Research Article

Effects of Air Pollution on Health and Environment

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ABSTRACT

It has been established that there is a linkage between air pollution (AP) and climate change (CC). However, both have direct and indirect consequences for health and every sphere of human endeavour. The negative effects of air pollution on our society have drawn a lot of attention to the problem in recent years. The well-being of individuals and the ecosystem at large is seriously threatened by the myriad consequences of air pollution on health and the environment. Respiratory issues are among the primary consequences of air pollution on health. Numerous breathing problems, including bronchitis, asthma, and other lung disorders, can be brought on by exposure to air pollution. These health issues can be especially harmful to children, the elderly, and those with pre-existing respiratory conditions. Moreover, air pollution also has a significant impact on the environment. One of its most concerning effects is its contribution to climate change. The emission of greenhouse gases from air pollutants leads to an increase in the Earth's temperature, resulting in extreme weather events, rising sea levels, and other severe consequences. Air pollution also degrades soil, water, and vegetation quality, which impacts the ecosystem as a whole and the species that live there. To conclude, the consequences of air pollution on human health and the ecosystem are indisputable and necessitate prompt action. To safeguard both human health and the environment, it is imperative that this problem be addressed and that long-term solutions be found to lower air pollution.

Key words: Air pollution, Health, Consequences, Ecosystem, Environment, Respiratory
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1. INTRODUCTION

Human activity pollutes the air, soil, and water, which has a negative impact on the environment. The industrial revolution brought about the generation of massive amounts of airborne pollutants that are damaging to human health, even if it was also a major achievement in terms of technology, society, and the supply of numerous services [1;2;3]. Without a doubt, environmental contamination on a worldwide scale is seen as a multifaceted international public health concern. This significant issue is linked to social, economic, and legal issues as well as lifestyle choices. Clearly, in our day and age, industrialization and urbanisation are escalating to previously unheard-of and unsettling levels around the globe [2]. Given that it causes approximately 9 million deaths annually; anthropogenic air pollution is one of the largest threats to global public health [1]. All things are impacted by air pollution. It damages forests, wildlife, and agriculture in addition to impairing our health. It also affects the environment by obstructing sunlight, decreasing visibility, and producing acid rain. Global warming is caused by greenhouse gas pollution, which has an impact on every part of the earth. Seven million people are thought to lose their lives to air pollution annually, according to the World Health Organisation [4].

Breathing becomes challenging due to the contraction of lung muscles caused by ground-level ozone. High ozone exposure can lead to lung inflammation, coughing, sore throats, and irreversible lung damage. Crops and plants that are exposed to continuous air pollution grow less [3;4]. Plants are harmed by ozone pollution because

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it damages stomata, which are microscopic openings on the underside of leaves that permit the plant to "breathe." Certain plant species can defend themselves by making antioxidants or temporarily closing their stomata, but other plant species are more vulnerable to harm [5]. Ozone pollution cost the US nine billion dollars in lost soybean and maize production between 1980 and 2011. Plants lose the nutrients necessary for growth and survival when the chemical composition of the soil is altered by acid rain, lead poisoning, and exposure to nitrogen oxides. This has an effect on grasslands, forests, and agriculture [6]. According to a number of epidemiological studies, exposure to these pollutants by people in high-pollution areas can lead to serious health issues like headaches, vertigo, throat, eye, and lung irritation, shortness of breath, upper respiratory infections, lung cancer, brain damage, liver and kidney damage, heart disease, and even death [7;8;9;10;11]. As a developing country, Nigeria is also experiencing fast urbanisation, which leads to unchecked expansion marked by an increase in vehicle traffic and a lack of physical planning, both of which contribute to high levels of air pollution from traffic.

Air pollution in the Niger Delta is primarily caused by the petroleum sector. In this sector, the primary causes of pollution are production processes like transportation, gas flaring and venting, and oil and condensate spills [12]. Heavy industry equipment such as boilers, burners, coolants, and separators, as well as power plants, are additional sources. Air quality in the Niger Delta is additionally hampered by industries like foundries, chemicals and solvents, autos, building and agriculture [13, 14]. Gas flaring in Port Harcourt and other Niger Delta states is a serious problem for the environment and human health. The effects on human health are wide-ranging and encompass a range of morbidities and fatalities [15]. Asthma, lung cancer, breathing difficulties, miscarriages in pregnant women, and early deaths are among the health concerns linked to chemicals released during flares [14;15]. Gas flares and other petroleum production-related activities generate certain gases, the health effects of which have been extensively documented [11;14]. Additional contaminants found in the Niger Delta region and their varied health consequences are documented by [16]. One of the biggest concerns of the twenty-first century in Nigeria is air pollution, which is largely caused by the country's transportation infrastructure, uncontrolled emissions from power plants, and a surge in industrial and construction activity [21]. Concerns about air pollution in the nation are also mostly caused by emissions from gas flaring and other petroleum refining operations [17]. As of 2015, more than 51% of the total gases produced in Nigeria for more than 50 years were reported to have flared. Nigeria is among the top seven gas-flaring nations in the world. Between 10,500 to 5,100,000 pollutants, including PM, are accounted for by this [17]. Using emission inventory methodologies, [18] calculated the annual PM loading contribution from petroleum refining in the Nigerian airshed to be 1,217 metric tonnes [19].
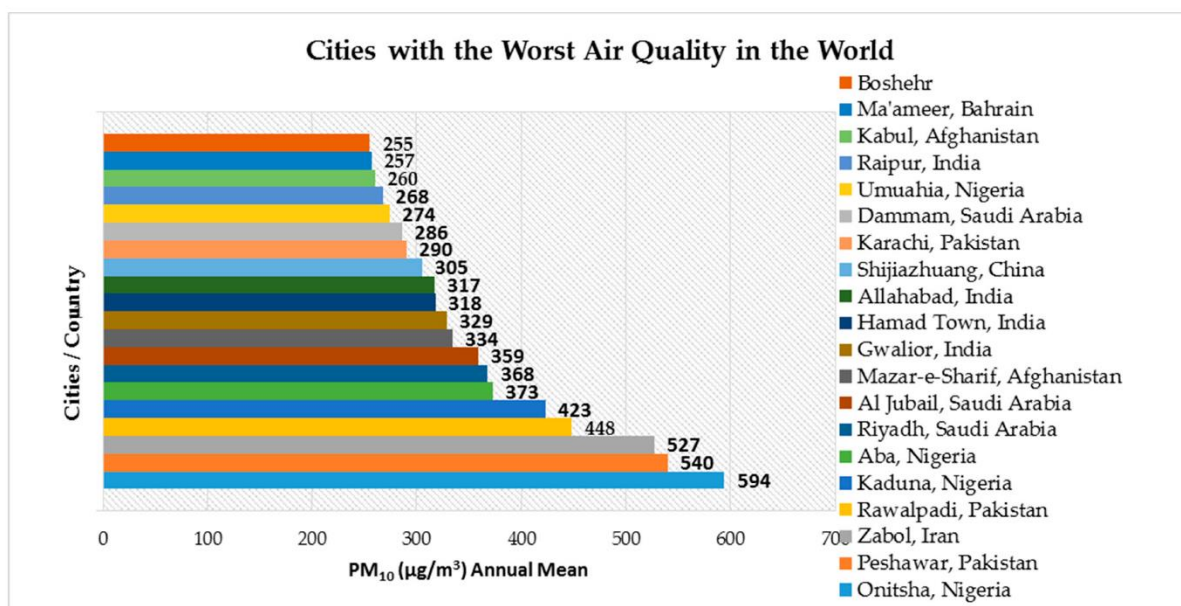

Figure 1: World Health organization (WHO) Urban Ambient Air Pollution Data Base 2016

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2. ENVIRONMENTAL RESPONSE TO AIR POLLUTION

2.1 The consequences of acid rain

An ecosystem is a group of living things, including soil, water, and plants, as well as other organisms. An ecosystem consists of interconnected things. Any disturbance to one species of plant or animal, the soil, or the water in an ecosystem can have an effect on all other components. Nitrogen and sulphur oxides are released into the atmosphere during the burning of fossil fuels [5;6;9]. When sulphur dioxide and nitrogen dioxide combine with atmospheric water droplets to produce nitric acid and sulfuric acid, acid rain is created as described in Figure 1. These contaminants can travel thousands of miles on wind before descending to the Earth's surface as acid rain, which destroys plant leaves, makes soils and water more acidic [10; 12]. While rainwater has a pH of between 5 and 5.5, which is mildly acidic, pure water, which includes distilled or deionized water, has a pH of 7. When certain air pollutants, including nitrogen dioxide and sulphur dioxide, are combined with rainwater, the result is a significant increase in acidity. Rainfall that has a pH of 4 is usually classified as acid rain since it is ten times more acidic than rain with a pH of 5. Natural ecosystems are severely harmed by acid rain, especially when it comes to the soil. Aluminium is among the roughly 45% of minerals that make up soil. Acid rain's ecological effects are most observed in aquatic settings, like lakes, streams, and marshes, where it can be detrimental to fish and other species[15;16]. Acidic precipitation has the ability to extract aluminium from soil clay particles as it percolates through the soil and into streams and lakes. Aluminium is discharged in proportion to the amount of acid added to the environment. Certain plant and animal species can withstand modest levels of aluminium and acidic water. Figure 2 indicates the effect acidic rain on plant[20;21]. But some are acid-sensitive, and as the pH drops, they will disappear. In general, juvenile animals are more susceptible to environmental changes than mature ones are. Most fish eggs are infertile at pH 5. Some mature fish die at lower pH values. Fish don't live in some acidic lakes [16; 17]. An animal or fish species may be able to survive in somewhat acidic water, but the plants or animals it consumes may not. For instance, mayflies, which frogs eat, are more sensitive and might not survive in a pH lower than 5.5, yet frogs have a critical pH of about 4.
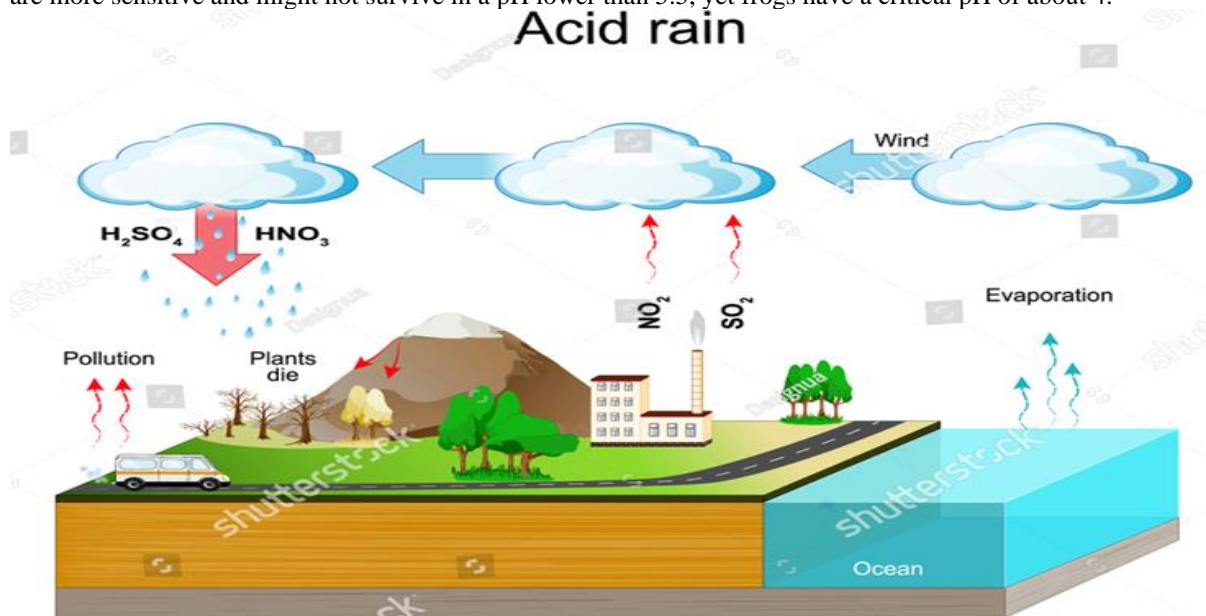

Figure 2: Formation of acid rain is caused by emissions of sulfur dioxide and nitrogen oxide, which react with the water molecules in the atmosphere to produce acids
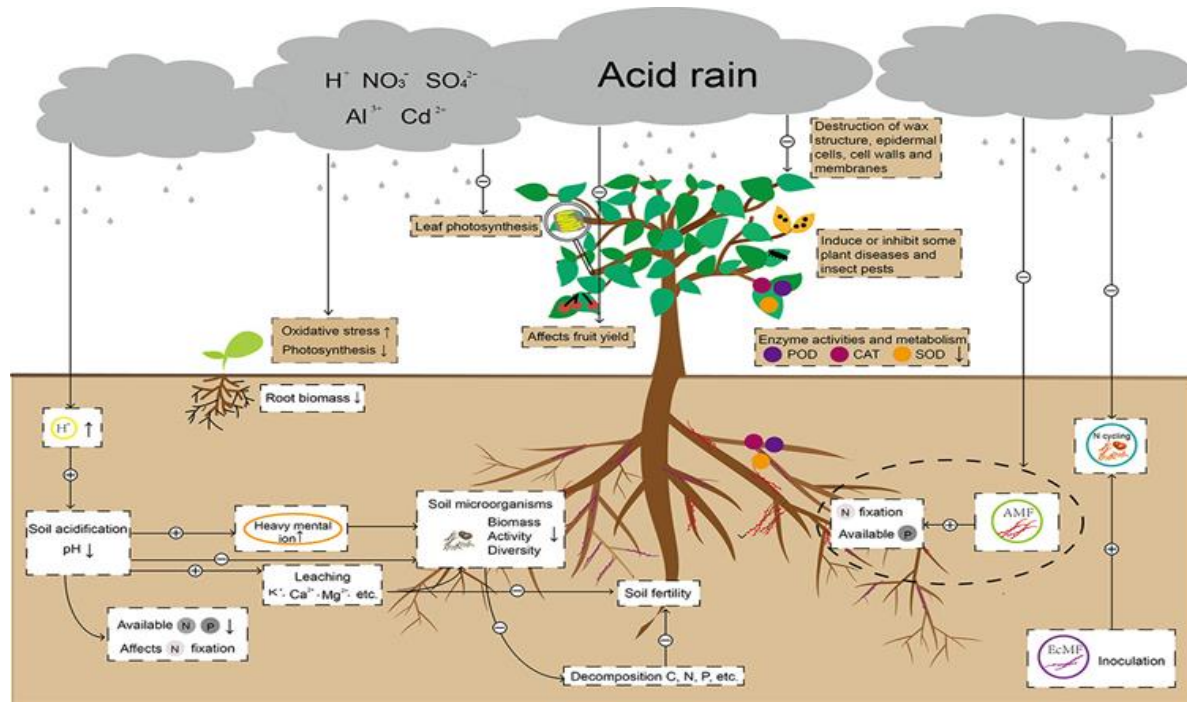
Figure 3: Effects of acid rain on plants
Source: [22]

SO2 and NOX gases can combine with other pollutants in the atmosphere to generate ozone, while some NOX can also be converted into sulphate and nitrate particles. The air is foggy and challenging to see through due to these particles and ozone [20; 21]. However, humans may be harmed by acid rain-causing pollutants such as SO2 and NOX, as well as sulphate and nitrate particles, when they are present in the atmosphere. People can breathe in fine sulphate and nitrate particles that are created when SO2 and NOX combine in the environment. Numerous scientific investigations have demonstrated a connection between these particles and lung function, including breathing difficulties for asthmatic patients, and heart function, including the possibility of fatal heart attacks in individuals with elevated heart disease risk [19].

2.2 Global warming and air pollution

Pollutant emissions into the atmosphere have the potential to alter the climate. The term "climate forcers" is frequently used to describe these pollutants, which include greenhouse gases. The climate is warmed by ozone in the atmosphere, but it can also be warmed or cooled by various PM components [10; 14; 15]. Greenhouse gases and air pollutants frequently originate from the same sources, such as diesel-powered automobiles and coal-fired power plants. The connection between air pollution and climate change is complicated because, despite sharing similar origins and human activity, air pollutants are typically separated from greenhouse gases in terms of their impacts. Since there is a direct correlation between air pollution and climate change, mitigating air pollution also protects the climate. Air pollutants include not just greenhouse gases (mostly carbon dioxide), but also other gases like methane and nitrous oxide [16;17]. However, there is a lot of overlap because the two communicate with one another frequently. For example, diesel engine particulate matter, which pollutes the air, travels the world and ends up in the most remote areas, such as the polar regions. While greenhouse gases harm the globe by warming it and endanger the survival of all living on it, air pollution directly affect human health and the ecology [18; 19]. Certain air pollutants have the ability to retain heat from the sun in the atmosphere, such as ground-level ozone. Black carbon, a component of fine particulate matter (PM2.5), is one of the air contaminants that disappears quickly from the environment. Methane, hydrofluorocarbons, and tropospheric or ground-level ozone are a few other examples of short-lived climatic pollutants (SLCPs). SLCPs have a significantly greater ability to warm the environment than CO2. An estimated one million people die annually from ground-level ozone, which is 80 times more powerful than carbon dioxide in warming the earth over a 20-year period [19;20]. Methane is a precursor to this gas, according to the Climate and Clean Air Coalition and Stockholm Environment Institute. The substantial warming potential of these substances combined with their relatively short lifespans allow for the quick delivery of climate benefits from measures aimed at reducing SLCP

emissions. Improving local air quality and health along with the worldwide advantage of reducing climate change are the two advantages of tackling short-lived climate pollutants.

3. CONCLUSION

Given the increasing urbanisation and population expansion in Nigeria, reducing air pollution may provide a substantial challenge for some countries, but improving air quality is essential for both long-term economic growth and the general health of the populace. Even though it will be challenging to completely eradicate the issue of anthropogenic environmental pollution, authorities, organisations, and medical professionals working closely together to regularise the situation might be envisioned as a beneficial solution. To successfully manage the problem's rise, governments should disseminate enough information, educate the public, and engage specialists in these matters. Establishing and implementing technologies in all businesses and power plants is necessary to reduce air pollution at its sourceIn addition to appropriately managing the detrimental health effects linked to air pollution, a global preventive policy should be developed to address anthropogenic air pollution. To properly address the issue, information from research should be combined with sustainable development approaches.

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