A Comprehensive Study of Environmental Management: An Exploration to Ranchi

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Abstract: Environmental pollution is one of the serious problems in most of the mega cities of the world, especially in developing countries, which not only experiences a rapid growth of population due to increasing rate of rural urban migration but also industrialization which is accompanied by air, water and vehicular pollution. Exposure to environmental pollution is now an almost an inescapable part of urban life of the world. The present paper is explored environmental management in Ranchi and measures variable to control it. As we know that rapid population growth continues to be a matter of concern as it has manifold effects, one of the most important being environmental pollution. Densely populated and rapidly growing Ranchi city is often entombed in a pall of pollution from vehicles, sewage and liquid wastes generated by human settlement and uncontrolled pollution from industries. The recent pollution control measures taken by Jharkhand government reduced the environmental pollution up to some extent.

Keyword: Environmental Management, Ranchi, Climate, Environmental Pollution

I. Introduction

Ranchi has a hilly topography and its dense tropical forests a combination that produces a relatively moderate climate compared to the rest of the state. However, due to the uncontrolled deforestation and development of the city, the average temperature has increased. Environmental pollution is one of the most serious issues in the majority of the world's megacities, particularly in developing nations that are not only experiencing rapid population growth due to rural-to-urban migration, but also industrialization, which is accompanied by air, water, and vehicular pollution. Environmental pollution is become an almost unavoidable aspect of urban life around the globe. This research attempts to investigate the trend in Ranchi's environmental management level and the varied strategies used to regulate it. As is well-known, fast population increase continuing to be a source of worry due to its many repercussions, environmental damage being among the most significant. Frequently, the densely populated and continuously expanding city of Ranchi is shrouded in a haze of pollution from automobiles, sewage and liquid wastes created by human settlements, and unregulated pollution from industry. Recent pollution control efforts implemented by the government of Jharkhand have decreased environmental pollution to some degree.

1.1 Climate

Ranchi is rapidly growing its economy, and certain parks, special economic zones and industrial areas are being developed. Of late, new sectors and modern areas have been built for the city's development. Ranchi is also nicknamed the 'City of Waterfalls'. Although Ranchi has a humid subtropical climate, its location and the forests surrounding it combine to produce the unusually pleasant climate for which it is known. Summer temperatures range from 20 to 42 °C, winter temperatures from 0 to 25 °C. December and January are the coolest months, with temperatures dipping to the freezing point in some areas (Kanke). The annual rainfall is about 1430 mm (56.34 inches). From June to September the rainfall is about 1,100 mm.

II. Background

Suman & Avishek (2017), In past decade, Geospatial Technology has witnessed expansion in the scope of environmental management, solid waste being just one of them. Remote Sensing and GIS has vast areas of application in solid waste management and planning. Ranchi city has a population of 10.07 lacs as per Census of India, 2011. Ranchi city witnessed urban and commercial growth after the creation of Jharkhand in 2000. Ranchi city lacks adequate infrastructure for handling solid waste being generated from within the municipal area. Open dumping at Jhiri is observed largely by RMC. In this research work, authors attempt to identify new solid waste disposal site using overlay tools in GIS platform using multiple criteria. The new sites identified carries higher scores as compared to Jhiri. Vehicle route networking in GIS platform is used to identify the shortest routes. The application of these techniques by RMC will reduce the environmental impacts of waste disposal on land, water and human life. Further the economics of vehicle routing can be adequately managed by adopting these route networks. With environmental perspective, shortest routes will result in reduced emission of atmospheric pollutants thereby addressing environmental health and sustainability. Thus, in this research a comparison of the old facilities and new facilities, and old route and new route is discussed that will be useful for policy makers as Ranchi has been selected under smart city project initiated by Government of India.

Avishek & Ranjan (2017), Safe water availability is a human right that sustains good health of human beings, but more than hundred millions of people on earth are denied of safe water. Thus, water quality monitoring and assessment are key working components of UN Organizations, national and international governmental bodies and researchers. This paper attempts to monitor the water quality of Harmu River that passes through the Ranchi city (India) and is highly polluted due solid waste dumping and liquid wastewater discharges. Although the state of the river is very poor it is currently being used by low-income group residents for small scale farming and bathing. Even though the state of the Water quality of the river is poor, governmental organizations are taking no effort to maintain the aesthetics of the river or stop the consumption of water from it. Thus, they attempt to highlight the crucial case of the river by monitoring and assessing the water quality of Harmu river. Water samples were collected randomly from various locations throughout the length of river and were analysed for 17 parameters. Based on the analysis it is observed that the water quality does not meet the specifications of Indian Standards for drinking, irrigation, aquaculture propagation, and industrial cooling. It is thus recommended that the water be restricted for any further use till treatment and cleaning is not conducted. With this work, they attempt to sensitize the users and administrative bodies on restricting the use and taking measures for river rehabilitation.

Chakraborty & Kumar (2016), Landfill leachate generated from open MSW dumpsite can cause groundwater contamination. The impact of open dumping of MSW on the groundwater of adjacent area was studied. To assess the spatial and temporal variations in groundwater quality, samples were collected around an open MSW dumping site in Ranchi city, Jharkhand, India. Groundwater samples were analysed for various physicochemical and bacteriological parameters for 1 year. Results indicated that the groundwater is getting contaminated due to vertical and horizontal migration of landfill leachate. Extent of contamination was higher in areas closer to the landfill as indicated by high alkalinity, total dissolved solids and ammonia concentration. Metals such as lead, iron, and manganese were present at concentrations of 0.097, 0.97 and 0.36 mg/L, respectively exceeding the Bureau of Indian Standards (BIS) 10,500 for drinking water. Enterobacteriaceae were also detected in several groundwater samples and highest coliform count of 2.1×10^4 CFU/mL was recorded from a dug well. In order to determine the overall groundwater quality, water quality index (WQI) was calculated using weighted arithmetic index method and this index was further modified by coupling with the analytical hierarchy process (AHP) to get specific information. WQI values indicated that the overall groundwater quality of the region came under "poor" category while zone wise classification indicated the extent of impact of landfill leachate on groundwater.

Krishna et al. (2015), Groundwater pollution due to anthropogenic activities is one of the major environmental problems in urban and industrial areas. The present study demonstrates the integrated approach with GIS and DRASTIC model to derive a groundwater vulnerability to pollution map. The model considers the seven hydrogeological factors [Depth to water table (*D*), net recharge (*R*), aquifer media (*A*), soil media (*S*), topography or slope (*T*), impact of vadose zone (*I*) and hydraulic Conductivity(*C*)] for generating the groundwater vulnerability to pollution map. The model was applied for assessing the groundwater vulnerability to pollution in Ranchi district, Jharkhand, India. The model was validated by comparing the model output (vulnerability indices) with the observed nitrate concentrations in groundwater in the study area. The reason behind the selection of nitrate is that the major sources of nitrate in groundwater are anthropogenic in nature. Groundwater samples were collected from 30 wells/tube wells distributed in the study area. The samples were analysed in the laboratory for measuring the nitrate concentrations in groundwater. A sensitivity analysis of the integrated model was performed to evaluate the influence of single parameters on groundwater vulnerability index. New weights were computed for each input parameters to understand the influence of individual hydrogeological factors in vulnerability indices in the study area. Aquifer vulnerability maps generated in this study can be used for environmental planning and groundwater management.

Debnath (2014), Within environmental management accounting (EMA) methodologies, material flow cost accounting (MFCA) has been successful in changing traditional attitudes of corporate organisations towards material wastes from production activities and supporting management with information to improve resource utilisations and material yields. However, EMA has not been able to expand itself beyond material wastes and cover greenhouse gas (GHG) emissions. On the contrary, GHG accounting has institutionalised itself as an independent framework to capture and report greenhouse gases from organisational activities and help firms manage its GHG related risks. The author proposes an experimental construct to integrate these two frameworks, based on their complementarity and commonality of organisational processes, and validates the construct with the help of a case example. The author believes that the proposed unification would help EMA to cover major environmental risks of businesses within single framework, help management with better information flow, and support environmentally-conscious decision-making.

Kumar & Pandey (2013), The present study investigates the status of the urban environment in Ranchi, a rapidly growing city in the eastern part of India. The various environmental indicators viz., ambient air quality, aerosol concentration, ambient noise level and urban green space were analysed in a spatio-temporal framework by employing geoinformatics. The ambient air quality measurement indicates a high concentration of Suspended Particulate Matter (>300 µ g/m^3) and Respirable Suspended Particulate Matter (>200 µ g/m^3), as well as low level concentrations of sulphur dioxide (<60 µ g/m^3) and nitrogen dioxide (<60 µ g/m^3) in Ranchi Township. The concentration of ambient air pollutants was significantly higher in Ranchi as compared to other major urban centres of Jharkhand. The spatial distribution of aerosol optical depth (AOD) indicated variation with high concentrations at transportation junctions (0.30–0.35% at 340 nm) and road junctions (>0.30% at 340 nm), and low concentrations (<0.22% at 340 nm) at planned residential areas. The AOD concentration in Ranchi was lower (<0.35% at 340 nm) compared to the Patratu coal mining-cum-industrial region (>0.8% at 340 nm). The majority of the locations in Ranchi exhibited ambient noise levels above the prescribed limits with an increasing trend from 2005 to 2010. The core urban area was the noisier one (>65 dB(A)) when compared to the peripheral areas in the city. The spatial assessment of urban green space derived from WorldView-II satellite data indicated the existence of adequate green spaces (12.7%) within Ranchi Township, although urban cores are largely devoid of green space due to dense built-up land. The study exhibited that vegetation significantly contributes in noise attenuation and a reduction in aerosol concentration.

Mukherjee et al. (2010), The species diversity of a cultural eutrophic lake at Ranchi was studied in relation to external variables (forcing functions) and internal or state variables. The lake receives daily detergent inputs in the form of washings of a variety of objects. A model was constructed for the estimation of detergent inputs from the increase in the phosphate concentration, and from changes in the concentration of inorganic carbon. Nutrients such as inorganic carbon, nitrates, phosphates, sulphates were found to be high in contrast to natural unpolluted systems. The DOM, COD and BOD were also found to be high suggesting organic pollution of the system with an organic carbon load of 5.4 m moles l-1. The growth and development of the plankton constituents was studied in this regime. The natural planktonic rhythm was found to be modified by the polluted condition existing in the lake. The phytoplankton exhibited four peaks in March, May, August, and November while, the zooplankton showed three peaks in February, July and October. The abundance of zooplankton during the annual cycle oscillated with that of the phytoplankton. There was much more evenness in the zooplankton population in comparison to the phytoplankton. Analysis of both, the zooplankton as well as the phytoplankton population was done using the Bray-Curtis dissimilarity index, importance value index and Shannon-Weaver diversity index. The importance value index was found to provide a better evaluation of the plankton community than the diversity index. The phytoplankton population showed no correlation with nutrient availability as indicated by the correlation-regression analysis and the planktonic rhythm was not in tune with normal unpolluted conditions. The lake was classified as meso-polysaprobic using biological and chemical indices.

III. Ranchi Environmental Management

3.1 Solid Waste Management Plan

Solid waste management is one of the most essential services for maintaining the quality of life in the urban areas and for ensuring better standards of health and sanitation. In India, this service falls short of the desired level as the systems adopted are outdated and inefficient. Institutional weakness, shortage of human and financial resources, improper choice of technology, inadequate coverage and lack of short- and long-term planning are responsible for the inadequacy of services. In 2016, the Union Ministry of Environment, Forests and Climate Change came up with the new Solid Waste Management Rules (SWM). These rules are the sixth category of waste management rules and do not include plastic, e-waste, biomedical, hazardous and construction and demolition waste. As per these new rules 'waste' is defined as solid waste alone which is generated by all the households, hospitality industry, big and small market vendors. These rules are applicable beyond municipal areas and extend to urban agglomerations, census towns, notified industrial townships, areas under the control of Indian Railways, airports, airbase, port and harbor, defence establishments, special economic zones, State and Central government organizations, places of pilgrims, religious & historical importance.

3.2 Plastic Waste Management Plan

Plastic products have become an integral part of our daily life as a result of which the polymer is produced at a massive scale worldwide. On an average, production of plastic globally crosses 150 Million tonnes per year. Its broad range of application is in packaging films, wrapping materials, shopping and garbage bags, fluid containers, clothing, toys, household and industrial products, and building materials. It is estimated that approximately 70% of plastic packaging products are converted into plastic waste in a short span. Once plastic is discarded after its utility is over, it is known as plastic waste. It is a fact that plastic waste never degrades, and remains on landscape for several years. Mostly, plastic waste is recyclable but recycled products are more harmful to the environment as this contains additives. The recycling of a virgin plastic material can be done 2-3 times only, because after every recycling, the plastic material deteriorates due to thermal pressure and its life span is reduced. Hence recycling is not a safe and permanent solution for plastic waste disposal. It has been observed that disposal of plastic waste is a serious concern due to improper collection and segregation system

3.3 C&D Waste Management Plan

Unlike other rules addressing various key urban wastes such as MSW, plastic wastes, BMW, the Construction and Demolition (C & D) Waste Management Guidelines on Environmental Management of C & D Wastes (CPCB, 2017) 2

Rules, 2016 are NEW rules that were notified on 29th March, 2016 by the Ministry of Environment, Forest and Climate Change (MoEF&CC). As per Rule 3 (c) "construction and demolition waste" means waste comprising of building materials, debris and rubble resulting from construction, re-modelling, repair and demolition of any civil structure.

3.4 Bio- Medical Waste Management Plan

'Biomedical waste' (BMW) means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities A lot of the waste from Health Care Facilities is infectious biological material or objects, which although they are considered "communal" waste, are in fact contaminated. These latter items include textiles, bandages, syringes, and other objects exposed to infection through contact with patients. Very much of the waste from hospitals is made up of special surgical instruments, such as surgical implants and other implements employed during operations.

3.5 Hazardous Waste Management Plan

Hazardous wastes are those that may contain toxic substances generated from industrial, hospital, some types of household wastes. These wastes could be corrosive, inflammable, explosive, or react when exposed to other materials. Some hazardous wastes are highly toxic to environment including humans, animals, and plants.It comprises the waste generated during the manufacturing processes of the commercial products such as industries involved in petroleum refining, production of pharmaceuticals, petroleum, paint, aluminium, electronic products etc. Hazardous Waste management is a major challenge in urban areas throughout the world. Without an effective and efficient waste management program, the waste generated from various human activities, both industrial and domestic, can result in health hazards and have a negative impact on the environment.

3.6 E- Waste Management Plan

Electronic Waste is emerging as a serious public health and environmental issue in India.[1] India is the "fifth largest electronic waste producer in the world"; approximately 2 million tons of e-waste are generated annually and an undisclosed amount of e-waste is imported from other countries around the world. Electronic waste or E-Waste describes discarded electrical or electronic devices. Used electronics which are destined for refurbishment, reuse, resale, salvage recycling through material recovery, or disposal are also considered e-waste.

3.7 Water Quality Management Plan

Water management plan will provide information about current water uses and charts a course for water efficiency improvements, conservation activities, and water-reduction goals. The plan establishes the priorities and helps to allocate funding for water-efficiency projects that provides the biggest impact. The proposed plan is in line with the

- Policy statement that ties water management plan to the long-term need of the district.
- Will also help in planning of resource allocation to meet the water management plan.

Understanding the current water uses and costs is essential to a comprehensive plan. This step involves collecting water and cost data and determining a baseline that will be used to calculate cost savings and determine overall water reduction potential associated with water efficiency opportunities. At the facility level, this task includes the following sub steps: Determine the marginal per-unit cost of water and sewer service Verify the appropriate rate structure is applied Identify services the utility might provide to help manage water efficiently. Utility information should include the following for potable and non-potable water: Contact information for all water and wastewater utilities Current rate schedules and alternative schedules that are appropriate for a particular use or facility type to ensure the best rate Copies of water and sewer bills for the past two years to identify inaccuracies and ensure the appropriate rate structure is applied Information about rebates or technical assistance from the utilities to help with facility water planning and implementing water-efficiency programs. Energy utilities often offer assistance with water-efficiency programs Contact information for the federal agency or office that pays the water and sewer bills Production information if the facility produces its water or treats its own wastewater, or both.

3.8 Domestic Sewage Management Plan

Domestic sewage carries used water from houses and apartments; it is also called sanitary sewage. Sewage is generated by residential, institutional, commercial and industrial establishments. It includes household liquid from toilets, baths, showers, and kitchen and sinks draining into sewers. In many areas, sewage also includes liquid waste from industry and commerce. The separation and draining of household waste into grey water and black water are becoming more common in the developed world, with treated grey water being permitted for use for watering plants or recycled for flushing toilets. Sewage treatment is the process of removing contaminants municipal wastewater, containing mainly household sewage plus some industrial wastewater. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safe enough for release into the environment. A by-product of sewage treatment is a semi-solid waste or slurry, called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land.

3.9 Industrial Waste Water Management Plan

Effluent Treatment Plant needs to be set up by every industry set in the District. This will help in using the treated waste water properly within the industry, thus, reducing the cost of 44 procuring water for additional purposes in the industry. Time to time the effluent treatment plants and their related impacts on the environment and district shall be checked by the concerned authorities. Industries using the treated waste water shall be recognised and considered as a model example for using the best out of the waste. Industrial wastewater Among the possible classifications of industrial waste-waters, one distinguishes between diffuse industrial pollutants, such as those from mining and agro-industrial, and end-of-pipe point discharges and mostly illegal discharges from tankers. The former are frequently highly polluting and difficult to contain and treat, while the latter can be contained, controlled and treated in circumstances where there is sufficient political will, regulatory power and resources (economic and human capacity) to ensure compliance. Large end-of-pipe discharges are generally easy to identify and can be regulated, controlled and treated. However, some wastewaters arise from concentrations of small enterprises that discharge wastewaters wherever they can and not necessarily to any identifiable sewer. Many are highly polluting containing acids and toxic metals from, for example, small metal finishing (plating) enterprises which have developed in specific localities. Not only do such discharges inflict considerable environmental damage especially to sensitive ecosystems but they also often come into direct (as well as indirect) contact with humans and animals with consequent dam-age to health.

3.10 Air Quality Management Plan

Main Sources of Air pollution in the district are Industrial (Brick kiln/Stone crushers/ Stone and Sand Mines/ Mineral Stockyard, Rice Mills), Vehicular traffic, and Domestic cooking (Rural areas). This plan aims to reduce the sources and amount of air pollutants responsible for reducing the ambient air quality. There are around 199 Air Polluting industries located in the District, mainly Stone Crushers, Brick kilns and Rice Mills, there are also one or two nos. of Tyre Pyrolysis Unit present.

3.11 Mining Activity Management Plan

Environmental management plan includes protection/mitigation/enhancement measures as well as suggesting post project monitoring programme. The management action plan aims at controlling pollution at the source level to the possible extent with the available and affordable technology followed by treatment measures before they are discharged. Fully conscious towards environmental responsibility towards the Stone beneficiation process, the plan focuses, apart from other relevant concerns, on the following important aspects.

a) Dust suppression measures by water sprinkling and

b) Proper maintenance of vehicles and equipment.

The different environmental components that are identified in the assessment chapter are dealt hereunder with necessary environmental management plan.

3.12 Noise Pollution Management Plan

Noise can be defined as unwanted or undesired sound and Noise pollution simply means when there is a lot of noise in the environment which is consequentially harming the environment. Like smoking, noise pollution affects active and passive recipients when noise levels cross certain safe boundaries. Noise pollution affects both human health and behaviour. Noise pollution also impacts the health and well-being of wildlife. Most activities that cause pollution are essential to meet the needs of the growing population and development. Therefore, preventive measures to minimize pollutants are more practical than their elimination.

IV. Strategy & Approach

Sl. No.	Action Points	Strategy & Approach	Responsible Stakeholders
1	Noise level Monitoring	➢ State PCB or its authorized Agency will conduct Noise level Monitoring ➢ Monitoring equipment/ noise measuring devices will be procured	District Administration JSPCB
2	Categorization of areas	➢ Categorisation of areas into industrial, commercial residential or silence areas/zones will be completed soon ➢ Sign boards will be installed in Silent zones	JSPCB ULBs

3	Restriction on use of loud speakers/ PA system etc and monitoring	➢ Loud speaker or a public address system will not be allowed to be used without obtaining written permission from the authority. ➢ A loud speaker or a public address system will not be allowed to be used at night (between 10.00 p.m. to 6.00 a.m.) ➢ Special team for monitoring during festivals	District Administration
4	Monitoring of polluting vehicle	DTO will take steps for monitoring/ checking of vehicles to ensure environmental norms are followed by the vehicles.	DTO
5	Creation of Awareness	Identification and control of noise hazard areas/ Industries etc and Public awareness to be created through IEC (Information, Education and Communication) campaign with participation of SHGs, NGOs, and Students.	District Administration NGOs

V. Conclusion

Environmental pollution is one of the serious problems in most of the megacities of the world, particularly in developing countries. These countries are not only experiencing a rapid growth of population as a result of an increasing rate of rural urban migration, but they are also experiencing industrialization, which is accompanied by air, water, and vehicular pollution. The risk of being exposed to pollution in the environment is now nearly unavoidable for those living in metropolitan areas wherever in the globe. The purpose of this article is to make an effort to investigate the progression of the degree of environmental management in Ranchi and the variable control mechanisms that are being used. Since we are all aware, rapid population expansion remains a cause for worry since it has a wide range of repercussions, one of the most significant of which is the deterioration of the natural environment. The heavily populated and fast expanding city of Ranchi is often shrouded in a haze of pollution caused by a combination of sources, including unregulated pollution from industry, sewage and liquid wastes produced by human settlements, and cars. Recent actions to manage pollution that the government of Jharkhand has done have helped to lessen the state's overall contribution to environmental pollution.

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