Bengaluru

ENVIRONMENT REPORT CARD 2021

CSD 20 YEARS of shaping a sustainable future

CITIZEN'S RANKING

Acknowledgements

Environmental Report Card 2021 was prepared by the efforts of Centre for Sustainable Development (CSD) to present the citizen's perception on the environment of Bangalore City. Contributions from Government departments, experts, and organizations have resulted in this report.

We express our gratitude to the Karnataka State Pollution Control Board, the Department of Environment and Ecology (Government of Karnataka), for giving us the opportunity to conduct a research study on the Environment Report Card for Bangalore city.

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Executive Summary - Citizen's Perception & Ranking of Environmental Issues

A report card usually depicts the performance of an individual or an organization using a system of grading to determine the quality of the work done. The ERC is essentially a report card based on citizens' perceptions of the quality of environment prevailing in their city.

The main objective of preparing the Environment Report Card (ERC) is to capture the citizens' perceptions on environmental issues which closely impact them and stimulate debate on the policies intended to benefit environmental protection. The study has adopted a three pronged approach, which takes into consideration the baseline information on the existing environment, citizens' perception on the environment and the government's efforts to mitigate the environmental problems.

The citizens' are given a set of environmental indicators like air quality, water, sanitation, climate change, and so on and asked to rank them in descending order. They are also given a satisfaction index in which they express their level of satisfaction or dissatisfaction on a scale of "Highly satisfied" to "Highly dissatisfied". This forms the basis to validate secondary information from government sources and measured data on key parameters to understand environmental issues of serious concern. Why are citizens' perceptions important?

Democracies like India are driven by citizens, as their government is elected by their elected representatives, that means they govern for their own benefit.

However, governments and political leaders often overlook people's opinions on matters that directly affect citizens, such as the environment and health. In such cases, government and citizens face conflicts, leading either to PILs or activists taking to the streets. Both of them are harmful, as the courts tend to smother the Executive's sphere, and activists' voices are suppressed or ignored in most cases. The best-case scenario would be to consider citizens' perceptions of issues that affect them daily and to design public policies that address solutions in an ecosystem. According to a citizen survey conducted by the ERC, air quality is one of the top three areas to be addressed by citizens.

Although most citizens in the satisfaction index have indicated that they are currently satisfied with the quality of air, they perceive it to be a major environmental issue shortly. Their perception is further corroborated by measurements of air quality levels in various parts of the city including residential, industrial, and sensitive zones which clearly show that PM2.5 is above permissible limits in most of the areas where air quality data were recorded by the CSD team. ERC also contains other indicators that demonstrate citizens' perceptions are very similar to real-life situations we may encounter in the future. In the 2012 ERC, citizens had ranked Water availability as the number one issue to be addressed. Five years later, in 2017 it indeed turned out to be a reality when Bangalore was put on the list of one of the most water-stressed cities in the world. Hence we can reasonably conclude that citizens' perceptions ought to be taken seriously, especially when addressing civic issues at the city level.

To assess the overall perception of the people, respondents were asked to rank concerns from 14 issues identified as issues of concern. It is interesting that the changes in priorities have shifted from 2005 to 2012 to the current scenario. In 2012 the highest priority was the quantity and quality of water which were ranked as 1 & 2 respectively. However, way back in 2005, the priority issues at 1 and 3 were pollution and traffic congestion respectively which are again ranked as 1 and 2 in the current ERC.

Another interesting aspect is the ranking for tree cover. It was prioritized at number 2 in 2005, went on to move down to 7 in 2012, and has now fallen further to 9. A similar trend is also observed for the lack of open spaces across the three-time scales. Keeping in view the current scenario two new aspects were added to the ranking system; waste segregation and management and the shrinking water bodies of Bangalore.

For a year waste segregation and decentralization of waste management have been made mandatory at the ward level. This has been a matter of concern for most residents as there is a belief that waste dump yards and landfills should not be located within the vicinity of residential quarters. While few residents have accepted this change there is a negative attitude towards this waste management scenario largely which is evident from the ranking system where it ranks at 4.

An important distinction to be made here is between Citizen ranking of environmental issues based on perceptions and the levels of satisfaction indicated in the survey sample. One may find varying responses to these two aspects.

The majority of citizens expressed satisfaction with a particular indicator, but ranked it as a serious issue. Water availability satisfaction levels are fairly high, with almost 80% of respondents saying they were satisfied with the current water availability scenario.

However, the same issue ranks number 5 in the ranking index indicating that citizens still perceive water to be a major issue although they are satisfied with water being available for their daily needs. In another instance, 95% of the citizens' surveyed expressed dissatisfaction at the declining tree cover status in Bangalore but also ranked it at number 9 out of the 13 issues indicating that tree cover may not be a serious issue of concern as it might not have been affecting them on a daily basis.

METHODOLOGY

The Environment Report Card (ERC) prepared by CSD is based on citizens' perceptions on the quality of environment prevailing in their city. The concept of ERC evolved in 2005 when the city's growth phase was in peak. It was prepared to capture citizens' perceptions on environmental issues and to encourage debate within the community on policies intended for environmental protection and to promote sustainable development in the city. The study was also conducted in the year 2012 with similar goals and aims but with modifications in the indicators, based to accommodate the recently added issues at the city level and review the same.

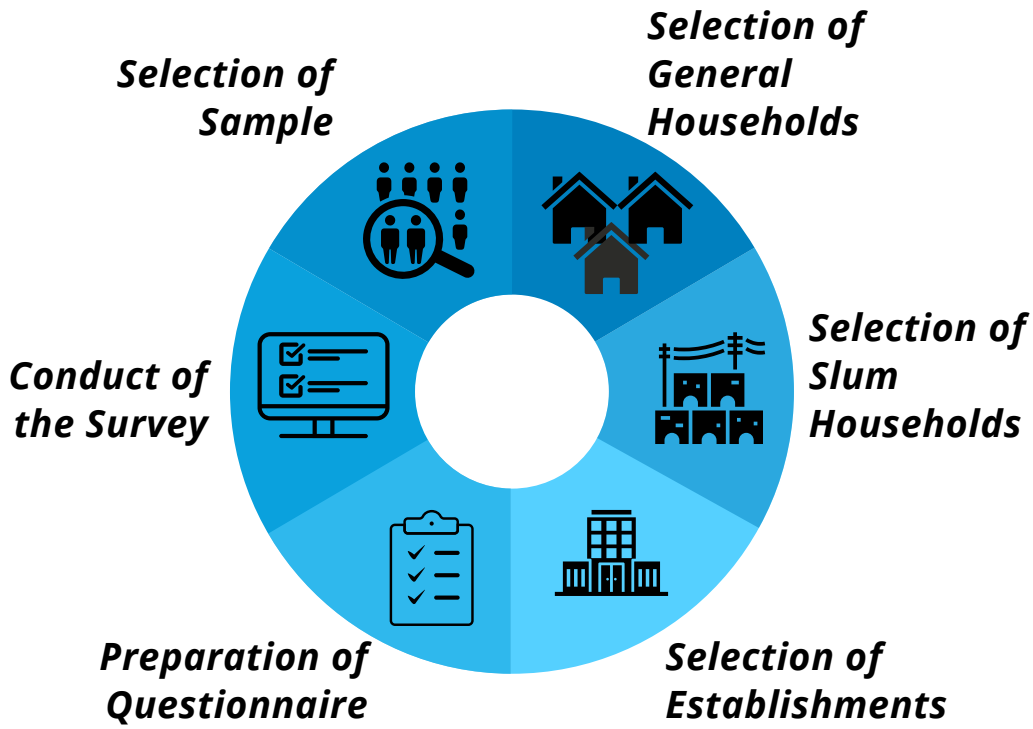
This is the third ERC for Bangalore city, with the objectives being the same but the approach is modified and enhanced a review the environmental issues and problems currently plaguing the city.

Three different aspects of Bangalore's environment included compiling information from different sources on the status of the environment, understanding actions taken and proposed plans by the Government, and most importantly citizens' perception of the changes in the environment of Bangalore.

Conducting a questionnaire-based survey was conducted in order to gather the citizens' perceptions. Each of the identified indicators was incorporated into the questionnaire.

The indicators identified for the study include Air, Noise, Water, Soil, Solid Waste, Land Use Land Cover (LULC), Biodiversity, Energy, Traffic and Transport, Weather, Climate, and Health. The citizens were given a satisfaction index in which they express their level of satisfaction or dissatisfaction on a scale of 'Highly satisfied' to 'Highly dissatisfied' for each of the indicators. Further, the citizens were also asked to rank these in descending order.

In this study, we have created an amalgam of three different aspects of the city; compile information from different sources on the status of the environment, understand actions taken and proposed plans by the Government, and most importantly citizens' perception on the changes in the environment of Bangalore.



Broadly BBMP is divided into 8 zones namely East, West, South, Yelahanka, Mahadevpura, Bommanahalli, Rajarajeshwarinagar and Dasarahalli zones. These zones have been further classified into 198 wards. The household survey has covered 1842 surveys and 440 commercial establishments.

The Environmental Report Card examines citizens' perspectives on the environment of Bangalore through a stratified multistage random sample survey of households as well as a multistage randomly selected survey of establishments.

Additionally, secondary sources were collected for the study. These included a collection of data from not only government sources, but also academic institutions, research studies, and newspaper articles.

Current Outlook

- The traditional issues of air, water and waste continue to dominate citizens future concerns. But the emphasis is shifting to newer issues of Land Cover-Land Use, Biodiversity and Health with the underlying pressure factor as climate change.

- Although there are a number of initiatives taken by State Government and its agencies, there is no data on the impact it is creating towards environmental protection.

- There is a general positive response from citizens for environment related civic services – water supply, quality, waste management, renewable energy, there is much dissatisfaction on core environment issues of tree cover, parks, lakes pollution and bio diversity.

- The involvement of communities and NGOs and some CSR is helping on-ground change.

- Trends in land use change, decrease in green cover and over exploitation of ground water shows intense competition for land and water resources, affecting our natural capital- native vegetation, soil, lakes and biodiversity.

- The intensity and frequency of weather events are changing causing concern on the complexity of linked impacts- habitat fragmentation, decline in agricultural land, increase in invasive species, new diseases.






CHAPTER 1
AMBIENT AIR

KEY POINTS

Air quality is one of the more important environmental concerns as it is a direct link to human and environmental health.

Moreover, air pollution is getting more and more severe as Bangalore's microclimate changes. As part of this study, nitrogen dioxide (NO2), sulfur dioxide (SO2), suspended particles PM10, and respiratory suspended particles (PM2.5) are taken into consideration.

Industries, vehicles, and construction dust (including metro and flyover activities) are the principal sources of air pollution in Bangalore. The growth of the economy in the city has led to an increase in the population which further has led to an increase in air pollution due to increased number of diesel vehicles.

Earlier, the Karnataka State Pollution Control Board (KSPCB) had installed High Volume Samplers for the National Ambient Quality Monitoring program in 1989 at three locations, namely: 1) AMCO Batteries; Mysore Road; 2) Graphite India (White field road); and 3) Anand Rao Circle. Currently, seven more Ambient Air Quality monitoring stations are installed at 1) City Railway Station, 2) Sanegruvanahalli, 3) Veterinary College Hebbal, 4) Shalini Ground - Jayanagar, 5) Kavika-Mysore Road, 6) Rajiv Gandhi Child Care Institute- NIMHANS, 7) H.S.R. Layout near Central Silk Board.

There are large industrial areas in Southeast Asia, such as the Peenya Industrial Area/Estate in Bengaluru. This area is highly polluted due to major industrial activities, construction works, traffic dust from unpaved roads,

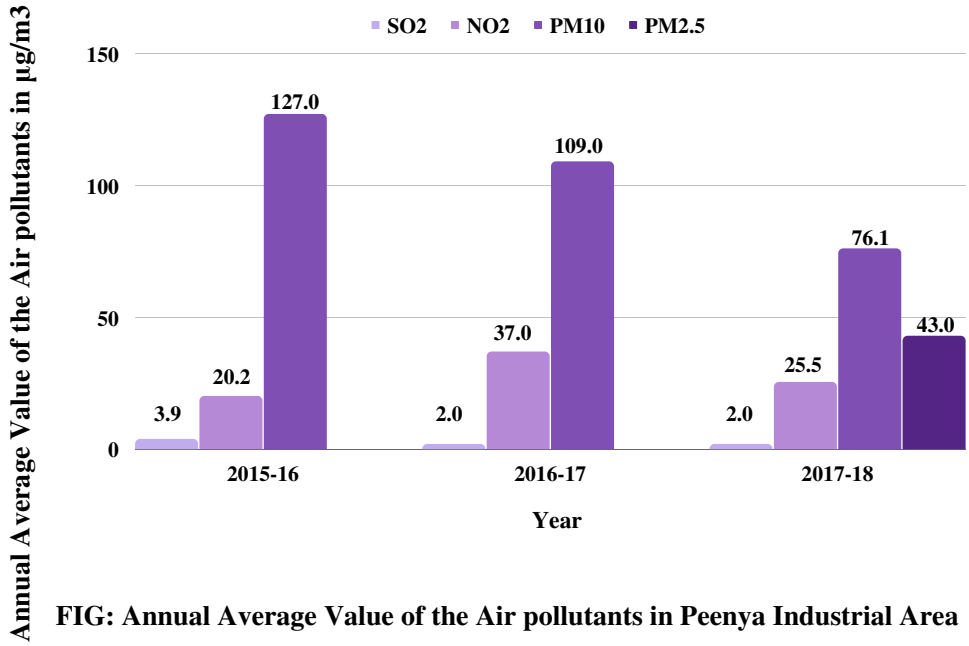


FIG: Annual Average Value of the Air pollutants in Peenya Industrial Area

The air quality monitoring by CSD was conducted in three main zones i.e. Industrial, Residential and Sensitive.

Results from the industrial zone showed PM10 levels in Peenya Industrial area and at Anand Rao Circle were higher than the permissible limit, while PM2.5 levels were higher everywhere. Except for 3 locations Hosakerahalli, Kempapura Agrahar, and Marenahalli. PM2.5 was observed above the permissible limit in Thanisandra, Bagalgunte, Hegganahalli, Kottigepalaya and Hosakerahalli. Even in sensitive zone locations - K. R. Market and Victoria Hospital, PM2.5 exceeded the limit, while PM10 was observed relatively low.

Considering the above result, PM2.5 seems to be the major pollutant in this area. In all three zones the industrial, residential, and sensitive zones, Sulphur dioxide (SO2) and Nitrogen Dioxide (NO2) concentrations were relatively low compared to Particulate Matter.

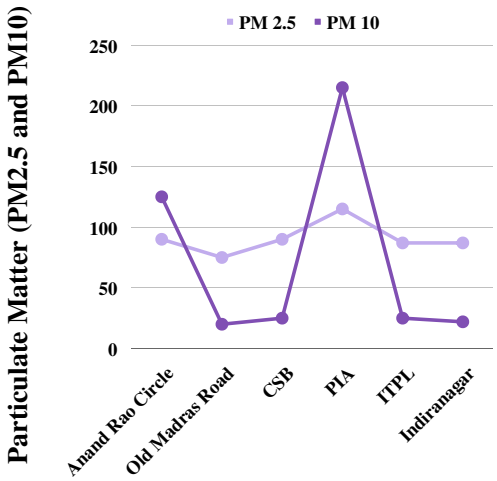


FIG: PM2.5 and PM10 value in Industrial Area

An increase in tree cover has reduced pollution levels, as the study shows an average lower pollution in areas with tree cover. Outdoor air pollution is a big concern; however, Indoor Air Pollution is even more worrying because it is contained within a controlled area, allowing more pollutants to build up. Inadequate ventilation, burning of fossil fuels, etc. causes pollution. In general, women and children are most vulnerable, as they stay indoors most of the time. The government has implemented a wide range of policies and programs, including The Air (Prevention and Control of Pollution) Act 1981. Section 21(1) of the Act says that no person shall, without the previous consent of the State Board, establish or operate any industrial plant specified in the schedule in an air pollution control area. To combat air pollution, the Bengaluru Clean Air Platform (BCAP) has been launched with the support of the Azim Premji Philanthropic Initiatives to catalyze collective action against air pollution.

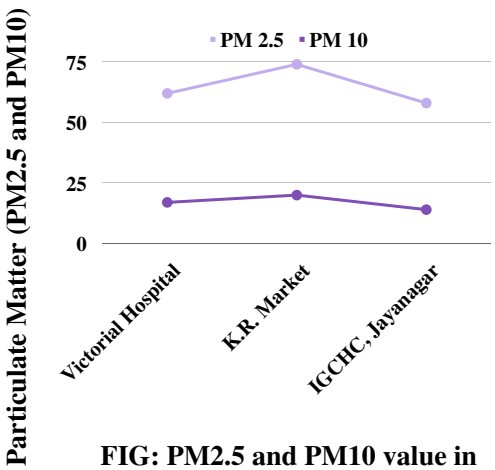


FIG: PM2.5 and PM10 value in Sensitive Zone

Citizen's perception

CSD conducted a survey via questionnaire method to find out the citizens' perception on the quality of air. Citizen's perception revealed that the overall satisfaction was high on air quality amongst households. However, the schools and slums were dissatisfied with air quality in Mahadevapura with 80 and 90 percent respectively and also 70 percent respondents of slums in Bommanhalli were also highly dissatisfied with air quality.

The presence of chimneys plays a very important role by removing indoor air pollutants. Presence of Chimneys was observed in 80% of households in RR Nagar. Among slum households, chimneys were observed in 75% in Dasarahalli and 72% in South Zone. Amongst the Banquets surveyed, 94% had Chimneys.

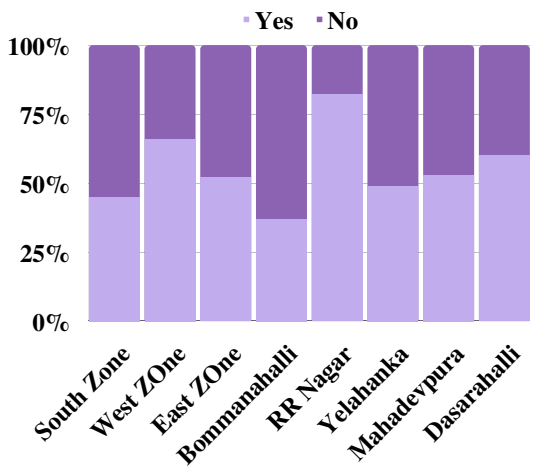


FIG: Presence of Chimney in Households

Vehicular dust also causes various respiratory disorders. The citizen survey showed that the major source of dust was vehicular emission in residential areas and slums, construction activities and lastly sweeping. Initiatives have been taken by various agencies in Bangalore to lower pollution levels. Initiatives include; KSPCB has come up with Action Plan to combat Air Pollution which comprises 17 long-term, 11 mid-term and 15 short- term proposals.

The plan has listed multiple action points by various departments to combat pollution. These include Transport Department, Traffic Police Department, BBMP, KIADB, BDA, BMTC, BMRCL, KSRTC, Food and Civil Supplies Department, Dept. of Energy and finally KSPCB itself. Another initiative is the Azim Premji Philanthropic Initiatives, a Bengaluru Clean Air Platform (BCAP) launched to catalyze collective action against air pollution. The BCAP aims to showcase how stakeholder engagement and joint action can improve the air quality in a city.

The BCAP's approach involves three key elements: improving open data availability, increasing citizen engagement, and supporting state-led actions. Other initiatives include improving fuel quality, introducing alternate fuels for autorickshaws, improving traffic management, implementing emission norms, promoting the use of green fuel by industries for DG sets, etc. In spite of this, air pollution remains as a big environmental problem.

According to the survey most people were satisfied with the quality of air, but it was observed that the level of PM10 and PM2.5 exceed the permissible limit in many locations. In areas like, Mahadevpura 80% of schools and 90% of slums were dissatisfied with the quality of air. In Bommanhalli Slums 70% were highly dissatisfied.

Annual Average Value of Air Pollutants in Peenya Industrial Area

Year	Annual Average Value of the Air pollutants in µg/m3			
	SO_2	NO_2	PM_{10}	$PM_{2.5}$
2015-16	3.9	20.2	127.0	Not Monitored
2016-17	2.0	37.0	109.0	Not Monitored
2017-18	2.0	25.5	76.1	43.0

Air Monitoring values and permissible limits for Air pollutants SO2, NO2, PM10 and PM2.5 in Industrial zones

Location	Parameter	Air pollutant in µg/m3	
		CSD Monitoring	Permissible Value
Peenya Industrial Area	SO_2	17.3	80
	NO_2	25.8	80
	PM_{10}	**212**	100
	$PM_{2.5}$	**113.2**	60
Near Anand Rao Circle	SO_2	20.2	80
	NO_2	31.8	80
	PM_{10}	**133.9**	100
	$PM_{2.5}$	**90.3**	60
Old Madras Road	SO_2	7.7	80
	NO_2	13.1	80
	PM_{10}	**77.5**	100
	$PM_{2.5}$	20.6	60
Central Silk Board	SO_2	8.3	80
	NO_2	16.7	80
	PM_{10}	88.3	100
	$PM_{2.5}$	25.9	60
Near ITPL, Whitefield Industrial Area	SO_2	8.2	80
	NO_2	15.8	80
	PM_{10}	87.4	100
	$PM_{2.5}$	25.8	60
Indiranagar, 100ft Road, KFC Signal	SO_2	7.6	80
	NO_2	14.6	80
	PM_{10}	83.4	100
	$PM_{2.5}$	23.2	60

Air Monitoring values and permissible limits for Air pollutants SO2, NO2, PM10 and PM2.5 in Sensitive zones

Location	Parameter	Annual Average Value of the Air pollutants in µg/m3	
		CSD Monitoring	Permissible Value
Victorial Hospital	SO_2	6.1	80
	NO_2	13.3	80
	PM_{10}	61.8	100
	$PM_{2.5}$	16.3	60
K.R.Market	SO_2	7.4	80
	NO_2	11.9	80
	PM_{10}	74.5	100
	$PM_{2.5}$	19.9	60
Indira Gandhi Childrens Health Care Centre, Jayanagar	SO_2	6.6	80
	NO_2	12.2	80
	PM_{10}	57.4	100
	$PM_{2.5}$	13.8	60

Air Monitoring values and permissible limits for Air pollutants SO2, NO2, PM10 and PM2.5 in Residential zones

Location	Parameter	Annual Average Value of the Air pollutants in µg/m3	
		CSD Monitoring	Permissible Value
Thanisandra	SO_2	14.2	80
	NO_2	22	80
	PM_{10}	**165.9**	100
	$PM_{2.5}$	**70.1**	60
Bagalgunte	SO_2	16.89	80
	NO_2	23.29	80
	PM_{10}	**144**	100
	$PM_{2.5}$	**99.2**	60
Hegganahalli	SO_2	14.2	80
	NO_2	22	80
	PM_{10}	**169.9**	100
	$PM_{2.5}$	**85.1**	60
Kottigepalaya	SO_2	20.5	80
	NO_2	29.6	80
	PM_{10}	**177**	100
	$PM_{2.5}$	**81**	60
Hogadooru	SO_2	6.5	80
	NO_2	13.5	80
	PM_{10}	78.2	100
	$PM_{2.5}$	22.4	60
Hongasandra	SO_2	7.9	80
	NO_2	15.5	80
	PM_{10}	85.4	100
	$PM_{2.5}$	23.5	60
Hosakerahalli	SO_2	17.8	80
	NO_2	27.1	80
	PM_{10}	**116**	100
	$PM_{2.5}$	58.3	60
Kempapura Agrahar	SO_2	16	80
	NO_2	22.7	80
	PM_{10}	**101**	100
	$PM_{2.5}$	50.4	60
Marenahalli	SO_2	15.1	80
	NO_2	23.3	80
	PM_{10}	95.9	100
	$PM_{2.5}$	56.8	60
Kaveripura	SO_2	6.4	80
	NO_2	12	80
	PM_{10}	69.2	100
	$PM_{2.5}$	17.4	60
Padarayanapura	SO_2	6.7	80
	NO_2	11.8	80

CHAPTER 2
NOISE

KEY POINTS

- Noise pollution is a silent killer that is increasing at a shocking rate. It is essential to take measures to control noise pollution.
- In Bangalore, noise levels have been steadily increasing in many areas as a result of rapid urbanization.
- The presence of vehicle traffic caused the greatest noise. According to the data, noise disturbance in residential complexes is perceived to be high by citizens.
- Tree cover play an important role in the reduction of noise and as the tree cover reduced the noise levels have increased.

In comparison with other environmental pollutants, noise pollution is rarely studied because it does not cause major health effects on humans. The psychological effects of noise pollution, however, have become a growing concern. Airplanes, trains, and motor vehicles are the main sources of noise pollution. Even our ocean no longer feels peaceful. Marine life suffers serious noise pollution as a result of an increasing number of shipping vessels and oil drilling rigs.

Despite WHO's classification of noise as the third most harmful pollution, many people are ignorant of its effects. As Bangalore's vehicle population has increased, there has been an increase in vehicular noise. A continuous noise monitoring station has been set up by the Karnataka State Pollution Control Board in various parts of Bangalore city to assess the level of noise pollution throughout the city. Over the last two years, noise pollution has increased at six locations out of ten. Additionally, pubs and restaurants are opening up all over Bangalore, which could also be contributing to this. Furthermore, during the Diwali festival, there is an increased level of noise pollution.

An order issued by the Karnataka High Court in 2005 requires all bars, pubs, and restaurants that play music to have proper permits to prevent noise pollution in residential areas. The Noise Pollution (Regulation and Control) Rules, 2000 state that loudspeakers or public address systems shall not be used without obtaining written permission from the competent authority.

Under the Environmental Protection Act, 1986 the Central Govt. can make rules providing for "the maximum allowable limits of concentration of various environmental pollutants (including noise) in different areas.

According to the Karnataka State Pollution Control Board, 15 percent of the 280 complaints it received during 2000-01 involved noise from industries such as power looms, engineering units, and D.G. sets close to residential areas. Observations showed that the noise level is exceeding the permissible limit in the Peenya Industrial area and near Anand Rao Circle

Noise levels higher than 55dB are considered nuisance by the Central Pollution Control Board (CPCB). It was found that noise levels were high in all locations except Vishwanathnagenahalli. Vehicle traffic or nearby industrial areas could cause this. The noise levels in the Silent zone were also above the permissible limit which can negatively affect the occupants.

The ERC report from 2005 and 2012 indicates a decrease in noise levels in Old Madras Road and Jayanagar. However, the current survey showed that rates exceeded what was expected.

Citizens perception

The citizen survey indicated that 90 percent of people were disturbed by noise pollution from outside in residential complexes in all zones except in RR Nagar where it was 70 percent. Most of the locations showed higher noise level than the permissible limit of 55dB when compared with the results of noise monitoring in residential areas. There was a decrease in noise pollution in the school and hospital areas. This could be because CPCB guidelines declared schools and hospitals as silent zones.

Nevertheless, 100% of hospitals in East Zone, 60% in West Zone, and 50% in Dasarahalli said no disturbance was reported. West Zone and RR Nagar saw 80% of respondents say there is no disturbance while East Zone reported 60% and Mahadevpura reported 40%. The increase in noise pollution could be attributed to the increase in technology and also to the fact that commercial complexes contribute to the noise of residential complexe.

In the study, vehicular traffic noise was recorded as nearly 84 percent; 50 percent of this number were recorded in the 2012 ERC report. With the reduction of noise, tree cover also plays a crucial role, and since the tree cover has decreased, the noise levels have increased.

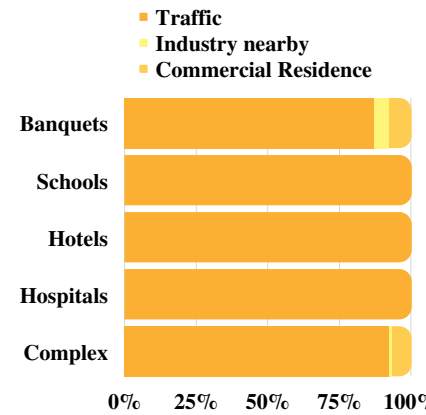


FIG: Source of Noise Pollution from different establishments.

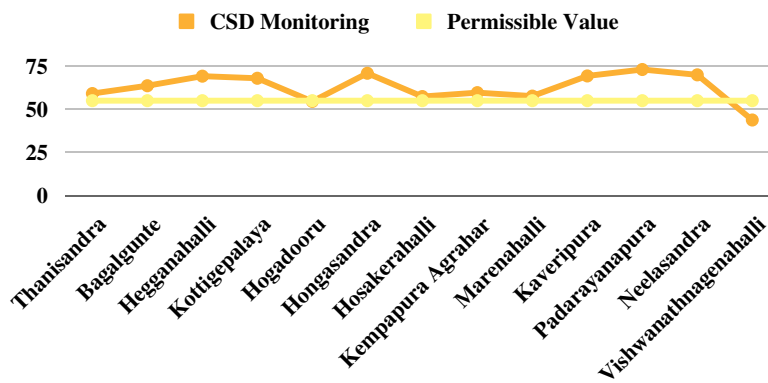


FIG: Noise Monitoring values and permissible limits in Residential zones

Chapter 3
Water

KEY POINTS

- BWSSB supplies water across 800sq. Km to about 9.5 million people of Bangalore city. They supply approximately 42,200ML/month.
- In a 40x60 residential site about 2,23,000 liters of rainwater can be harvested, given the annual average rainfall of 1000mm
- With the increasing demand for water resources, poor water infrastructure, and contaminated existing supplies, Bangalore's ability to grow and prosper in the future may be seriously compromised.
- Water management policies and strategies employed by the city have not been able to cope with the demands for water supply and wastewater treatment, which necessitates a different approach and consideration with regards to water supply, water use, and water resources that are realistic.

Bangalore has experienced a gap between supply and demand in terms of water. Bangalore's Water Supply and Sewerage Board (BWSSB) supplies water to an area of approximately 575 square kilometers of Bangalore in the central part of the city and is also connected to 110 villages (225 sq. km) of which 42 have already been supplied water. The poor quality of water is responsible for nearly 70% of diseases in developing countries.

As per a survey conducted by the Central Pollution Control Board (CPCB), only 1.6% of the water supplied to Indian cities meets the set standards. Of the treated water, only half reaches households, with the remainder being lost either through leaks or leakages during transport of the water.
Presently, 1445 MLD of water supplied to Bangalore by the Cauvery River, the city's main source of water. To meet the rising demand, other sources of water are required. Villages rely primarily on borewells for water supply.

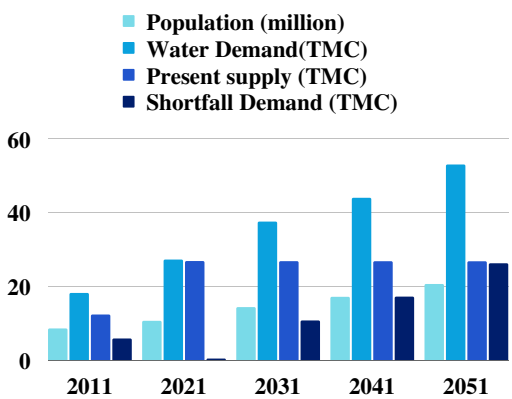


FIG: Population and Water supply requirements (Source: BWSSB)

In response to Bangalore's shortage of water supply, the Urban Development Department of the Government of Karnataka (GoK) allocated an additional 10 TMC (775 MLD) of Cauvery Water which was the Formulation of Cauvery Water Supply Scheme (CWSS) Stage V scheme for Bangalore City to be implemented by 2023.

Further, by 2028, the city will have 350 MLD from Mekedhatu. But by 2050, water demand is over 3300 MLD, and BWSSB needs to install more Rainwater Harvesting structures and recycle and reuse treated water, eliminating a deficit of 500-600 MLD.

As per ERC 2012 survey, total water supplied to Bangalore from two sources, i.e. Cauvery and Arkavanthy river was 994 MLD. In addition, 200MLD was extracted from groundwater sources. Currently, the water supply is 1445 MLD exclusively from the Cauvery river which is an increase of over fifty percent.According to the survey, 80% of the water was extracted from private borewells.

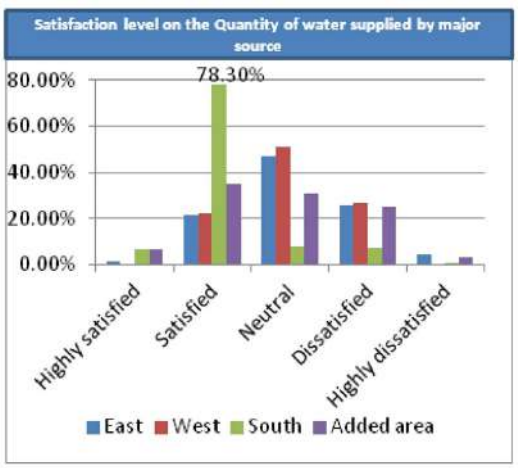
Water Monitoring results of Groundwater

Indicator	Desired level	% within desired limit	
pH	6.5 to 8.5	85%	borewell water of Thanisandra and borewell water in Mallasandra is acidic in nature rnet of things (IOT)
TDS	500 mg/L	29%	surface and borewell water which have a high level of TDS as compared to the limit
Hardness	200 mg/L	70%	Pulikeshi Nagar, Vishwanathaneganhalli, Vijinapura, Gottigere, Hongasandra, Kaveripura, and Chikpete has total hardness above acceptable limit making the water very hard
Nitrate	45 mg/L	45%	Kevempu Nagar, Thanisandra, Kodeigehalli, Mallasandra, Hegganahalli, Bagalgunte, Ullalu, Kottigepalya, Yeshwanthapura, Kaveripura, Lakkasandra, Hosakerehalli, Kempapura Agrahar etc. display high levels of nitrate.
Coliform	0%	62%	Pulikeshi Nagar, Vishwanathaneganhalli, Neelasandra, K R Puram, Vijinapura, Chikpete, Gottigere, Konankunte, and Hongasandra has high level of coliform count then recommended for drinking water.

Citizen's perception

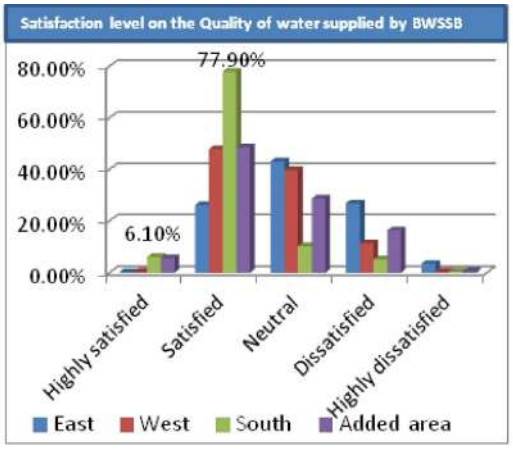
The majority of water supplied to residential complexes is from unidentified private borewells. In addition to BWSSB, water tanker supplies is another major source of water for hotels, commercial complexes, and schools. Compared to the previous ERC 2012, which showed less than half of the water supplied by BWSSB and 60% of from borewells and private water tanks, the present survey indicated more than 70% of the water is met by BWSSB supply followed by borewells and private tanks.

FIG: Satisfaction level on the Quantity of water supplied by major source



The satisfaction level with water quality and quantity is higher than 80% in households, schools, hospitals, and hotels. However, it is 38% in a slum household and 11% is unhappy. A surprising finding is that 15 % of those with high satisfaction resided in slums.

FIG: Satisfaction level on water supply quality by BWSSB



The results indicate high TDS, Nitrate, Total Hardness, and Coliform Count values, while the pH of both Thanisandra (surface water) and Mallasandra (borewell water) was slightly acidic. TDS, Total Hardness, and Nitrate were found at high concentration levels in many samples.

The current method and strategies that have been developed over the years by various Government agencies, for the growth and sustenance of Bangalore, thus need a fresh look by reviewing the objectives and analysis, besides continued commitment and strengthening in more problematic areas of water governance.

Rainwater Harvesting

In 2009, the Bangalore Water Supply and Sewerage Act made Rain Water Harvesting (RWH) mandatory for specific cases in the city. As per the survey, Mahadevpura and Bommanahalli have achieved 100% implementation of the RWH, while Yelanhanka, Dasarahalli and Eastzone have a higher percentage.

It is estimated that householders, hotels, schools, hospitals, etc. implement RWH at a rate of under 36%.

RWH has become increasingly important to many builders in the last few decades when it comes to design and construction. Bangalore city is expanding rapidly and so rainwater harvesting is very important to meet its water demand. In the survey, it was noted that less than 40% of households, hospitals, slums, etc. are resistant to stormwater drains in their neighborhood. In slum households, stormwater drainage satisfaction was higher than 80% except in solitary households.

A lot of households in RR Nagar, 97% slums in Bommanhalli, and 100% of residential buildings in Yelahanka reported flooding during heavy rain frequently.

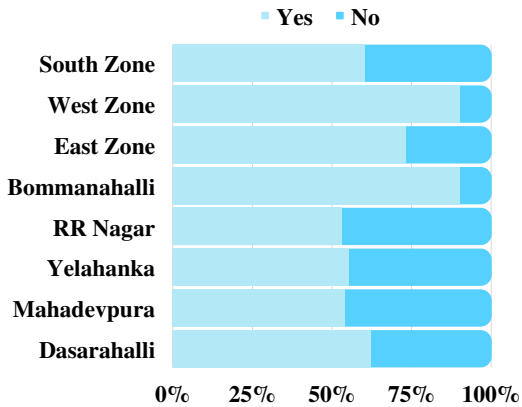


FIG: Rain Water Harvesting in HH

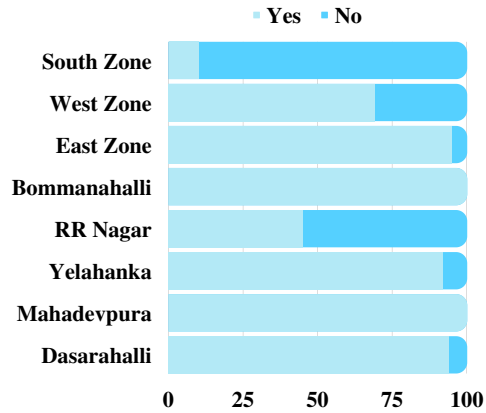


FIG: Rain Water Harvesting in Slums

Sanitation Facilities

Related to sanitation facilities, it was revealed that 19 percent of residents of Pulakeshinagar in the East zone reported not having toilets.

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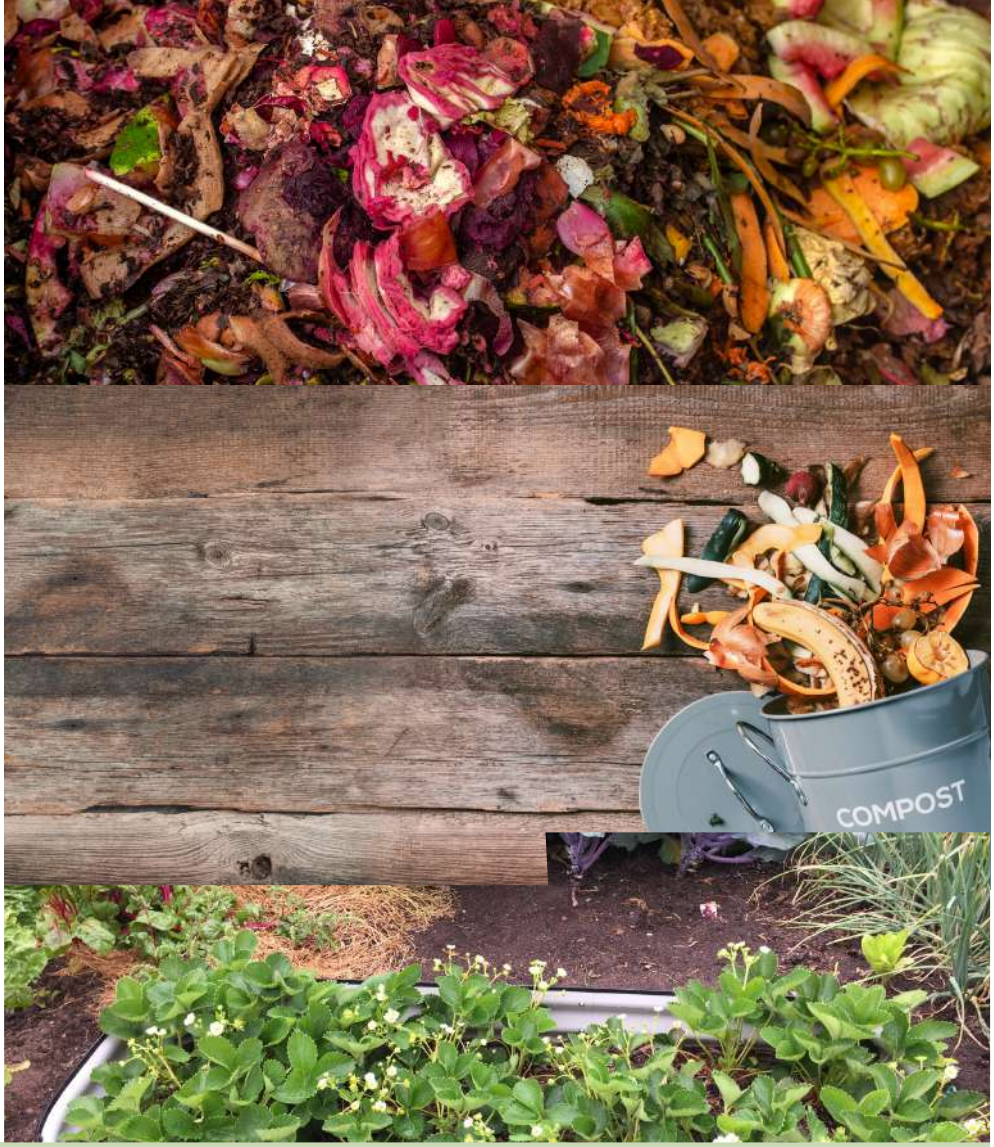
Sewerage System

Sewage generated in the house is managed by most residents through the conventional sewerage system. Residents have septic tanks a very small percentage. In most cases, respondents responded negatively to unpleasant odors originating from open sewerage except for residents of slums (49%). In addition, the maintenance of sewerage systems caused a high level of dissatisfaction amongst slum residents.

Similar to the Environment Report Card 2012, the new Report shows a substantial change in the water resource status and water supply status. As of the present survey, the people (80%) are satisfied with the improved situation.



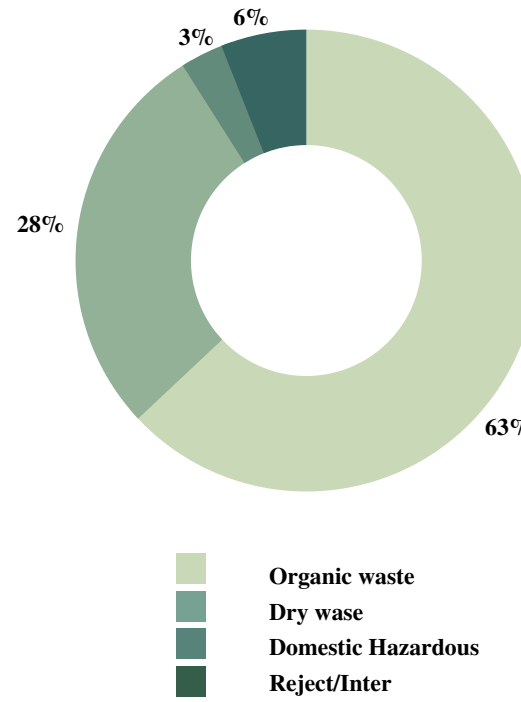
Chapter 4
SOLID WASTE

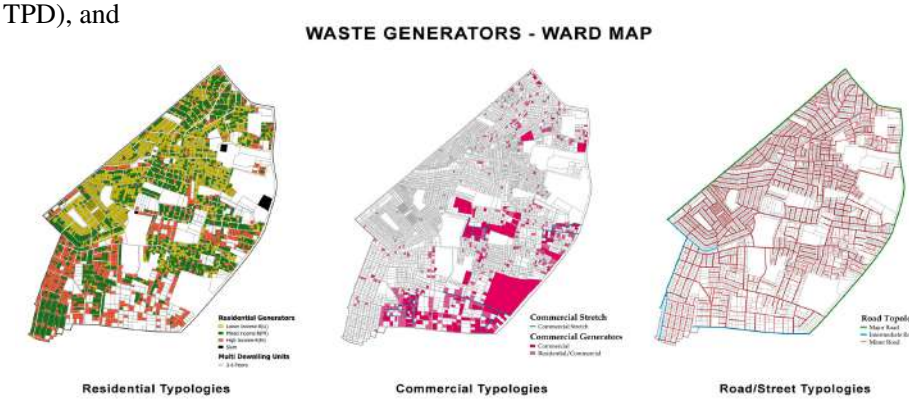
KEY POINTS

- Bangalore generates an average of 5000-5760 tonnes of solid waste per day, of which 65 percent is organic and 32 percent is dry waste. The remaining constitute hazardous waste and reject materials
- Currently, BBMP adopts the decentralized system of solid waste management wherein separate dry collection facilities have been developed ward-wise.
- According to solid waste management 2016 rules, production of waste quantity greater than 100 kg h.as to maintained and processed within the premises of the establishment where it is generated.
- There is a need to create awareness on waste management to the citizens of the city. Aligned with the concept of ‘My waste My Responsibility’, citizens should take care of their waste produced at the ward level.
- There is no doubt that Solid Waste Management and Public Health are very closely related. Proper management of solid waste will reduce significantly the rate and occurrence of diseases.

As a result of social activities in a city, municipal solid waste is a conglomeration of waste that is generated by residents. This waste consists of both organic and inorganic materials. Improper handling, management, and disposal could pollute the atmosphere, cause health issues, and create imbalances in society as a whole.

According to the official data, Bengaluru produces 5000-5760 tonnes of solid waste each day, 65 percent of which is organic and 32 percent dry. The waste generation is mainly handled by households, 49.7 percent by commercial establishments, as well as 6.8 percent by street cleaning. Bangalore generates approximately 3370 tons of residential waste and 2800 tons of commercial waste. Those remaining are hazardous wastes and reject materials. In the present system, the BBMP has developed separate dry waste collection facilities in each ward so that waste does not have to travel long distances for further management. Previously, there were four large waste management facilities on the outskirts of the city namely Mavallipura (600TPD), Mandur (1000TPD), Terra Firma (600 TPD), and Seegehalli (200TPD) to manage the wastes. This resulted in two major issues: one is the transport of collected waste to these locations and the second is the dissatisfaction of the local people in these regions as there was a lot of air pollution and water contamination.





Source: Global Opportunity Explorer

Table: Percentage contribution of MSW

Sl no.	Type of waste	Percent
1	Vegetable	30
2	Paper	9
3	Plastic	12
4	Cardboard	4
5	Textiles	4
6	Grass/leaves/wood	6
7	Electronic goods	2
8	Metal waste	1
9	Other organic waste	23
10	Glass	3
11	Debris	5
12	Biomedical	2

Source: BBMP

At present, many processing units exist for different types of waste, leading to positive changes in the waste handling industry. These have been listed in Table. Segregating waste and handling them separately is a way to manage waste decentral. Besides a separate 80TPD bio methanation unit was also installed to receive bulk organic waste primarily from hotels, restaurants, and nightclubs; however, it has not been in operation for over four years. However, BBMP has a plan to extend bio methanation units at the ward level so that all waste management activities can be coordinated there.

The primary collection of waste is carried out using pushcarts and auto tippers. In addition, there are Dry Waste Collection Centers. E-waste and biomedical wastes are handled separately. Currently, BBMP is working with Saahas, an NGO working in waste management for more than three decades on the management of e-waste. Similarly, there are five different units set up for the management and handling of biomedical waste. These include Ramky Enviroengineers, Maridi Eco- Industries Pvt. Ltd., Ann Autoclave, Meera Envirotech, and Prapval Autoclave.

According to solid waste management 2016 rules, production of waste quantity greater than 100 kg has to be maintained and processed within the premises of the establishment where it is generated.

Earlier in January 2020, BBMP finalized the Solid Waste Management (SWM) bylaws. The bye- laws define eight different categories of waste– wet, dry, sanitary, non-recyclable, non-biodegradable, domestic hazardous, construction and demolition waste, and slaughterhouse waste along with specific strategies for processing each of these different types of waste.

Construction and demolition waste of 2016 has also been brought into effect to combat pollution and waste management, whereby every waste generator should segregate every construction and demolition trash and hand it over to authorization facilities.

Citizen's perception

Most households reported of generating less than half a kg of waste, with the exception of Dasarahalli and East zones, where they generated between half and one kilogram of waste.

Our Survey indicated that in the residential zone, the West zones show the least segregation at 79%, but BBMP ranks the west zone as the best in segregating waste.

Segregation has not been seen in all slums where the results show Bommanahalli and east had the lowest percentages of segregated waste, with 10 and 18 percent respectively, and only three percent respectively in
Eighty percent of respondents at the previous ERC said they don't segregate, which is an improvement from the previous survey.

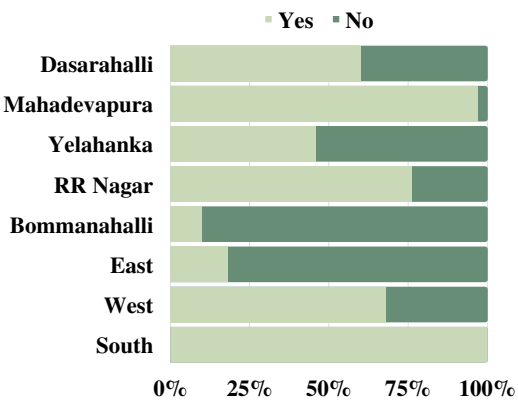


FIG: Waste segregation by HHs

Furthermore, some people disposed of their waste in street bins and some dumped on street corners. Bommanahalli (20%) and the East Zone (3%) are of concern due to the percentage of residents burning the waste generated.

E-waste

During the survey, it was found that most residents throw e-waste along with MSW. A small percentage of people sell the e-waste generated and another small percent also try to recycle it but these initiatives are very minimal.
It was also observed that 3% of respondents in slums disposed of their e-waste in government-recognized e-waste bins.

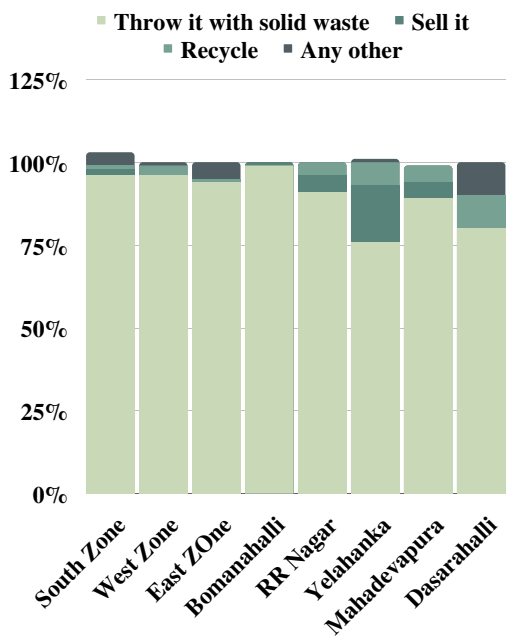


FIG: E-Waste disposal by HHs

Biomedical Waste Management

The level of satisfaction of hospitals with regards to managing and disposing of biomedical waste is high. The highest amount of hospital waste was generated in Mahadevapura, followed by South Zone. In terms of BBMP's waste collection, hospitals remain very satisfied. It was also observed that hospitals did complete segregation at the source.

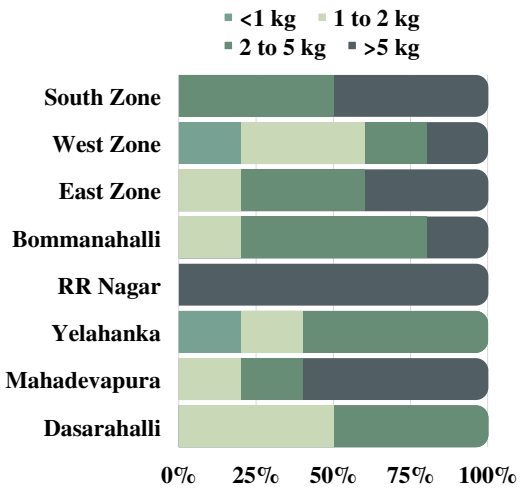


FIG: Zone-wise Biomedical Waste generation by hospitals Bangalore

Chapter 5
Soil

KEY POINTS

- The soil analysis was conducted to get a preliminary understanding of soil status and contamination in Bangalore city.
- The Agriculture Department, Government of Karnataka, has a scheme ‘Bhoochetana’ to conduct fundamental soil analysis across all districts, including Bangalore Urban.
- Trace metals lead (Pb), arsenic (As), cadmium (Cd), and mercury (Hg) were analyzed using a standard protocol. Of the twenty-two locations where soil samples were analyzed, cadmium was observed at three locations: Mahadevapura, Bellandur lake, and Doddanakundi.

Most soil parameters and their classification are determined by their use. Organic matter, moisture, air, and minerals are the typical components of soil. Detailed information about soil conditions was created for the entire Bangalore Urban district, so the information in this section is relevant to the entire district and not just to the boundaries of BBMP. There are two types of terrain in the district: rocky upland and plateau & flat top hills at roughly 900m. Red laterites, loams, clays, and fine loams are the soil types in Bangalore.

Across all districts of Karnataka, including Bangalore Urban, the State Agriculture Department has an initiative called "Bhoochetana." implemented in 2009. The primary strategy of Bhoochetana is soil test based nutrient management with a major thrust on micronutrients and bio-fertilizers which were made available at subsidized prices (50 per cent) to farmers through Raitha Samparka Kendra's (RSKs). The programme started with six districts and 200,000 farmers, has reached over 26,000 villages and 4.2 million farmers as on July 2018.

Factors like pH, electric conductivity, Iron, Copper and Manganese were within limits. Certain locations in Bangalore's urban district have low concentrations of elements like organic carbon, boron, and zinc while they are rich in phosphate, potassium, and sulfur. The various parameter of soil that was tested is given below.

pH

Most of the soil samples were found to have a pH of neutral or slightly alkaline. Certain areas such as Thanisandra in residential areas, Rajaji Nagar Industrial Area, Yeshwanthpur Market in Industrial Zones, and Belahalli, Jakkur, and Bellandur lake in sensitive zones were showed higher concentration of Ph.

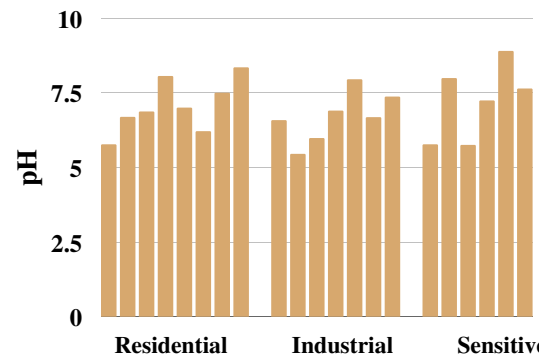


FIG: pH in soil samples

Electric Conductivity

The Electric Conductivity in soil samples analyzed indicate that all values across all zones are well within limits.

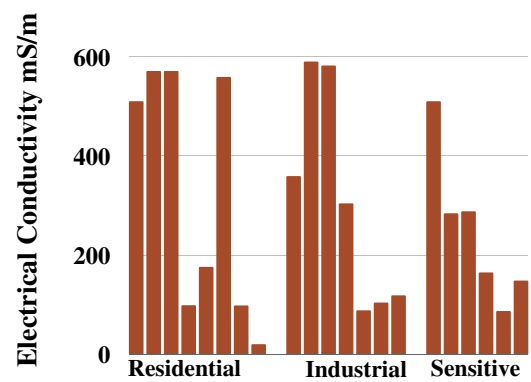


FIG: Electrical Conductivity in soil samples

Organic Carbon

At 0.91 percent and 0.8 percent respectively, Dasarahalli and Bommanahalli are two areas with high organic content, while the other five areas contain low organic content. Organic content in the Industrial Zone ranges from 0.5 percent to 0.75 percent for the three regions, Graphite India, Domlur Flyover, and Central Silk Board. All zones showed low levels of organic matter, except the soil around Bellandur lake, which has a high concentration.

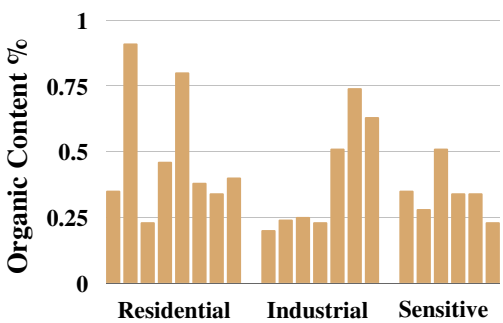


FIG: Organic Content in soil samples

Phosphorous

All regions had exceedingly high levels of phosphorous which was greater than 22kg/acre or 54.4kg/ha. Padarayanpura had high levels at 1000 kg/ha

Potassium

Potassium concentrations were generally high except in RR Nagar, Hosakote, and Kaveripura. Dasarahlli showed exceptionally high values at 921.3 kg/ha. The Rajaji Nagar Industrial Area has a value of 175.5 kg/ha, and Graphite India has a value of 250.9 kg/ha. Belahalli Jakkur was found to have the highest concentration at 605 kg/ha in sensitive zones. Dougenakundi lake's values were within the permitted limits.

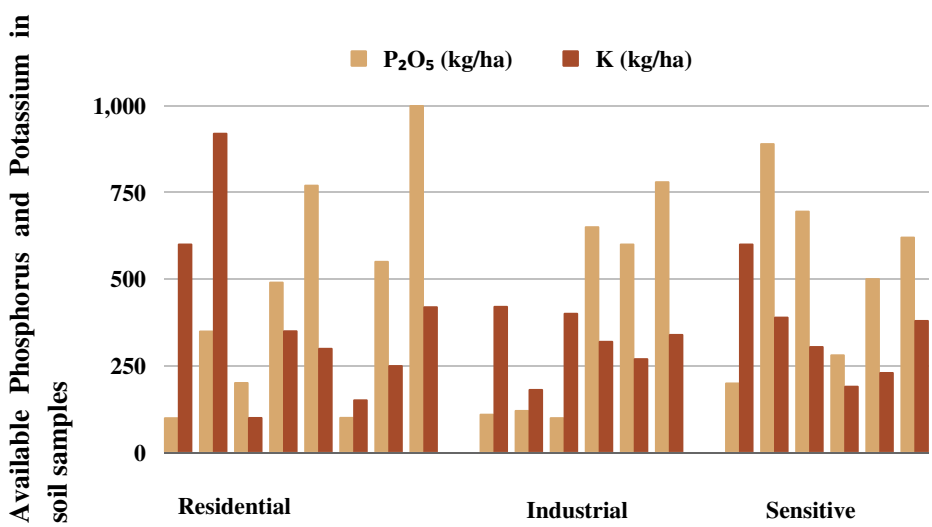


FIG: Available Phosphorus and Potassium in soil samples

Sulphur

Padarayanpura observed values within the normal range for residential areas. Neither Kaveripura nor Bommanhalli exceeded 10 parts per million. However, there are still high Sulphur concentrations in the remaining locations. There are low levels of Sulphur in Domlur and Central Silk Board. Victoria Hospital had a value that was within the limit, and Nimhans and K R Market had low values.

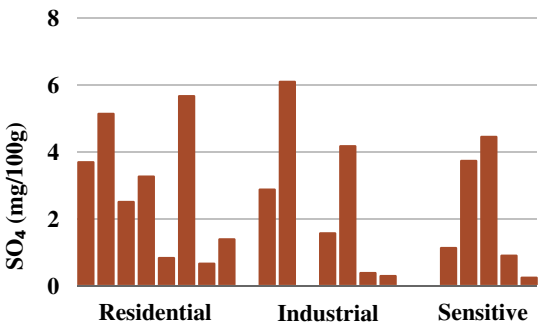


FIG: Available Sulphur in soil samples

Iron and Manganese

The Iron and Manganese values were above the permissible limit in soil samples.

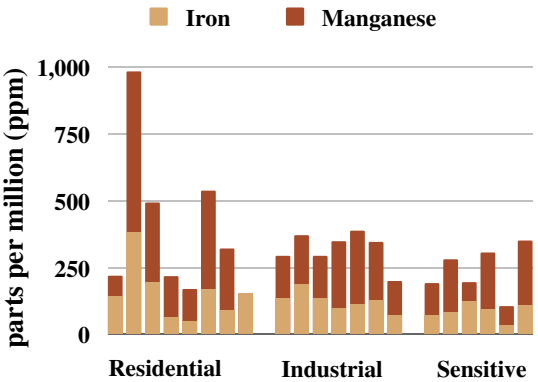


FIG: Iron and Manganese in soil samples

Boron, Zinc, and Copper

In all zones, the above parameters- Boron, Zinc and Copper exceeded the permissible limits. Specific locations, such as K R Market and Central Silk Board had higher Zinc levels.

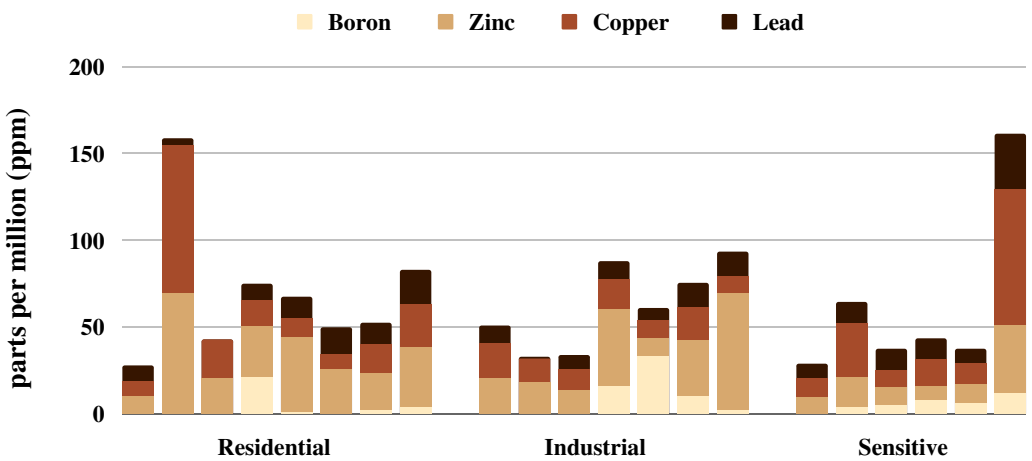


FIG: Boron, Lead, Zinc and Copper in soil samples

CHAPTER 6
LAND USE LAND COVER

KEY POINTS

- There has been an increase in the built-up area and a corresponding decrease in green cover in Bangalore city.
- The number of parks in the city has increased based on data obtained from BBMP.
- There is a greater degree of dissatisfaction with regards to maintenance of parks when compared to satisfaction levels of ERC 2012 which showed more than eighty per cent people were satisfied
- This could be a point to ponder for BBMP wherein increase in number of parks along with better maintenance could probably lead to an increase in number of people visiting park regularly which could enhance the overall quality of life in the city.

As the city of lakes and gardens, Bangalore has now evolved into the city of concrete, also known as the IT hub of India. More than 50 major lakes have been lost over the years due to development, for instance, the Hennur Lake, which has been converted to the HBR layout. Several lakes have been converted into stadiums, like the Sampige Lake, converted to Kanteerava Stadium, and the Akkithimannahalli Lake, which has been converted to hockey Stadium

A study by IISc shows that Bangalore's green cover has drastically decreased. Using multi-criteria decision-making techniques, it was discovered that 93.3 percent of Bangalore is covered with urban planning, leading to a reduction of green cover.

Furthermore, it has been reported that the vegetation has decreased from 68.27 percent in 1973 to 6.46 percent in 2017, while the built-up area has gone up from 7.97 percent in 1973 to 78.65 percent in 2017.

From an ecological perspective, the Comprehensive Development Plan (CDP) of 2015 identified the main recommendations to ensure the green belt of the city is protected and the wetlands are protected within the city limits. In its current version, the 2031 Master Plan highlights the possibility of the city growing uncontrollably and negatively affecting the lives of its citizens.

The development of greenbelt areas has always been more favorable since the 1980s. Zonal regulations have also been relaxed to facilitate agricuture land conversion. Greenbelt in Bangalore has reduced from 7,149 sq.kms in 1996 to 300 sq. kms in 2015.

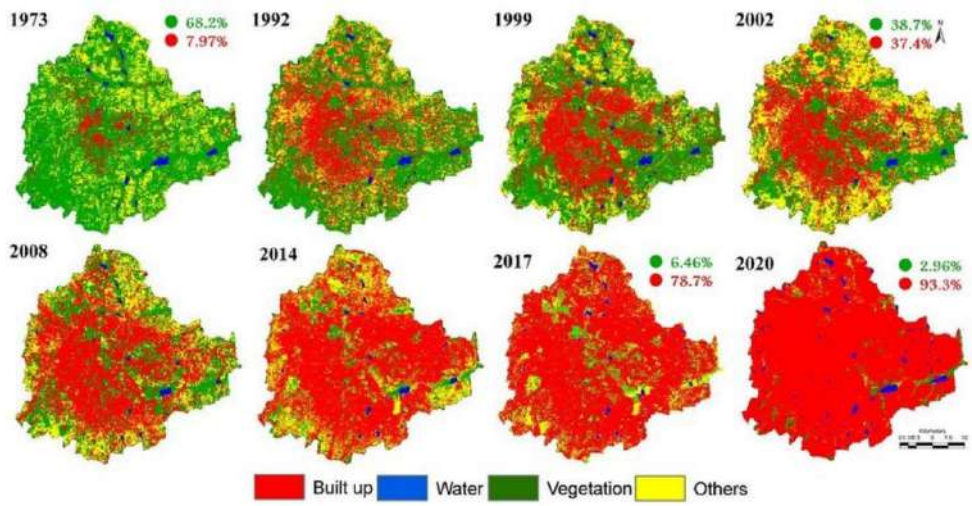


FIG: Change in LULC of Bangalore city (Source: Ramachandra and Aithal, 2016)

Citizen's perception

The city of Bangalore has traditionally been known for its lakes, many of which were artificial. Over Bangalore's history, groundwater has declined in quantity, caused by excessive dependency on it. This could also be due to the reduction in the city's wetlands. Water table levels have declined to 300 meters from 28 meters over the past 20 years, according to a study by the Indian Institute of Science.

People in slums were also found to be more aware of how lakes are faring than those living in affluent neighbourhoods. Among the residents of Bomanahalli, 13 percent were aware of the condition of lakes in their area, which also ranked the highest. Although Gottigere is one of Bangalore's larger lakes, none of the respondents were aware of the conditions of the lakes in their locality. The conclusion was reached that although lakes are integral to the city ecosystem, they are unable to realize its importance.

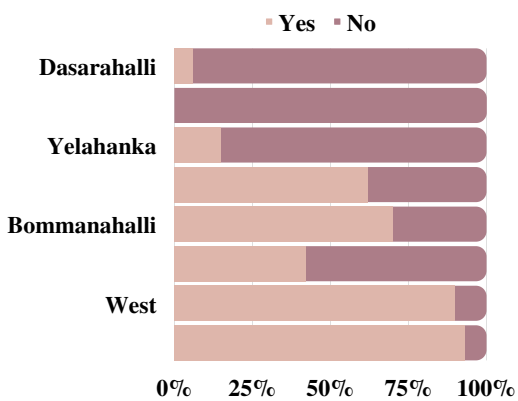


FIG: Awareness on condition of lakes and wetlands around where they live in slums

Parks, Playgrounds and other open spaces

The city of Bangalore has 1408 parks, of which 1135 have been developed, while the remaining 273 are undeveloped. The central areas of east, west, and south account for 59 percent of the total parks. A survey revealed that Dasarahalli had the highest percentage of people living within a half-km radius of parks, which amounted to 33 percent. In the previous ERC, there were 1079 parks spread across the city. From 2012 to 2020, the number of parks has increased by 30 percent.

Despite the increased number of parks, it was found that the number of visitors to parks was very low. Except for RR Nagar (71%), South zone (68%), and West zone (60%), satisfaction levels with the parks are mostly high. In all other areas, satisfaction levels are over 80 percent. This results contrast with those observed in ERC 2012, where the satisfaction levels associated with park maintenance were higher in both the South and West zones.

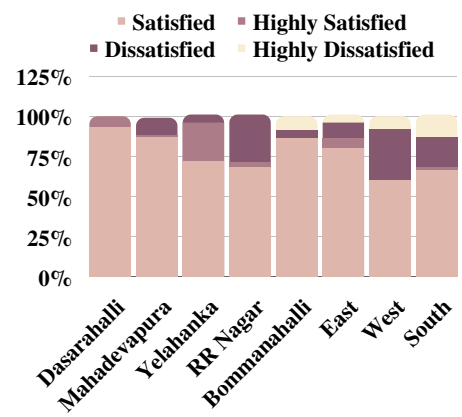


FIG: Satisfaction levels of residents with regards to maintenance of parks in HH

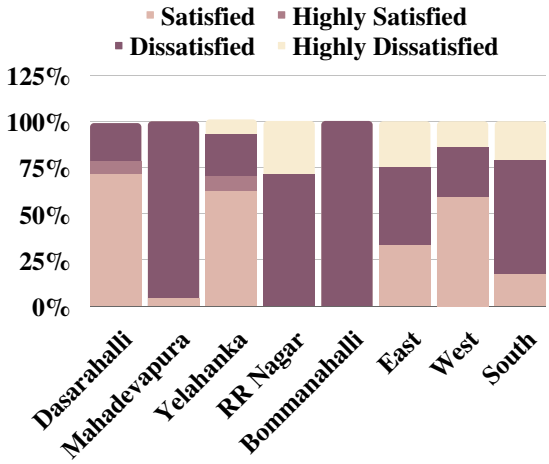


FIG: Satisfaction levels of residents with regards to maintenance of parks in Slum

Mahadevpura and the south zone also had only 40 schools with playgrounds, whereas RR Nagar had a zero percent positive response to playgrounds within school grounds.

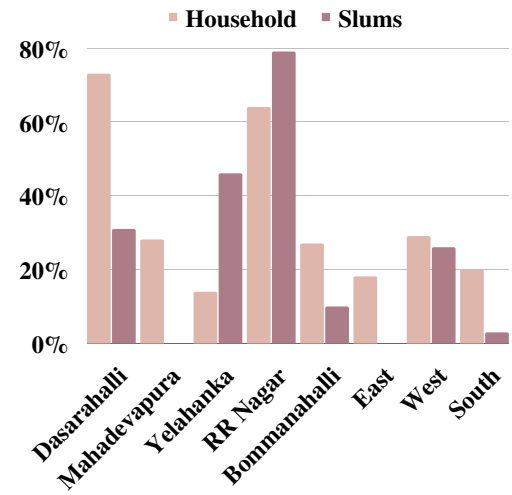


FIG : Citizens perception on encroachment of green spaces across different zones in HH and Slums

Chapter 7
Biodiversity

KEY POINTS

- Bangalore even today is rich in biodiversity, and this is not merely limited to trees, but includes all kinds of fauna too.
- Except for Dasarahalli, there is a great level of dissatisfaction with the Biodiversity of flora and fauna.
- The tree cover data of IISc report from in 2014, says there is one tree for every seven people in the city, and it is quite possible that since then there may have changes in the landscape which has led to the change in people's perception.
- Levels of dissatisfaction were high amongst residents of both slums and households concerning tree cover and biodiversity. A point to be noted is the discrepancy in citizens' perception and actual data on tree cover.

The rich biodiversity of Bangalore city attracts a lot of people and businesses. Biodiversity is an additional indicator added to this ERC, and hence cannot be compared to the earlier one.

In this section of the report, we discuss how biodiversity changes affect citizens.

Located in Mysore state, the district of Bengaluru was known for its dense canopy of huge trees and many lakes. Due to the forest, it was known as the 'Garden city of India'.

It is estimated that the Bangalore district possessed 980 species of flora in 1973. Over the years, urbanization has led to a gradual and steady loss of green cover. The number of species of flora in the city alone was enumerated as 142 in 2006 (Neghinal, 2006). Every year, the BBMP plants an average of one lakh saplings in the city

The government has enforced many policies and programs like The Biological Diversity Act, 2002 which came into force in February 2003. A state-level Karnataka Biodiversity Board was formed to advise the Government on matters relating to the conservation of biodiversity and other allied inputs to increase the or enhance the local biodiversity.

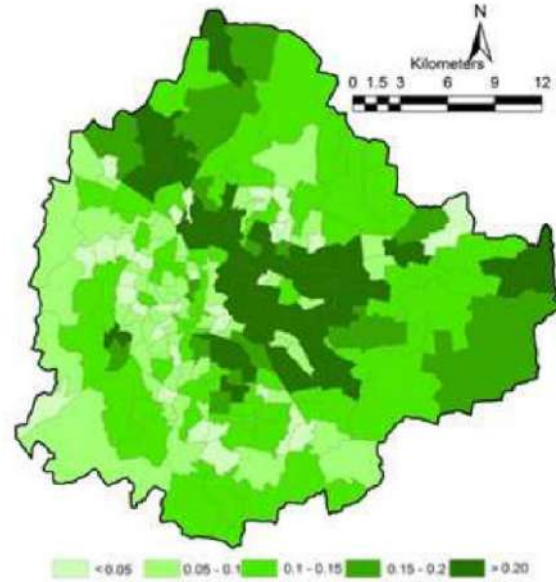


FIG- : Ward-wise vegetation density (Source: Ramachandra et al.,2017)

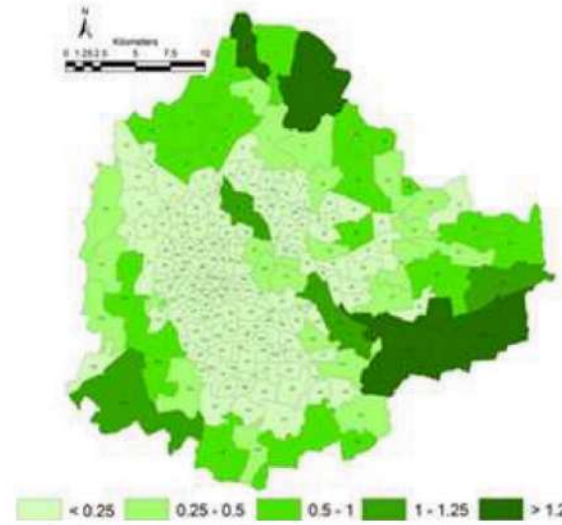


FIG: Ward-wise trees per person (Source: Ramachandra et al.,2017)

Citizen's perception

Across all zones of Bangalore, there is a consensus on dissatisfaction concerning the extent of tree cover. Except for Dasarahalli, 53 percent said the extent of tree cover is less where they live, and responses across all other zones were greater than ninety percent. It was found that all residents of Mahadevapura and Bommanahalli slums are of the opinion that the extent of green cover in the city is 100% not satisfactory. The dissatisfaction level on tree cover is greater than 95 percent across all zones.

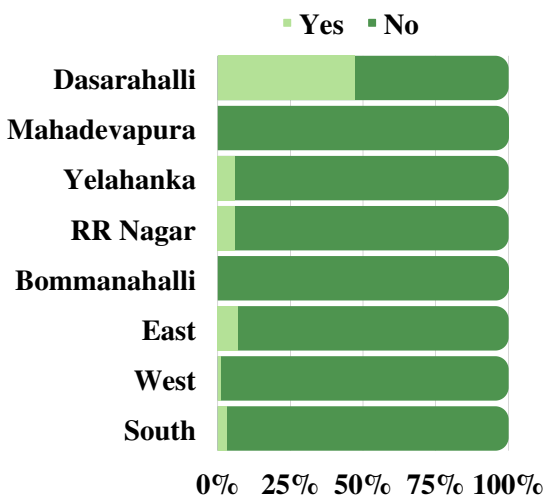


FIG: Satisfaction on Tree Cover extent in HHs

Bangalore's biodiversity is dissatisfies most residents. There were concerns regarding the declining bird population in Dasarahalli (26%), as well as other minor complaints. As the lakes decrease, birds that migrate to these lakes don't migrate anymore.

In response to increased urbanization and more open spaces, birds like egrets have been decreasing. A snake can emerge off the highways from these areas once home to snakes. Residents of the slum are dissatisfied, except in Dasarahalli, where 37 percent are satisfied.

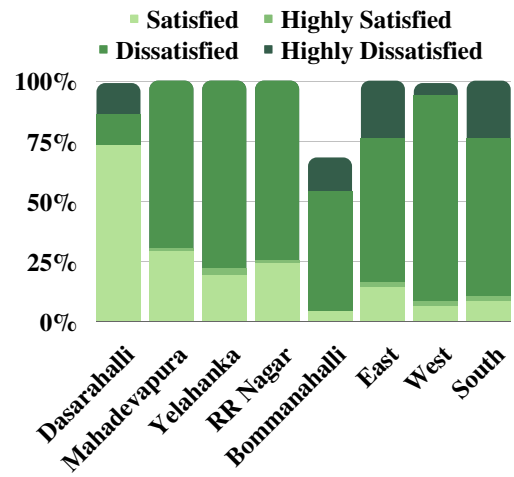


FIG: Satisfaction levels on local biodiversity amongst HHs

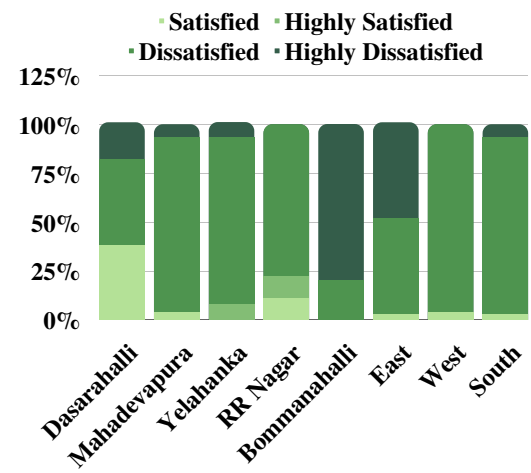


FIG: Satisfaction levels on local biodiversity amongst Slums

CHAPTER 8
ENERGY

KEY POINTS

- Most households have some form of renewable energy and among the usage of renewable energy solar water heaters were a favorite amongst residents.
- At the Household level, most have solar water heaters and the numbers have increased since the 2012 ERC Report.
- Approximately 85-105 Million units of energy are consumed per day.
- The usage of renewable energy sources in the slums across zones varies drastically, with zones like Dasarahalli having all residents responding to them incorporating renewable energy and zones like Mahadevapura having nil responses to the use of renewable energy.

Karnataka has been a leader in renewable energy with 50% of its energy supply coming from renewables. ERC 2012 did not include this indicator as it is a specific addition for this year. In the survey, the only questions addressed was the type of cooking fuel used by households and whether solar water heaters were installed.

Power demand in Bangalore in April 2019 was 6156 MW, probably because summer power consumption spikes. BESCOM reports that Bangalore's electricity is required to be on average 85-105 million units per day.

As one can see from the state's current renewable energy capacity, the target for renewable energy was 6000MW by 2021, which was achieved long ago. The state of Karnataka has a variety of renewable energy sources, including small hydro, cogeneration, biomass, solar, and wind. Composting of wet waste is a goal, which has been accomplished by the waste-to-energy facility in Kannahalli, which will provide 40 MW of power to KPTCL. The waste-to-energy facility in Kannahalli finally opened recently.

Citizen's perception

Most households and slums in the Bangalore-centric BBMP region receive their electricity from BESCOM, the government agency responsible for electricity distribution.

Some form of renewable energy source is incorporated into the households of Dasarahalli residents (25%), RR Nagar residents (16%), and South Zone residents (15%). A mere 2 percent of renewable energy can be developed in the slums.

Residential power cuts were uncommon across all zones. In the slums, power outages are most frequent in RR Nagar, where 71 percent of respondents reported daily power outages. Dasarahalli respondents reported 31 percent and West zone respondents 54 percent never experienced power outages.

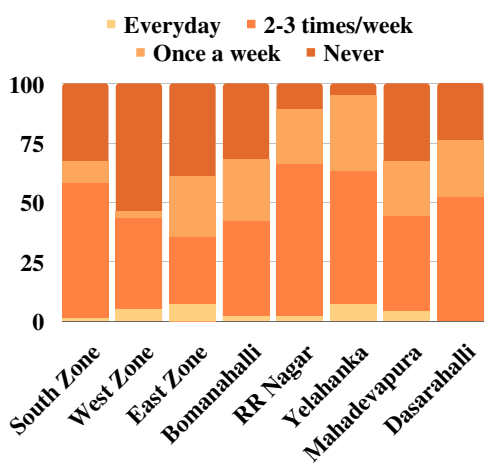


FIG: Power outrage in Households .

Energy usage

The use of energy-efficient systems is one of the most influential aspects of energy use, while air conditioners are among the most energy-consuming household items.
There is substantial use of LED lighting systems in households and slums, but the share in general households (86.5%) is slightly higher than the share in slums 84.4%.Most households in Dasarahalli have air conditioners, with 69 percent having at least one.Overall, there is a high level of satisfaction with electricity in these households. The West zone has the highest levels of dissatisfaction, while the East zone has a lower level of dissatisfaction, at 25 percent. According to the survey of respondents living in slums, especially those in Mahadevapura and Bommanahalli, there was a high level of dissatisfaction with the electricity supply. The greatest satisfaction rate was in Dasarahalli, at 79 percent.

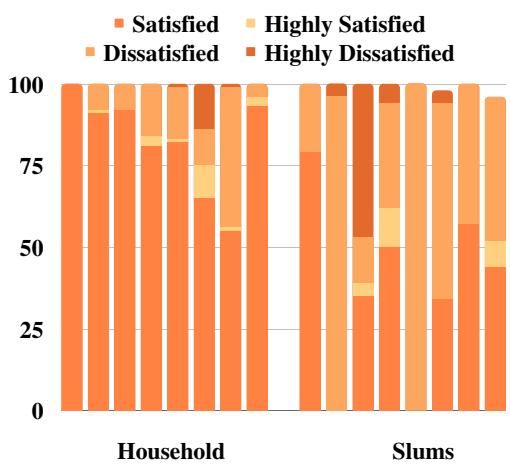


FIG: Satisfaction levels of residents with regards to energy supply in households and Slums.

Renewable Energy Usage

Solar water heaters were a favourite among residents for using renewable energy. Nearly all households have some type of renewable energy.

Solar cookers were used by 49 percent of people in the east zone. The use of renewable energy sources in the slums varies drastically by zone. In Dasarahalli where all residents responded in affirmative for use of renewable resources, there was also a cent per cent response to usage of Solar Cookers .

Yelahanka has 77 per cent of respondents using solar cookers while RR Nagar had 52 per cent using solar water heaters. Residential complexes have been incorporating renewable energy source, which is a positive step towards optimal use of energy.

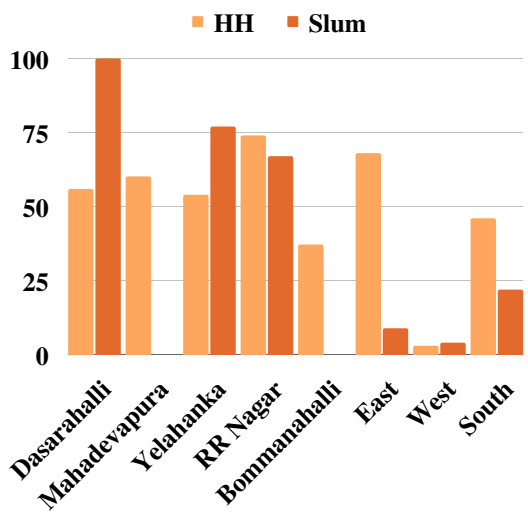


FIG: Usage of renewable energy in Households and Slums

CHAPTER 9
WEATHER AND CLIMATE

KEY POINTS

- Overall people's perception is that there is a change in weather on a temporal scale.
- There is an increase in average temperature and second, while there hasn’t been much impact on the average rainfall, the number of rainy days has gone up.
- Most of these issues can be effectively handled with proper planning and conservation of natural resources be it lakes or trees within city limits.
- A need to understand these more deeply is the need for the day along with possible solutions to ensure local weather changes are neither drastic nor sudden in nature.

Climate change is a global phenomenon. In order to focus our discussion on changes in local weather patterns, we restricted our discussion to Bangalore city and its environs. The LULC and Biodiversity aspects also cover heat islands caused by increased infrastructure and the reduction of green cover.

The rising temperatures are evidenced by changes in average temperature and rainfall between 1979 and 2019. Although there was an increase in rainy days, the average precipitation has not changed substantially.

It is possible that this is a reaction to the latent heat generated in the city by increasing temperatures which resulted in convection-driven rains.

In addition to affecting weather and climate, Government policies also strive to improve biodiversity, increase renewable energy usage, and proper management solid wastes.

In Karnataka, a state action plan has been developed to address climate change at the policy level

Citizen's perception

In this particular section, citizens were asked to examine any changes they have observed in Bangalore's weather over the years.

The majority of Bangalore residents in every zone are not convinced that the weather has changed over time. In the past, fans, and air conditioners, were never needed.

There was a small percentage (5%) of residents in the West and South zones who were of the opinion that it had not changed. Interestingly, a few slum residents, especially in RR Nagar, expressed similar views regarding changes in the weather. More than 39 percent of residents said there has been more or less consistency in the weather.

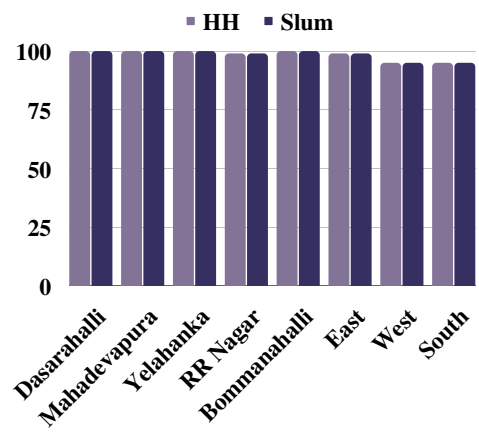
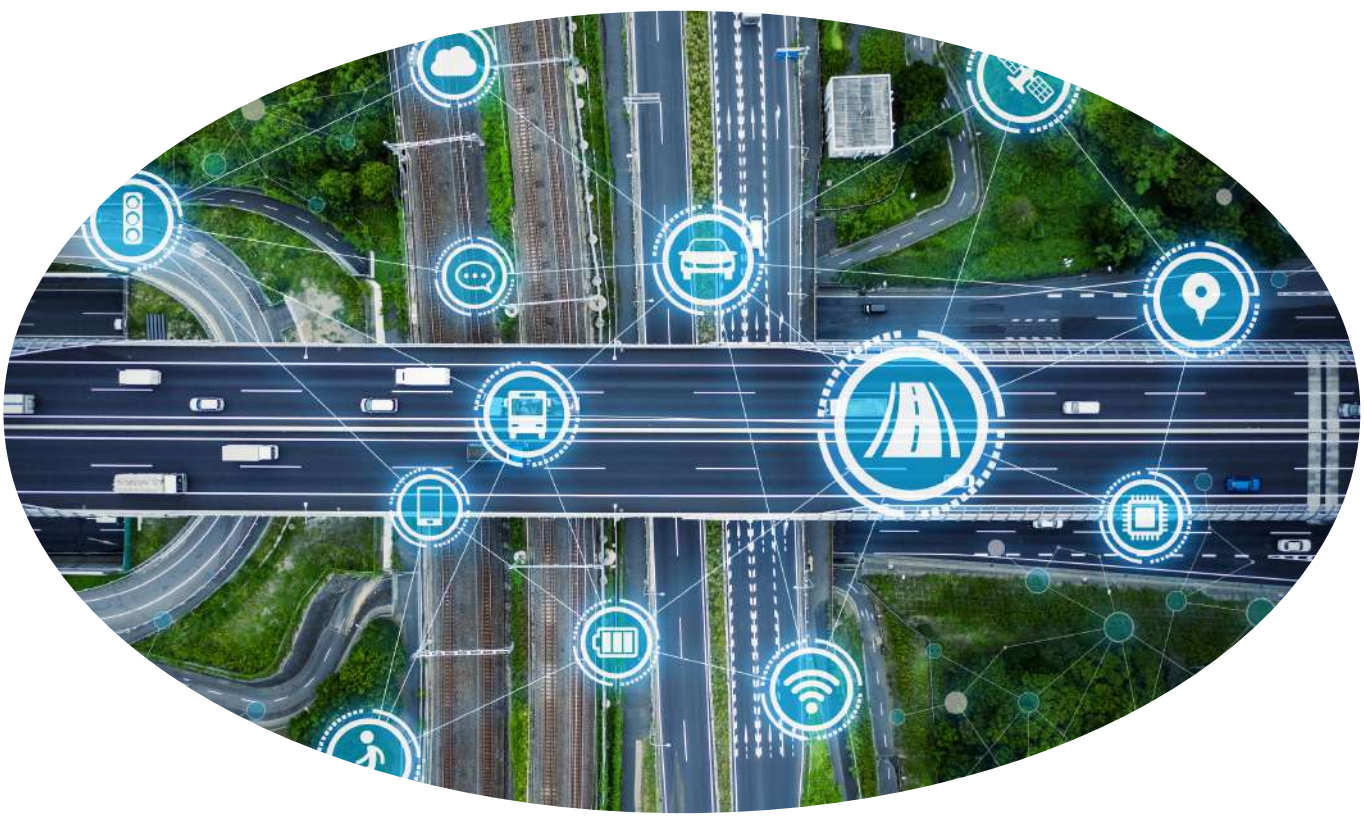


FIG: Has the weather in Bangalore changed? In Households and Slums

Chapter 10
Transportation and Infrastructure

KEY POINTS

- Traffic, Transport, and Infrastructure for movement are extremely essential indicators. It is also known to be one of the prime problems associated with Bangalore city.
- The poor land use planning, location of important offices, and business activities located in the central locations add further to congestion causing higher emissions.
- Five Zones (South, East, Bommanahalli, RR Nagar, and Yelahanka) have residents with a greater number of four-wheelers running on diesel than petrol.
- Need to speed up metro services to cater to larger areas of the city. Currently, there is greater satisfaction among residents using metro services, however, the percentage of the population using it is minimal. This needs to be brought to the foreforont.



Based on the 2011 census, 38.60% of the population of Karnataka lives in urban areas, which represents a 15.69 percent increase in the city of Bangalore alone since the 2001 census.

There is a great deal of concern about traffic and transport in Bangalore. Excessive vehicular usage poses several environmental concerns. In addition, there is an increase in greenhouse gas emissions, air pollution, noise pollution, and traffic woes.

Transportation activity is expected to grow significantly in the coming decades. While Bangalore was built as a circular town, it still has insufficient circumferential roads despite having been developed as a radial town.

There has been an enormous increase in vehicles. The number of vehicles has grown from less than a lakh in 1976 to about 80.5 lakhs as of March 2019 which include both transport and non-transport vehicles.

Two main public transportation systems available in Bangalore are; the Bangalore Metropolitan Transport Corporation (BMTC) and the Bangalore Metro Transport Corporation Ltd (BMTCL). The BMTC is a Government agency that provides the bus service across Bangalore city.

Coordination between the city's different departments of transport is lacking in Bengaluru. Karnataka's Directorate of Urban Land Transport (DULT) was formed to ensure a cohesive approach to transport planning and development in urban areas.

Citizen's perception

The survey data supports that The survey data confirms that two-wheelers account for a majority of the vehicular population in Bangalore. At 40 percent, Dasarahalli residents own the most cars, and other five zones (South, East, Bommanahalli, RR Nagar and Yelahanka) have residents with greater number of four-wheelers running on diesel than petrol.In slums, two-wheelers were observed to be very prevalent as expected. However, as in the case of households, more residents own diesel cars than petrol cars in zones South and Yelahanka.

According to the survey, only 8 percent of respondents in Yelahanka slums owned any type of vehicle. Neither the households nor the slum population is heavily dependent on Metro, in particular. In the west zone, 54 percent of respondents said they take the bus to travel around.

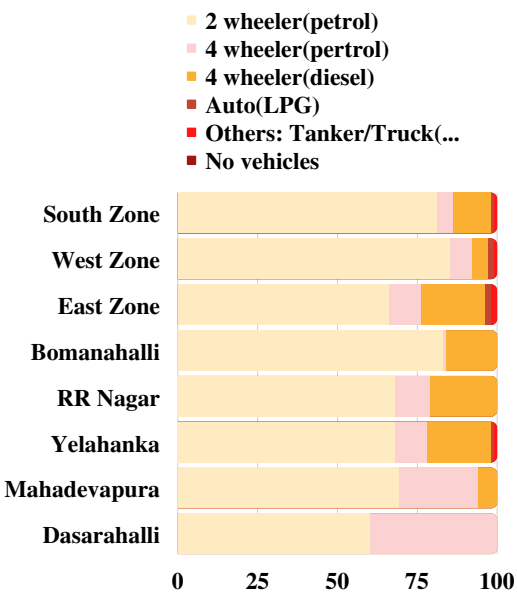


FIG: Vehicle Ownership in Households

In spite of the fact that there are bus services available to most of the localities, some places depend more on private transportation. The majority of respondents in Dasarahalli said their residence was within half a kilometer of the closest bus stop. Interestingly enough, Dasarahalli is also the location where 87% of respondents said they used private transportation. It is imperative to further investigate this difference in citizen responses and to take corrective measures to resolve it.

In fact, it is evident simply from the responses of residents, who, across all zones, have indicated that they live at a distance exceeding a kilometer from the nearest metro station.

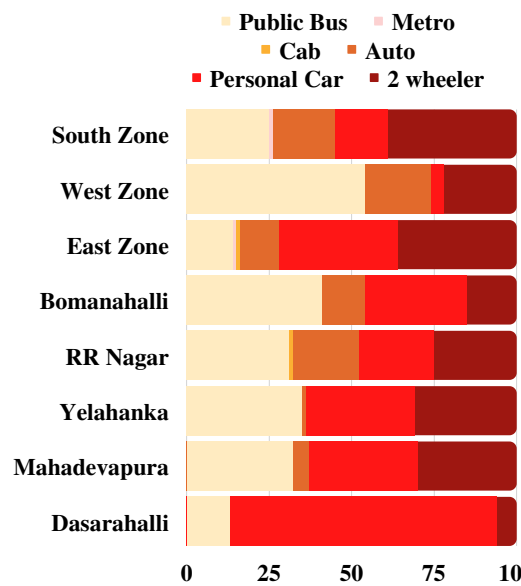


FIG: Mode of transport used for daily commute in Households

Bus services are currently more popular than metro services. In most cases, people use personal vehicles such as cars and two-wheelers. The majority of respondents from Dasarahalli and East affirmed that they commute to work daily by their personal vehicles. Similarly, 47 and 55 percent of respondents said that these areas have a perennial traffic congestion problem. Private transportation contributes significantly to traffic congestion.

Traffic woes in the area may also be the result of the lack of adequate infrastructures such as better quality and wider roads.

In most areas, there is a high level of satisfaction with roads, with Dasarahalli respondents being the most satisfied at 80 percent. In older areas dissatisfaction levels are high. Another reason why 81 percent of people commute by four-wheeler is likely to be this factor.

Metro users are extremely satisfied in these areas with more than 75 percent satisfaction. For respondents living in the slums, the results are quite different because they are dissatisfied with the metro services in the city.

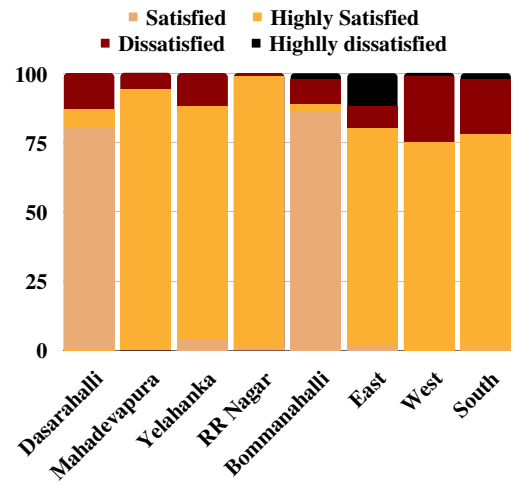


FIG: Satisfaction levels of residents with regards to Current routes of Metro

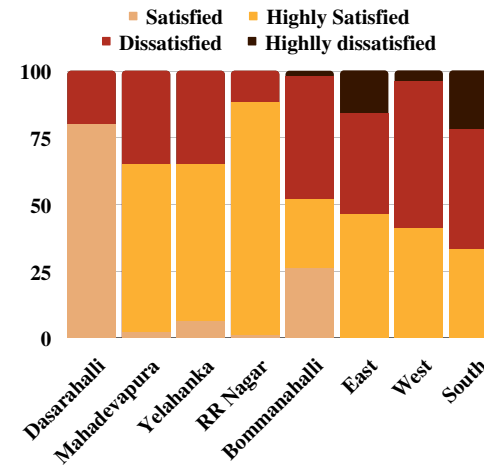


FIG: Satisfaction levels of residents with regards to Overall Quality of Roads

CHAPTER 11
HEALTH

KEY POINTS

- An interesting initiative by Bruhat Bengaluru Mahanagara Palike (BBMP) is the Public Health Information and Epidemiological Cell (PHIEC) , which needs to be commended. This initiative has ensured better monitoring of vector-borne diseases within BBMP limits.

- Proper sanitation facilities form the backbone of the public health system. Most respondents across all zones in both households and slums replied negatively with regards to both presence of facilities and their maintenance.

- The number of Slum households that do not have in-house sanitation facilities is more in RR Nagar, with sixty percent of the respondents said they do not have in house toilets facilities.

- In order to maintain a healthy environment, it is imperative that establishments realize and take punitive measures to ensure a better environment that enhances its overall health status.

An essential indicator of a city's overall well-being is the Health index. Indicator Health is also a new part of the Environment Report Card. There has been a significant improvement in Karnataka's health facilities and overall access to facilities over the years. However, lifestyle diseases are on the rise. Based on the data from MDS Collaborators 2010, it is estimated that there are 346,500 avoidable deaths in Karnataka every year, ranging from children to the elderly.

A major thrust of the Karnataka Health Policy is creating the awareness about vector and communicable diseases among the general population.

As part of its 2017 public health policy, Karnataka also outlined various development sectors, including rural development, agriculture, food production, sanitation, drinking water supply, and education.

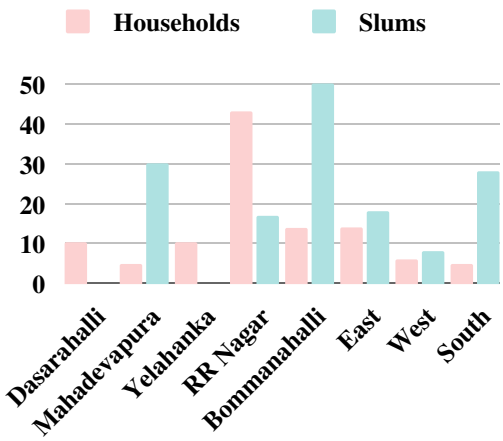


FIG: Incidents of Air/Water borne disease in Households and Slums

Citizen's perception

Prevalence of Air and Waterborne diseases

The local environment directly influences airborne and waterborne diseases. The occurrence of such diseases was perceived to be significantly more common by households only in the RR Nagar zone. In the slums, the responses were almost the same, although the number of cases increased slightly. Approximately half of RR Nagar respondents reported that water- and air-borne diseases were prevalent. While ERC surveys were conducted in hospitals, respondents provided interesting feedback on environmental concerns related to health. There were instances of allergic cough and dysentery, which were both related to air and water quality, even though among the questions addressed, vector-borne diseases were more common than air and water-borne diseases. These findings are not conclusive because an allergic cough may also be brought on by tree pollen, and dysentery issues may come from eating the wrong foods.

Presence of Sanitation facilities

Public health relies on proper sanitation facilities. The majority of respondents across all zones in households and slums answered negatively regarding the availability and maintenance of sanitation facilities . The lack of public sanitation facilities was cited as a major concern by more than 85 percent of respondents across all zones. Maintenance of the sanitation facilities is an issue as reported by the respondents in RR Nagar (100%) and South Zone (97%) zones.

Vector-borne diseases are a special point of concern especially occurrences of Dengue and Chikungunya. These can be linked to other factors like waste management, sanitation facilities and sewerage system in households.

Concerns also exist with regards to public sanitation facilities. While the survey data show that the quality and quantity of the water has improved and more than 80% of the people surveyed are satisfied with the quality and quantity of water they are receiving. But the testing conducted for borewell and surface water show that many locations the water was unfit for drinking. Other zones also reported issues of cleanliness, but not as high as these zones. Absence of in-house sanitation facilities, a major concern found in many households.

Slums of Bangalore express significant dissatisfaction with sanitation, as predicted. In the Bommanahalli slums, all respondents were dissatisfied, while seven percent of respondents in the Mahadevapura slums were satisfied.

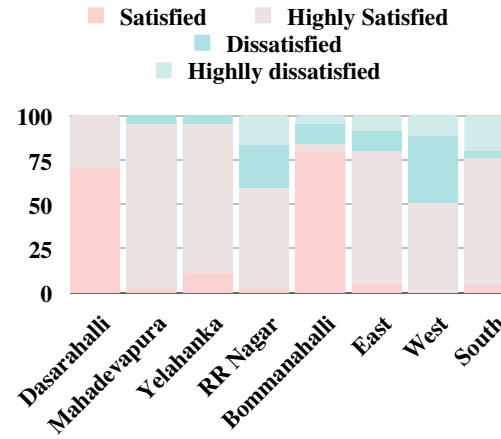


FIG: Satisfaction levels of residents with regards to health and sanitation in Households

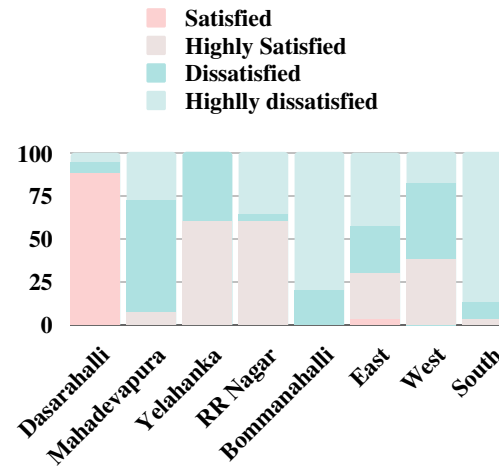


FIG: Satisfaction levels of residents with regards to health and sanitation in Slums

CONCLUSION

Since the previous ERC prepared by CSD, there have been many changes in different aspects of the environment in Bangalore city. Currently, Bangalore city is on the brink of many problems and with the same pathway, it may face considerable socio-economic and environmental risks. Three major indicators were found to influence; Land Use Land Cover, Traffic, and Pollution and Health.

One of the major factors of influence is the changes in the Land Use Land Cover of Bangalore city. There has been an increase in a built-up area and a corresponding decrease in green cover in Bangalore city. BBMP data states that the number of parks in the city has increased, there is hence a need to ponder on this reduction in green cover and whether developmental activities can incorporate greening as part of its project goals. Despite an increasing number of parks, there is a greater degree of dissatisfaction concerning maintenance of parks when compared to satisfaction levels of ERC 2012 wherein more than eighty percent of people were satisfied.

A pattern was observed in the citizen's survey between maintenance of parks, their proximity, and the frequency of visits of residents. This could be a point to ponder for BBMP wherein an increase in the number of parks along with better maintenance could probably lead to an increase in the number of people visiting parks regularly which could enhance the overall quality of life in the city. The level of dissatisfaction was observed great amongst residents of both slums and households with respect to tree cover and biodiversity.

The fact that citizens perceive and actual data on tree cover differs from one another is worth noting. However, tree cover data from IISc are from 2014, so it is possible that since then there has been an enormous change in landscape, which has led to a change in perception.

One of the biggest problems of Bangalore city is traffic and pollution as a side effect. Bangalore and traffic are usually translated in the same term. It is also a concern in the city that traffic leads to air and noise pollution. Emissions are higher due to poor land use planning and location of important offices and business activities in central locations.

Low speed and congestion also leads to pollution and other related problems. The air monitoring analysis data of various locations of Bangalore showed that particulate matter is of concern in Bangalore city. During the survey, it was observed that the major source of noise was due to vehicular traffic.

Citizen perception on disturbance due to noise in residential complexes was observed high and the actual data say the same. However on a positive note, with the advent of metro services, more people are moving towards this environmental friendly mode of public transport system. Further, BMTC is continuously trying to improve the system for better connectivity. With the new venture of real-time tracking system, it really helps bus commuters for better time management.

There are few concerns raised in the study, such as the need to provide better infrastructure across different regions. Concern areas are more concentrated in the central regions than the outskirts. The areas close to M.G. In order to simplify transport, the road metro station and roads leading to the corporation circle have been redesigned. White topping is also being undertaken on several major roads. Side roads have been particularly problematic, with bad roads and a lack of maintenance being a source of concern. The need to speed up metro services could also be important for larger areas of the city. Currently, there is great satisfaction amongst residents using metro services, however, the percentage of population using it is minimal.

Health and environment are interlinked and it is hence essential that establishment realises and takes punitive actions to ensure a better environment so as to enhance the overall health quotient of the city. Allergic cough and dysentery seem to be the most common problems observed in the city. Air pollution is a big problem that the city faces today. The KSPCB has taken many initiatives to improve the quality of air, such as improving fuel quality, introducing alternate fuels for autorickshaws, improved traffic management, implementation of emission norms, promoting the use of green fuel by industries for DG sets, etc. However awareness amongst people along with alternative modes of fast transport will enable a reduction in dependency in public vehicles thereby reducing pollution levels. Noise pollution is a silent killer that is increasing rapidly.

Major action needs to be taken to control the noise level. As per the data from KSPCB noise level in many areas has increased in the past few years in Bangalore city and this is mainly due to rapid urbanization.

The combination of increasing demand for water resources, poor water distribution infrastructure, and contamination of existing supplies could constrain the ability of Bangalore to grow and prosper in the future as demand continues to grow in the city and wider region.

Swachcha Bharat Mission has been included in the BBMP program to provide sanitation facilities. This initiative should, however, be prioritized more. It's an interesting initiative of BBMP, PHIEC, which should be respected. In response to this initiative, vector-borne diseases are monitored within the limits of the BBMP.

Segregation of waste at source is the key to proper management of waste. This has improved since ERC 2012 but Bangalore still has a long way to go. Segregation, in fact, is the first step towards an efficient Management system, and citizens need to be proactively involved in it. Another important aspect is the localised way of dealing with the waste. Decentralisation of waste management facilities is the key to handling wastes. Dry waste collection centres and bio-methanation plants has to be carried out on ward level. There is a need to create awareness on waste management to the citizens of the city. Aligned with the concept of ‘My waste My Responsibility’, citizens should take care of their waste produced on the ward level. It is very important for citizens to play an active role in managing the waste.

Composting is slowly becoming more prominent within the city, and this may reduce dependency on BBMP facilities. Additionally, citizens should use less plastic especially in packaging food items. There is an increase in people bringing their own containers to get food packed with the ban on single-use plastics. While Bangalore has experienced many drawbacks over time, it has struggled to maintain its "all-time pleasant weather". In some cases, weather changes are acceptable, but they are also standard. The problem arises when these changes are sudden and drastic, which is also not normal. According to people, climate change has occurred over a longer period of time.

Further, two major changes have been observed from secondary data: one is that there has been a rapid increase in average temperatures; second, while there hasn't been much impact on rainfall, the number of rainy days has increased. Understanding these issues deeper is vital for today, along with potential solutions to ensure local weather changes are neither drastic nor sudden. The majority of these issues can be effectively addressed through proper planning and conservation of natural resources in the city, such as lakes or trees. Growth should be controlled so that the city's management regimes are sustainable. As a result, a slow and steady shift towards a more pleasant climate will occur.

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