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Review Paper on "Planning of Eco-City for Environs of Kanpur"

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Abstract: ***A collection of apparently disconnected ideas about urban planning, transportation, health, housing, energy, economics, developments and social justice all comprise a single framework the "eco-city". A survey of several paradigms or movements that have been floating around for last 20 or so years may help in understanding dimensions of eco-city concepts. In this study eco-city concept aims at developing a comprehensive environmental management strategy for the Kanpur city based on baseline information with regard to urban environment quality and services. This concept takes a closer look at the existing framework of the state's policy on various components of environment; identify the processes and causes, which are leading to deterioration and decline of the environment in and around Kanpur. The report after detailing the threats to environment has made an attempt for future action plans aimed at ensuring compliance with the proposed city development plan. Selection of a suitable landfill site for Solid Waste Management (SWM) forms an important component of urban planning. The problem of SWM has assumed significant proportion for the municipal authorities in the wake of rapid industrialization, urbanization and resultant pressure on existing resources. Many criteria such as distance from residential locations, transport connectivity, presence of water-bodies (drains, ponds, rivers etc.) and forests, ground water table and geology are taken into consideration while planning for suitable sites. An accurate and authentic data is prerequisite for proper planning and management. If one looks for proper urban planning, especially site selection for waste disposals then accurate and authentic data on geomorphology, soil texture, transport network, surface water bodies, land use/land cover, slope, lithology and ground water become paramount. In order to achieve such data in time satellite remote sensing and geographic information system has proved its potentiality.***

Keywords: eco-city, Solid Waste Management, landfill site

1. Introduction

The Environmental concerns and considerations have assumed greater importance in the urban planning processes recently. Cities, now home to more than half of the world's population, are at the forefront of our most pressing environmental challenges, which require Governments, public and private organizations and individuals to take a fresh perspective at how economic and social activities can best be organized particularly for those living in crowded urban areas (Kemp, Rozer, 2008). There have been a growing number of studies on the eco-city concept. Practices over the years have underscored the importance of further studying the interaction between urbanization and sustainable development .Cities are the engine of economic growth, but today more and more countries have realized that it would be good to alter the traditional emphasis on the pursuit of higher economic growth with scant regard for environmental protection and social harmony. There is a demand for the collective actions as a few societies are being left untouched by major environmental problems. In India, the sheer magnitude of urbanization driven by massive demographic shifts is unprecedented with greater implications for human well-being and the environment. For the first time since Independence, the absolute increase in population is more in urban areas that in rural areas. Level of urbanization increased from 27.81% in 2001 Census to 31.16% in 2011 Census.

Population (in Crore)

	2001	2011	Difference
India	102.9	121.0	18.1
Rural	74.3	83.3	9.0
Urban	28.6	37.7	9.1

(**Source**: Census report 2011)

Management of solid waste is now a major global concern that is increasing day by day (Rahman et al. 2008). The traditional methods of solid waste management i.e. land filling of waste without applying any proper technique is still in vogue in most of the developing countries like India. Many cities in India are facing the problem of management of huge quantities of municipal solid waste (MSW) being generated at an ever increasing rate. According to an estimate, per capita municipal solid-waste generated daily in India ranges from a low of 100 g in small towns to a high of over 500 g in big cities (Jayasheela et al. 2007). At present in India, about 125 million tonnes of municipal solid waste (MSW) is being generated annually and it is estimated to increase at a rate of 1% to 1.33% per annum. (CPCB report 2004).

2. Literature Review

Need Of Eco-city Concept

The way we design, plan and build our cities and their infrastructure is critical for developing competitive and liveable cities. Cities are already suffering from severe environmental problems, such as pollution, congestion and excessive waste, while the basic needs of hundreds of millions of urban residents are yet to be met. The unprecedented urbanization imposes an even greater challenge for providing adequate housing, energy, water, sanitation and mobility to all. Cities are at a crossroads. Choices made in urban infrastructure development today will determine the success of cities in delivering services to everyone while growing competitively within a protected environment for decades to come. Decision makers need to adapt as much as infrastructure choices made need to be based on eco-efficient and socially inclusive principles and criteria in order to realize necessary win-win situations, and to build competitive and

liveable cities through environmental improvements.

- Resource conservation maximizing efficiency of water and energy resources, constructing a waste management system that can recycle waste and reuse it, creating a zero waste system
- Restores environmentally damaged urban areas
- Ensures decent and affordable housing for all socio-economic and ethnic groups and improve jobs opportunities for disadvantaged groups, such as women, minorities, and the disabled
- Supports local agriculture and produce
- Promotes voluntary simplicity in lifestyle choices, decreasing material consumption, and increasing awareness of environmental and sustainability issues

Water pollution

The main source of surface water in the city is from the catchment of Ganga river and Pandu river. The water flow in the Ganga varies between a mean minimum of 72.6 m3/s and a mean maximum of 8.860 m3/s. After tapping water from upper and lower Ganga canals, minimum water flow of 6m3/s is maintained in the river Ganga near Kanpur. After construction of Ganga Barrage, a permanent and reliable source for the water supply is available to provide 1600 MLD raw water. This is sufficient to cater to the needs of the city till the year 2031. The total amount of water available to the distribution system from these two surface water sources is 300 MLD while 120 MLD is drawn from groundwater, comprising of tube wells and hand pumps

Kanpur is the most populated town along the river Ganga in UP.The present population of Kanpur, in 2011, is about 27,67,031 (*Source: Census 2011*) with municipal area of about 261.50 Sq.km. In terms of population, Kanpur is the second largest city of North India, the largest being Delhi. 60% of the water requirements of the city are met from the river Ganga, which is badly polluted from various point and non-point pollution sources. Kanpur generates approximately 400 million litres per day (MLD) of sewage that is discharged through dozens of drains that finally opens in to the river. The stretch of Ganga near Kanpur is especially vulnerable because of inadequate discharge and flow. The Ganga in Kanpur is always strewn with human corpses and animal carcasses in addition to non-biodegradable polybags.

S No.	Region	City	River	Sampling Point	DO(Mg/l)	BOD(Mg/l)	Total Coliform MPN/100 ml	Water Quality Index (WQI)
1	Kanpur	Kannauj	Ganges	Upstream Kannauj	9.2	3.1	4300	Unsatisfacory
2	Kanpur	Kannauj	Ganges	Downstream Kannauj	9	3.8	6300	Unsatisfacory
3	Kanpur	Kanpur	Ganges	Bithoor	9.9	3.1	3800	Unsatisfacory
4	Kanpur	Kanpur	Ganges	Upstream Kanpur	8.8	3.5	5800	Unsatisfacory
5	Kanpur	Kanpur	Ganges	Downstream Knapur	7.8	6.4	84000	Unsatisfacory

Primary water quality criteria for various uses of fresh water - CPCB norms

Designated best use	Class	Criteria
Drinking water source without conventional treatment but after disinfections	A	Total coliform organisms mpn/100ml shall be 50 or less Ph between 6.5 and 8.5 Dissolved oxygen 6 mg/l or more
Outdoor bathing (organized)	B	Biochemical oxygen demand 2 mg/l or less Total coliform organisms mpn/100ml shall be 500 or less Ph between 6.5 and 8.5
Drinking water source with conventional treatment followed by disinfection	C	Dissolved oxygen 5 mg/l or more Biochemical oxygen demand 3 mg/l or less Total coliform organisms mpn/100ml shall be 5000 or less Ph between 6 and 9
Propagation of wild life, fisheries	E	Dissolved oxygen 4 mg/l or more Biochemical oxygen demand 3 mg/l or less Ph between 6.5 and 8.5
Irrigation, industrial cooling, controlled waste disposal		Dissolved oxygen 4 mg/l or more Free ammonia (as n) 1.2 mg/l or less Ph between 6 and 8.5 Electrical conductivity less than 2250 micro mhos/cm Sodium absorption ratio less than 26 Boron less than 2 mg/l

Air pollution

The air pollution problems in Kanpur are due to traffic and transportation, burning of solid waste, use of coal and cow-dung for cooking purposes, lack of green belt/buffer zones etc. In addition following factors also contribute largely to the problem.

1) Increase in the number of vehicular traffic
2) Poor(damaged) road condition
3) Under construction buildings
4) Smoke emitted from factory chimneys

Sl. No	Place	Category	Quantity(Microgram/cubicmeter)			
			P.M 10	SO2	NO2	AQI
1	Kidwai Nagar	Residential	210.2	6.7	50.3	***173***
2	Jarib Chauki	Commercial	243.2	7.9	47	***195***
3	Panki	Industrial	264.9	8.6	44.4	***215***
4	Shashtri Nagar	Residential	228.9	7	47.9	***186***
5	Kalyanpur	Residential	221	7.6	49.8	***181***
6	Dadanagar	Residential	239.2	9.5	44.7	***193***
7	IIT Campus	Residential	147.1	2	19.4	***118***
8	Rama Devi	Commercial	346.2	5.5	37.8	***296***

Good (0-50)	Minimal Impact	**Poor** (201-300)	Breathing discomfort to people on prolonged exposure
Satisfactory (51-100)	Minor breathing discomfort to sensitive people	**Very poor** (301-400)	Respiratory illness to the people on prolonged exposure
Moderate (101-200)	Breathing discomfort to the people with lung, heart disease, children and older adults	**Severe** (>401)	Respiratory effect even on healthy people

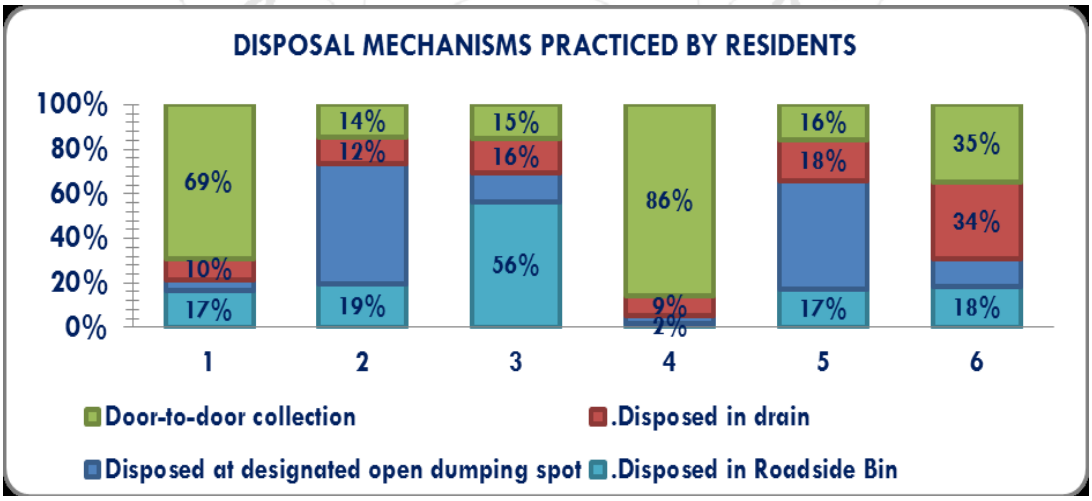
Solid Waste Management (SWM)

The total solid waste generated in the city per Kanpur Nagar Nigam (KNN) is 919 tonnes per day. The main sources of waste generation include residential, commercial, industrial establishments, hospital & nursing homes, hotels & restaurants, slaughter houses, street sweeping, sanitary drains and construction and demolition sites. Apart from solid waste generated by Households, commercial establishments and institutions, Kanpur also has a number of industries and other businesses that generate different type of waste;

- Bio-medical waste generated by hospitals and nursing homes.
- Sludge buffing and other waste produced by tanneries in jajmau area.
- Industrial waste produced by textile, rubber and other industries operating in the city.
- Dung waste straw and other waste from dairies (parag).
- Silt from nallas and drains.
- Coal ash and fly ash from panki thermal power station.

Solid Waste Treatment and Disposal

The private concessionaire has been handling the processing and disposal of solid waste in Kanpur City since October 2009, however, the extension of contract in September 2010 with a concession period of 30 years, has witnessed an increase in its scope with the inclusion of the design, construction and operation & maintenance of a 1500 TPD integrated solid waste management facility generating electricity from the waste. The operations of the plant include composting, RDF and electricity generation (15 MW capacities). Majority of the fuel used in the plant is RDF derived from the waste and the private concessionaire plans to sell the electricity to the State as well as on commercial basis. The primary surveys have disclosed that the residents do not practice sound disposal of solid waste. The rampant practices observed in the city are disposal at the road sides, disposal at designated open dump spots, and disposal into drains/open nallas.



Indicative strategies to improve the city environment

- A master plan for the city needs to be in place with clear cut guidelines for different type of land use for commercial, industrial and residential purpose
- The city planners and policy makers must not allow heavy and medium size industries within the city limit
- Environmental resource map showing distribution of natural forests, plantations, water bodies, agricultural land and open lands would help in the planning process
- Drainage and sewerage network map showing drains/nallas, sewer lines, pumping stations, disposal points and location of sewage treatment plant would guide in the preparation of environment management strategy.

- Vehicles responsible for air and noise pollutions should be phased out and in no case they should be allowed to ply on the road after 15 years
- Strict regulation to be made for not allowing poorly maintained tempos who are the main culprit for causing noise pollution. They must be banned from plying on the city roads.
- The city should take up the concept of Compressed Natural Gas (CNG) - run vehicles in phased manner.
- Phasing out of tempos must be initiated since they are mainly responsible for the air and sound pollution exceeding the set limits in the city
- Efforts should be made to identify the environmental hot spots such as poor air quality area, ground water contaminated area, unsewered area, waterlogged area, slums, polluted river stretches etc. so that remedial measures can be put in place.
- Decision makers in top policy making bodies like UP Jal Nigam, Pollution Control Board and Kanpur Development Authority should work in tandem for implementing development projects without delay
- There is a need for a centralized waste disposal facility for the city so that wastes after disinfection and incineration can be disposed to a separate dedicated facility. In addition waste collection, storage and transportation network need to be strengthened.
- Development of integrated waste management planning, inter-agency coordination and institutional capacity building measures to improve the efficiency and effectiveness of solid waste management at each stage of collection, transportation, treatment and disposal should be in place.
- Relocation of polluting industries from non-confirming areas should be made with proper supporting infrastructure.
- Projects that are earmarked for execution under GAP, Phase-II should be taken up as per the timeline and remaining drains should be tapped to bring it under STP
- Kanpur Development Authority (KDA) and Police should not comprise on issues relating to granting of licenses for installation of industries within the city limit.
- Some senior officers of the SPCB are of the view that a quasi-judicial body such as Pollution Control Commission with sweeping powers should be in place to deal with matters for ensuring a clean city environment.

Actions required

- To ease the traffic congestion and related environmental problems, new roads with improved width should be laid, pedestrian facilities and parking facilities provided.
- Regulation of traffic is essential in the core area of the city. Mixed nature of traffic should be provided on these roads and certain slow moving traffic like bullock cart and hand carts should be banned during day time.
- All vehicles moving on the road should meet the stipulated emission norms.
- Two wheelers are responsible for 70% of the vehicular pollution. An organized mass transport system may reduce the use of two wheelers. Conventionally, the environmental problems are solved by introducing environmental management technique such as control of pollution at source, providing sewage treatment facilities etc. However in large urban conglomeration like Kanpur city, the problems can not merely be solved by pollution control measures.
- The environmental aspects are to be induced into each of the developmental activities at the planning stage itself and are to be well coordinated and balanced An analysis of the various environmental attributes such as air, water and land use indicate that the city is currently not geared to attain environmental sustainability unless remedial measures are in place.
- Critical assessments of the existing situation indicate that demographic structure, economic condition of the people and land use largely determine the state of the environment in Kanpur. Therefore it is the planners and policy makers who have to decide on various parameters that need to be in place for a sustainable environmental plan for the city.
- Scientific methodology must be adopted for the site suitability analysis for the waste disposal site selection.

Remote Sensing and Geographical Information System for Landfill Site Selection

Remote sensing and GIS plays an important role in site selection studies since most of the information involved include spatial component, integration of information from various levels of jurisdiction (city, zone range and health ward level), requires assimilating voluminous information for analysis, non-availability of organized maps of other data, lack of properly updated data and comprehensive or cohesive system to handle large amount of data. GIS is ideal for preliminary waste disposal site selection studies since manual method of selections is very tedious. The ability of overlay gives it a unique power in helping us to make decision about the identification of waste disposal sites. Once a GIS database was developed, it provides an efficient and cost effective means of analyzing the best disposal of solid waste. Integration and correlation of the information related to the factors considered for site selection, which is very complex, can be handled easily with GIS. On completion of data analysis GIS helps in planning and managing the environmental hazards and risks. GIS supports activities in environmental assessment, monitoring and mitigation and can also used for generating environmental models. Sumathi et al., (2007) carried out a study on the siting of a new landfill in the Kanpur city using a Multi-Criteria Decision Analysis (MCDA) and overlay analysis using a Geographic Information System (GIS). Surface water bodies, sensitive sites, land use, geomorhology, slope, groundwater quality and geology are the several factors considered in the siting process. Depending upon their relative importance, the weightings were assigned to each criterion.