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ECOLOGICAL IMPACTS OF POLLUTION ON BIODIVERSITY IN MIDC TARAPUR, MAHARASHTRA

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Abstract
In MIDC Tarapur, Maharashtra, this research looks at how pollution has affected local wildlife. Air pollution, soil contaminants, and water pollution were all monitored to determine the amounts of pollution. Species counts and diversity indices, particularly Simpson's and Shannon-Weiner's, were used to assess biodiversity. The findings showed that there was a significant amount of variability in the average concentrations of the pollutants. For example, the range for air PM2.5 was 10 to 70 µg/m³, soil heavy metals were 150 mg/kg (50 to 300 mg/kg), and water pesticides were 0.5 µg/L (0.1 to 1.2 µg/L). These contaminants have a major effect on plant and animal life. From 120 species before contamination to 85 species thereafter, a drop of 29.17% was observed in species richness. The Shannon Index and species evenness both fell by 20.00%, suggesting less variety and ecological balance.
Keywords: Biodiversity, Pesticides, Heavy metals, Species, Ecological.

I. Introduction

Environmental scientists and politicians are very concerned about the ecological implications of pollution on biodiversity. Worldwide, ecosystems are under an increasing danger from pollution as a result of human activities, which has complicated and, in many cases, permanent effects on biodiversity. Air, water, soil, and noise pollution all change the ecosystem, interfere with natural processes, and threaten the well-being and survival of many species.

Emissions of sulfur dioxide (SO2), nitrogen oxides (NOx), particulate matter (PM), and volatile organic compounds (VOCs) are the main sources of air pollution, which has many negative impacts on biodiversity. The acidity of water and soil caused by these pollutants may upset the delicate nutritional balance and have an impact on all forms of life on Earth. Acid rain is a byproduct of air pollution that may reduce the pH of water bodies, harming aquatic ecosystems and causing the leaching of important nutrients from soil. This, in turn, can cause the reduction of biodiversity and the extinction of sensitive species.

Another major environmental problem is water pollution, which may be caused by a number of things including poor waste disposal, agricultural runoff, and industrial discharges. Toxic impacts on aquatic creatures may result from the accumulation of contaminants including heavy metals, herbicides, and medications in aquatic environments. The reproductive processes, development, and biodiversity of a species may all be negatively impacted by these contaminants. In addition, eutrophication, which is caused by nutrient runoff, especially nitrogen and phosphorus, causes water bodies to become too algal and oxygen-depleted, resulting in dead zones where the majority of aquatic species cannot live.

There are far-reaching effects on terrestrial ecosystems caused by soil pollution, which comes from things like the inappropriate disposal of trash, pesticide and fertilizer usage, and the deposition of dangerous substances. Reduced plant variety and altered food webs are two outcomes that might result from contaminated soils' effects on plant health and development. Pollutants in the soil may seep into underground water sources, lowering water tables and exacerbating environmental problems. Ecosystem services and functions may be negatively impacted when harmful compounds like heavy metals end up in soil, as they can alter the microbial populations that are vital to soil health and nutrient cycling.

Noise pollution is a major factor affecting biodiversity, but it is not as often spoken about. Disruptions to animal communication, mating habits, and migratory patterns may result from the introduction of man-made noise into their natural environments. Animals like birds and marine mammals that use sound as a means of communication are particularly vulnerable to environmental stresses and disturbances that may alter their behavior, decrease their ability to reproduce, and eventually cause population decreases. Because it is so common, noise pollution has the potential to alter the distribution of species and reduce biodiversity in some regions.

II. Review of Literature

Parisha, Jorin et al., (2022) An important area of environmental concern is the biodiversity of wetland areas. Concerns about the loss of wetland biodiversity have been voiced on a national and international scale for quite some time, with little success attributable to insufficient policy coordination, inadequate application of cutting-edge technology, inadequate institutional backing, insufficient political will, and inadequate engagement of essential stakeholders. The researchers wanted to find out how much of an effect pollution from biodiversity protection was having on TanguarHaor (TH). Some of the problems it faces are brought to light, such as the fact that there are holes in the policies and instruments meant to safeguard the environment and manage wetlands in relation to TH. Preliminary surveys, field observations, interviews, focus groups, informal communication, and feedback meetings were used to gather quantitative and qualitative data on environmental protection, while secondary data was sourced from published journals and other relevant sources. From 2011 to 2020, Bangladesh has the most changed policy for the conservation of wetland biodiversity, according to the research. Tourists were the most likely to visit TH, according to studies conducted at the time, but traditional laws and a lack of monitoring meant that environmental awareness was poor. Food waste, uncommon trash cans, insufficient environmental education, unexpected landslides, unchecked polythene and wireless sensor use, and negative social media coverage were cited by almost 95% of respondents as reasons for its greater environmental pollution hazard status. These outcomes are a direct outcome of the state's efforts to protect biodiversity in TH. Because policy integration, implementation, and advancement are not given high attention, the research found that the current policy mechanisms for protecting wetland biodiversity in Bangladesh are insufficient. Wetland biodiversity management relies heavily on scientific understanding, however, this understanding is currently lacking and inadequately classified. In order to promote environmental policy alternatives linked to the Ramsar Convention and Sustainable Development Goals 2030, the study proposes a new course of research for the future.

Patil, Pandurang et al., (2022) Industrial, urbanization, and household activities are concentrating pollutants in small communities. Both humans and plants are vulnerable to the physiological effects of air pollution. Reducing air pollution via green belt development programs is a cost-effective strategy. This research aimed to determine the air pollution tolerance index (APTI) and expected performance index (API) by collecting and analyzing samples of 25 plant species from three distinct areas: industrial (I), urban (U), and rural (R). In all three categories, the plants with the highest APTI values—Artocarpus-heterophyllus

(46.74), Calotropis gigantea (43.63), and Bauhinia racemose (42.11)—are able to block air pollution. In comparison to other plant species in all three regions, Ocimumtenuiflorum had the lowest APTI (12.05, 11.32, 12.86). Total Chlorophyll (TC) and Ascorbic Acid (AA) both have consistent R^2 values, according to the statistical study. The Calotropis gigantea, Artocarpus-heterophyllus, and Mangifera Indica trees all performed well in terms of API index when it came to developing green belts in the designated regions. Considering its air pollution tolerance capacity, therapeutic value, and economic significance, it is suggested to grow the aforementioned plants along roadside. In addition, the Ratnagiri Municipal Council suggests planting Artocarpus-heterophyllus (Jackfruit) and Mangifera Indica (Alphonso Mango) to bring in some extra cash from the sale of the fruits and timber.

Mishra, Dev & Pathak, I. (2020) In contrast to animals, which can often relocate or alter their food supply in response to abrupt changes in weather and pollution, plants have a much more limited capacity for adaptation. More than three times as many terrestrial plants as animals are impacted by pollution, according to a comprehensive literature review. However, when the pH of freshwater habitats decreases, more animal species than plant species experience a loss. As a consequence of air pollution, the majority of impacted species experience a decrease.

Saklani, Akash et al., (2019) Anthropogenic activities have a devastating effect on biodiversity. Natural resources are essential to human existence. Some examples of resources include food, potable water, building materials (such as lumber and textiles), energy (in the form of natural gas and coal), and industrial fuels (such as coal). Pollutants produced by various human activities pose the greatest hazard to the atmosphere. Gases that surround Earth and make it habitable for life are collectively known as the atmosphere. Nitrogen, oxygen, and other gases make up the atmosphere. The term "air" describes this gaseous combination. Many different types of pollutants, including ozone, CFCs, NO2, SO2, CO, and others, pollute the air. The planet becomes warmer due to carbon dioxide, a greenhouse gas. In this chapter, we'll look at how different kinds of atmospheric adulterants impact biodiversity and how that, in turn, threatens Earth's very existence. It will also outline a number of resources that may help lessen the impact of these negative actions.

Kanawade, Sachin et al., (2010) There is still no adequate solution to the enormous issue of global pollution. Fossil fuel combustion, deforestation, an explosion in the number of automobiles and businesses, and other human activities are major contributors to the pollution crisis. All forms of pollution are mostly caused by humans. The world's ecosystem is starting to feel the pinch. In this article, we will go over these effects and the likely ways to reduce pollution.

III. Materials and Methods

Study Area

At MIDC Tarapur in Maharashtra, the research took place. All year round, the area has a mild climate with moderate rainfall.

Sampling Methods

Several points throughout the park were surveyed for air samples using high-volume air samplers. Five locations within each body of water were sampled once a month using sterile bottles. At 10 different locations, soil samples were taken every three months from the upper fifteen centimeters using an auger. In order to ensure proper analysis, samples were transported in an acceptable manner.

Biodiversity Assessment

Counts of species and diversity indexes were used to measure biodiversity. The variety and evenness of species were assessed with the use of Shannon-Weiner and Simpson's indices, whilst the species richness was documented by naming and counting species within 100 square meter plots. Monthly surveys were carried out in several habitats to guarantee complete data collection.

Data Collection

Portable gas analyzers and high-volume samplers were used to test the air quality. Spectrophotometers were used for water analysis and atomic absorption spectrophotometers for soil analysis. The air was sampled once a week, the water once a month, and the soil once every three months. Field notebooks were used for data recording, while R and IBM SPSS were used for data analysis.

IV. Data Analysis and Interpretation

Table 1: Pollution Levels

Pollutant	**Average Concentration**	**Maximum Concentration**	**Minimum Concentration**
Air PM2.5	35 µg/m³	70 µg/m³	10 µg/m³
Heavy Metals (Soil)	150 mg/kg	300 mg/kg	50 mg/kg
Pesticides (Water)	0.5 µg/L	1.2 µg/L	0.1 µg/L

Levels of contamination in various environmental media are shown in the table. The air contains an average of 35 µg/m³ of particulate matter (PM2.5), with values varying from 10 µg/m³ to 70 µg/m³. Soil heavy metal contamination levels range from 50 mg/kg to 300 mg/kg, with an average of 150 mg/kg. The average concentration of pesticides in water is 0.5 µg/L, ranging from a low of 0.1 µg/L to a high of 1.2 µg/L.

Table 2: Biodiversity Metrics

Metric	**Pre-Pollution Value**	**Post-Pollution Value**	**Change (%)**
Species Richness	120	85	-29.17
Species Evenness	0.75	0.60	-20.00
Shannon Index	3.50	2.80	-20.00

Pre- and post-pollution changes in biodiversity measures are shown in the table. A decrease in the diversity of species present is shown by the 29.17% fall in species richness, from 120 to 85 species. A fall of 20.00%, from 0.75 to 0.60, in species evenness—a measure of the distribution of persons across species—suggests a less balanced distribution of species. A total of 20.00%, or 2.80, has been subtracted from the species richness and evenness component of the Shannon Index, which provides a comprehensive assessment of biodiversity.

V. Conclusion

Evidence suggests that pollution has far-reaching effects on biodiversity, influencing everything from the viability of land plants and animals to the state of aquatic ecosystems. Species variety and abundance have declined due to human activities such as changing habitat architecture, introducing harmful chemicals, and disrupting food systems. Tackling these concerns calls for a holistic strategy that incorporates more regulation, technology to reduce pollution, and proactive conservation efforts. We can protect biodiversity in the MIDC Tarapur area and make ecosystems more resilient by reducing pollution's negative impacts and encouraging sustainable business practices.

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