International Journal of Zoology Studies
www.zoologyjournals.com
ISSN: 2455-7269
Received: 12-09-2025, Accepted: 12-10-2025, Published: 27-10-2025
Volume 10, Issue 4, 2025, Page No. 27-29

A review on environmental pollution and its mitigation approaches

Dr. Archana Mantale
Department of Zoology, Shri Muktanand College, Gangapur, Chhatrapati Sambhajinagar, Maharashtra, India

Abstract
Environmental pollution has emerged as one of the most critical global challenges in the 21st century, affecting the integrity of natural ecosystems and the quality of human life. This review paper explores various forms of pollution—air, water, soil and noise—and their far-reaching impacts on ecological stability and public health. The study also discusses advanced mitigation techniques such as green technologies, sustainable waste management, renewable energy adoption and eco-friendly policy frameworks. Emphasis is placed on the need for integrated approaches combining technological innovation, legislation and public participation to achieve long-term environmental sustainability. A significant improvement in our global environment may be guaranteed by being aware of the threat of pollution and having enough understanding of mitigation measures.

Keywords: Environmental pollution, mitigation, sustainability, ecosystem, green technology, renewable energy

Introduction

The introduction of hazardous pollutants into the natural environment, which has detrimental impacts on live creatures and ecosystem processes, is refer as environmental pollution. Pollution levels have increased alarmingly throughout the world as a result of the fast progress of industrialization, urban development, and technical innovation. The build-up of pollutants in air, water, and soil has led to a reduction in biodiversity, health risks, and disturbances in the world's climate.

The environment is crucial for sustaining life on earth but the increasing worldwide pollution and contamination of the environment has become a significant concern in recent years (Ukaogo PO, *et al*., 2020 & Singh J., 2015) [12, 14]. Pollution in the environment can occur in different forms including air pollution, water pollution, soil pollution, and noise pollution (Nnaemeka AN, 2020) [10]. The modern world is facing numerous pollution challenges that have severe repercussions for ecosystems, human health, and economic development (Mitreska Jovanovska E. *et al*., 2023 & Mali, H. *et al*., 2023) [8, 9]. These challenges originate from the rapid industrialization and urbanization that define our era (Joshi N. *et al*., 2020 & Hrkic Ilic, Z. *et al*., 2021) [6]. Environmental pollution is increasing gradually and causing a serious impact on living organisms including humans. It poses a severe and escalating threat to human health, ecosystem and the overall well-being of our planet. One of the most pressing issues facing the world today is environmental pollution.

Innovative and sustainable environmental management strategies are urgently required to address the escalating global pollution crisis. The aim of this paper is to review the sources and consequences of environmental pollution and to evaluate modern mitigation approaches that can minimize ecological damage. To restore environmental integrity and guarantee a sustainable future for future generations, effective mitigation measures must involve collaboration between science, government, and society.

1. Types and Sources of Environmental Pollution

Environmental contamination and pollution occur when harmful substances and contaminants are released into the air, soil, and water causing significant damage to the environment and human health (Hill MK, 2020) [3]. Environmental pollution and contamination can have significant economic consequences including the cost of cleaning up contaminated sites and mitigating the adverse effects on human health (López-Pacheco IY, *et al*., 2019) [7]. Air, water, soil, and noise pollution are the main categories of environmental pollution. The combustion of fossil fuels, industrial emissions, and vehicle exhaust cause air pollution, which releases hazardous substances including CO2, NOx, and SO2. Acid rain, which is abundant in sulfur and other compounds, is caused by these harmful gases released into the atmosphere by industry. Water pollution results from the discharge of untreated sewage, agricultural runoff, and industrial effluents. As a result, many of our water sources have a high amount of industrial waste in them which seriously impacts the health of our ecosystem. The misuse of fertilizers, pesticides, and inadequate garbage disposal are the main causes of soil pollution. Soil contamination is destroying native plants and causing issues in agriculture. Despite being frequently disregarded, noise pollution has a major impact on both people and animals by interfering with their behavior and communication patterns.

2. Impact of Pollution on Environment and Human Health

Pollution alters ecosystem functions by degrading air, water, and soil quality, leading to habitat destruction and species loss. Microorganism which adds nutrients to soil eventually die because of acid rain (Manisalidis *et al*., 2020). The acid rain acidifies the water and soil environment, damage the tree and plantations. Suspended particle and gases are the main reason of depletion of ozone layer and cause global warming result in increases the temperature of earth. Respiratory problems, cardiovascular illnesses, and global warming are all consequences of air pollution. Food insecurity is caused by the impact of soil pollution on agricultural production. Additionally, those who regularly come into contact with this kind of soil experience persistent health problems.

Water contamination results in eutrophication, loss of aquatic biodiversity and the spread of waterborne diseases. Soil degradation reduces agricultural productivity and disrupts nutrient cycling. Regardless of the setup, noise is undesirable and has negative consequences. Noise has several negative consequences, including sleep disruption, impacts on hearing and communication, other health effects like affecting people's mental and physical well-being, and impacts on work efficiency. Furthermore, pollution has significant socioeconomic consequences, such as higher medical expenses and lower labor efficiency.

3. Mitigation Approaches and Technological Interventions

Mitigating environmental pollution requires a combination of technological, legislative, and community-driven initiatives. Advanced treatment methods such as bioremediation, phytoremediation, and nanotechnology offer promising results in removing pollutants from soil and water. Renewable energy technologies like solar, wind, and hydroelectric power help reduce dependence on fossil fuels, thereby lowering greenhouse gas emissions. Recycling, composting, circular economy models, and other waste management strategies are also essential for reducing environmental harm.

One key strategy is adopting cleaner production methods, reducing the use of hazardous chemicals, and minimizing waste generation in industries. Adopting these pollution prevention techniques focuses on eliminating and reducing pollution in industries (Prince U, *et al*., 2020) [11]. Establishing environmental management systems, such as ISO 14001, fosters a culture of continuous improvement and ensures industrial compliance with environmental standards (Ahmed A, *et al*., 2021) [1]. These measures collectively contribute to creating more sustainable and environmentally responsible industrial processes, fostering a healthier planet for future generations.

Industries can reduce pollution by using cleaner production technologies and practices, governments can also enforce regulations and penalties for industries that violate pollution standards (Song L, Zhou X., 2021) [13]. Transportation can be improved by promoting the use of public transport, electric vehicles, and bicycles. Governments can also enforce regulations on vehicle emissions. implementation of proper waste disposal systems to help waste management practices such as recycling and composting (Haywood LK, *et al*., 2021) [2].

4. Policy and Community Involvement

Governments play a critical role in pollution control by enforcing environmental laws, promoting sustainable industries, and encouraging public participation. International agreements such as the Paris Climate Accord and the Basel Convention have strengthened global cooperation for environmental protection. However, effective mitigation requires active community engagement through education, awareness programs, and lifestyle changes that support sustainable consumption and production practices.

An assessment, recently presented in an Intergovernmental Panel on Climate Change (IPCC) special report, covered the impacts and projected risks associated with 2 levels of global warming, 1.5 °C and 2 °C. The report investigated the negative impact of global warming on freshwater sources, food security and food production systems, ecosystems, human health, urbanization as well as poverty and changing structures of communities. The report also investigated climate change impact on key economic sectors such as tourism, energy and transportation.

In 1988, the Intergovernmental Panel on Climate Change (IPCC) was set up by the World Meteorological Organization in collaboration with the United Nations Environment Programme (UNEP) to provide governments and official bodies with scientific knowledge and information that can be used to formulate climate-related policies (IPCC 2013).

Conclusion

Environmental pollution poses a significant threat to the planet's ecological and biological systems. The increasing concentration of pollutants demands immediate and comprehensive action at local, national and international levels. Sustainable pollution mitigation is possible only through the integration of scientific innovation, policy reform, and public responsibility. Transitioning to renewable energy, implementing eco-friendly technologies and promoting environmental education are key to achieving long-term ecological balance and ensuring a healthier environment for future generations.

References

1. Ahmed A, Mathrani S, Jayamaha N. An integrated lean and ISO 14001 framework for environmental performance: an assessment of New Zealand meat industry. Int J Lean Six Sigma, 2021. https:// doi. org/ 10. 1108/ IJLSS- 05- 2021- 0100.
2. Haywood LK, *et al*. Waste disposal practices in low-income settlements of South Africa. Int J Environ Res Public Health,2021:18(15):8176.
3. Hill MK. Understanding environmental pollution. Cambridge: Cambridge University Press, 2020.
4. Hrkić Ilić Z, Kapović Solomun M, Šumatić N, Ristić R, Marjanović-Balaban Ž. The role of plants in water regulation and pollution control. In Nature-Based Solutions for Flood Mitigation: Environmental and Socio-Economic Aspects; Springer: Berlin/Heidelberg, Germany, 2021, 159–185. [Google Scholar]
5. Intergovernmental Panel on Climate Change (IPCC). Climate Change and Pollution: Impacts and Solutions. Geneva: IPCC, 2023.
6. Joshi N, Joshi A, Bist B. Phytomonitoring and mitigation of air pollution by plants. In Sustainable Agriculture in the Era of Climate Change; Springer: Berlin/Heidelberg, Germany, 2020, 113–142. [Google Scholar]
7. López-Pacheco IY, *et al*. Anthropogenic contaminants of high concern: existence in water resources and their adverse effects. Sci Total Environ,2019:690:1068–88.
8. Mali H, Shah C, Raghunandan BH, Prajapati AS, Patel DH, Trivedi U. *et al*. Organophosphate pesticides an emerging environmental contaminant: Pollution, toxicity, bioremediation progress, and remaining

challenges. J. Environ. Sci,2023:127:234–250. [Google Scholar] [CrossRef] [PubMed]
9. Mitreska Jovanovska E, Batz V, Lameski P, Zdravevski E, Herzog MA, Trajkovik V. *et al*. Methods for urban Air Pollution measurement and forecasting: Challenges, opportunities, and solutions. Atmosphere,2023:14:1441 . [Google Scholar] [CrossRef]
10. Nnaemeka AN. Environmental pollution and associated health hazards to host communities (case study: Niger delta region of Nigeria). Central Asian J Environ Sci Technol Innov,2020:1(1):30–42.
11. Prince U, Ewuzie U, Onwuka C. Environmental pollution: causes, effects, and the remedies. Amsterdam: Elsevier, 2020, 419–29.
12. Singh J. International conference on harmonization of technical requirements for registration of pharmaceuticals for human use. J Pharmacol Pharmacother,2015:6(3):185–7.
13. Song L, Zhou X. Does the green industry policy reduce industrial pollution emissions? —Evidence from China's national eco-industrial park. Sustainability,2021:13(11):6343.
14. Ukaogo PO, Ewuzie U, Onwuka CV. Environmental pollution: causes, effects, and the remedies. In: Chowdhary P, editor. Microorganisms for sustainable environment and health. Amsterdam: Elsevier, 2020, 419–29.
15. United Nations Environment Programme UNEP. Global Environment Outlook 7: Healthy Planet, Healthy People. Nairobi: UNEP, 2023.
16. World Bank. Pollution Management and Environmental Health: Policy Approaches for a Cleaner Future. Washington D.C, 2022.
17. World Health Organization (WHO). Air Pollution and Health Impacts: Global Review. Geneva: WHO, 2022.