment, 15 are listed in the Report on Carcinogens. In addition to combustion, many industrial processes, such as iron, steel, and rubber product manufacturing, as well as power generation, also produce PAHs as a by-product. PAHs are also found in particulate matter.

Anthropogenic air pollution …..

Anthropogenic air pollution sources are:

- **Combustion of fossil fuels**, like coal and oil for electricity and road transport, producing air pollutants like nitrogen and sulfur dioxide
- **Emissions from industries and factories**, releasing large amount of carbon monoxide, hydrocarbon, chemicals and organic compounds into the air
- **3.Agricultural activities**, due to the use of pesticides, insecticides, and fertilizers that emit harmful chemicals
- **4.Waste production**, mostly because of methane generation in landfills

Air pollution effects

- It is impossible to describe the whole extent of potential and actual damage caused by all forms of air pollution. But here are the main consequences:
- **ON THE ENVIRONMENT**
- Air pollution has a major impact on the process of plant evolution by preventing photosynthesis in many cases, with serious consequences for the purification of the air we breathe. It also contributes to the formation of acid rain, atmospheric precipitations in the form of rain, frost, snow or fog, which are released during the combustion of fossil fuels and transformed by contact with water steam in the atmosphere.

- **GLOBAL WARMING**
- On top of that, air pollution is a major contributor to global warming and climate change. In fact, the abundance of carbon dioxide in the air is one of the causes of the greenhouse effect. Normally, the presence of greenhouse gases should be beneficial for the planet because they absorb the infra-red radiation produced by the surface of the earth. But the excessive concentration of these gases in the atmosphere is the cause of the recent climate change.

- **ON HUMAN HEALTH**
- Our continual exposure to air pollutants is responsible for the deterioration of human health.

  Air pollution is indeed a significant risk factor for human health conditions, causing allergies, respiratory and cardiovascular diseases as well as lung damage.

How does air pollution affect our health?

- **Respiratory Disease**
- Air pollution can affect lung development and is implicated in the development of emphysema, asthma, and other respiratory diseases, such as chronic obstructive pulmonary disease (COPD).
- PM and nitrogen oxide are linked to chronic bronchitis.
- **Cardiovascular Disease**
- Fine particulate matter can impair blood vessel function and speed up calcification in arteries.
- NIEHS researchers established links between short-term daily exposure by post-menopausal women to nitrogen oxides and increased risk of hemorrhagic stroke.
- For a cross-section of older Americans, exposure to TRAP can result in lowered levels of high-density lipoprotein, sometimes called good cholesterol, increasing their risk for cardiovascular disease.

- According to a National Toxicology Program (NTP) report, TRAP exposure also increases a pregnant woman's risk for dangerous changes in blood pressure, known as hypertensive disorders, which are a leading cause of pre-term birth, low birth weight, and maternal and fetal illness and death.
- **Cancer**
- A large study of more than 57,000 women found living near major roadways may increase a woman's risk for breast cancer.
- The NIEHS Sister Study found other airborne toxic substances, especially methylene chloride, which is used in aerosol products and paint removers, are also associated with increased risk of breast cancer.
- Occupational exposure to benzene, an industrial chemical and component of gasoline, can cause leukemia and is associated with non-Hodgkin's Lymphoma.
- A long-term study, 2000-2016, found an association between lung cancer incidence and increased reliance on coal for energy generation.

- When the National Ambient Air Quality Standards were established in 1970, air pollution was regarded primarily as a threat to respiratory health. Over the next decades as air pollution research advanced, public health concern broadened to include cardiovascular disease; diabetes mellitus; obesity; and reproductive, neurological, and immune system disorders.

- Air pollution exposure is associated with oxidative stress and inflammation in human cells, which may lay a foundation for chronic diseases and cancer. In 2013, the International Agency for Research on Cancer of the World Health Organization (WHO) classified air pollution as a human carcinogen

Air pollutionprevention

There are **ways to prevent, control and eventually reduce air pollution**:

1. Renewable fuel and clean energy production

The most basic **solution for air pollution** is to move away from fossil fuels, replacing them with alternative energies like solar, wind and geothermal.

- **2. Energy conservation and efficiency**

  Producing clean energy is crucial. But equally important is to reduce our consumption of energy by adopting responsible habits and using more efficient devices.

- **3. Eco-friendly transportation**

  Shifting to electric vehicles and hydrogen vehicles, and promoting shared mobility (i.e carpooling, and public transports) could reduce air pollution.
- **4. Green building**

  From planning to demolition, green building aims to create environmentally responsible and resource-efficient structures to reduce their carbon footprint.

- In addition, monitoring air pollution levels has become very important to detect pollution peaks, better control air pollution and eventually **improve air quality**.

- **How is air quality measured?**
  With measuring devices using laser-based technologies, chemiluminescence, flame ionization, etc. These devices are, for instance, located close to the traffic, far from the traffic and close to industrial zones. All the collected data are compiled into a value scale, called the **Air Quality Index** (AQI).