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PS 1.4 Changing Environment

The Air Quality Shift and Micro Climate of Shillong City in Conjunction with Green Spaces – A Case Study of a City In North Eastern India

C P Marak, M S Tiewsoh
Meghalaya State Pollution Control Board,
Shillong, State of Meghalaya, India

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Content

- Study Area
- Methodology
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- Discussions and Recommendations

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Study Area

- Shillong city, being a hill city, is well known for its scenic beauty throughout the country of India.
- It is situated at an average altitude of 1496 meters above sea level.
- The population of the metropolitan city of Shillong is 354,325.
- The Shillong Urban Agglomeration consist of seven zones namely Shillong Municipality, ShillongCantonment, Nongthymmai, Mawlai, Madanrting, Pynthorumkhrah, Nongmynsong.
- The total area of the Shillong under the Shillong Master Plan covers about 17,400 Ha

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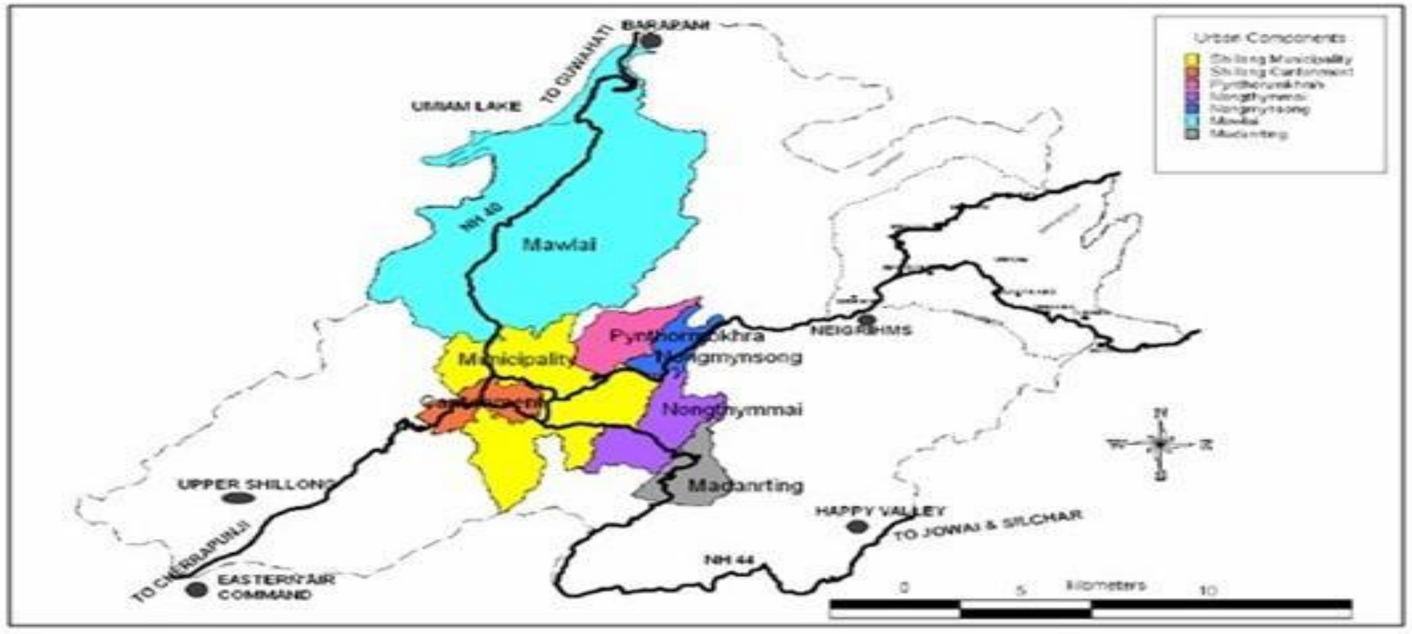

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Methodology

- The air quality study is being carried out by studying the pattern of change of parameters viz. PM10, SO_2 and NO_x of two selected Stations within Shillong City which are carried out according to the Indian Standards using a Respirable Dust Sampler Machine.

- The Air Quality Index (AQI) and Exceedence Factor(E_x) are calculated from the data recorded for the two stations.

- The temperature of the two stations is also noted.

- LULC data for the purpose of this study has been provided by the Urban Affairs Department, State Government of Meghalaya, India.

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Air Quality Index (AQI)

- Air Quality Index is a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour

AQI Category (Range)	PM_{10} 24-hr	$PM_{2.5}$ 24-hr	NO_2 24-hr	O_3 8-hr	CO 8-hr (mg/m^3)	SO_2 24-hr	NH_3 24-hr	Pb 24-hr
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5 –1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1- 10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748*	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430 +	250+	400+	748+*	34+	1600+	1800+	3.5+

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Exceedence Factor

The air quality has been categorized into four broad categories based on an Exceedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard).

- The four air quality categories are:
- Critical pollution (C) : when E_x is > 1.5;
- High pollution (H) : when E_x is between 1.0 - <1.5;
- Moderate pollution (M): whenE_x between 0.5 - <1.0; and
- Low pollution (L) : when E_x is < 0.5.

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Land Use Land Cover (LULC)

The data of LULC for Greater Shillong Planning Area (GSPA), 2010 as per data acquired form the Urban Affairs Department, State Government of Meghalaya, India

Sl. No.	Component	Area in hectares	Percentage
1	Built up Area	6,090	35
2	Vacant	4,350	25
3	Forest	6,960	40
	Total	17400	100

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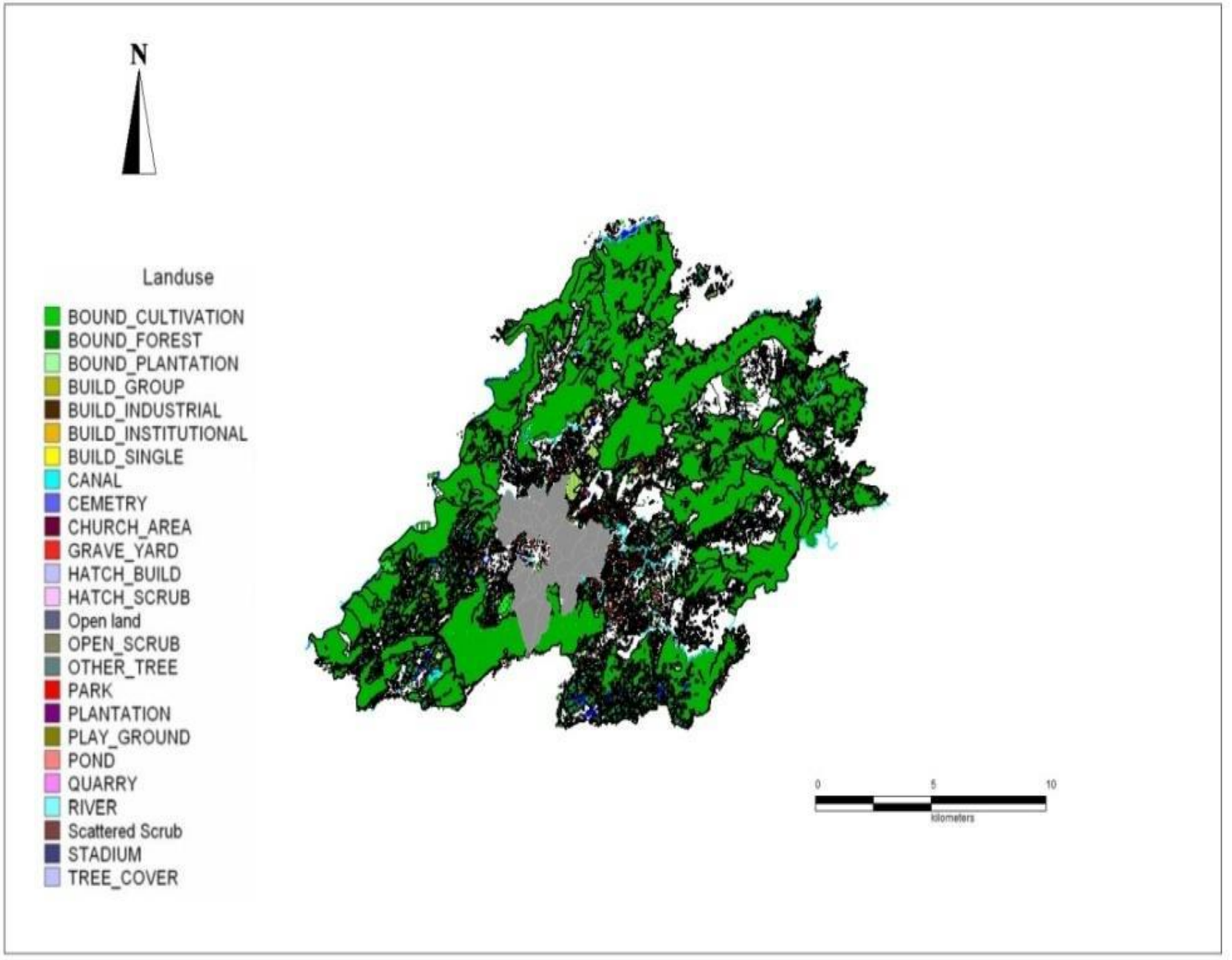

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The LULC for the area under Shillong Municipal Board is given as

Sl. No.	Component	Area in Hectares	Percentage
1	Residential	393.68	38
2	Commercial	93.24	9
3	Recreational	20.72	2
4	Industrial	41.44	4
5	Transportation	93.24	9
6	Public/Semi public	372.96	36
7	Forest	20.72	2
	Total	1036	100

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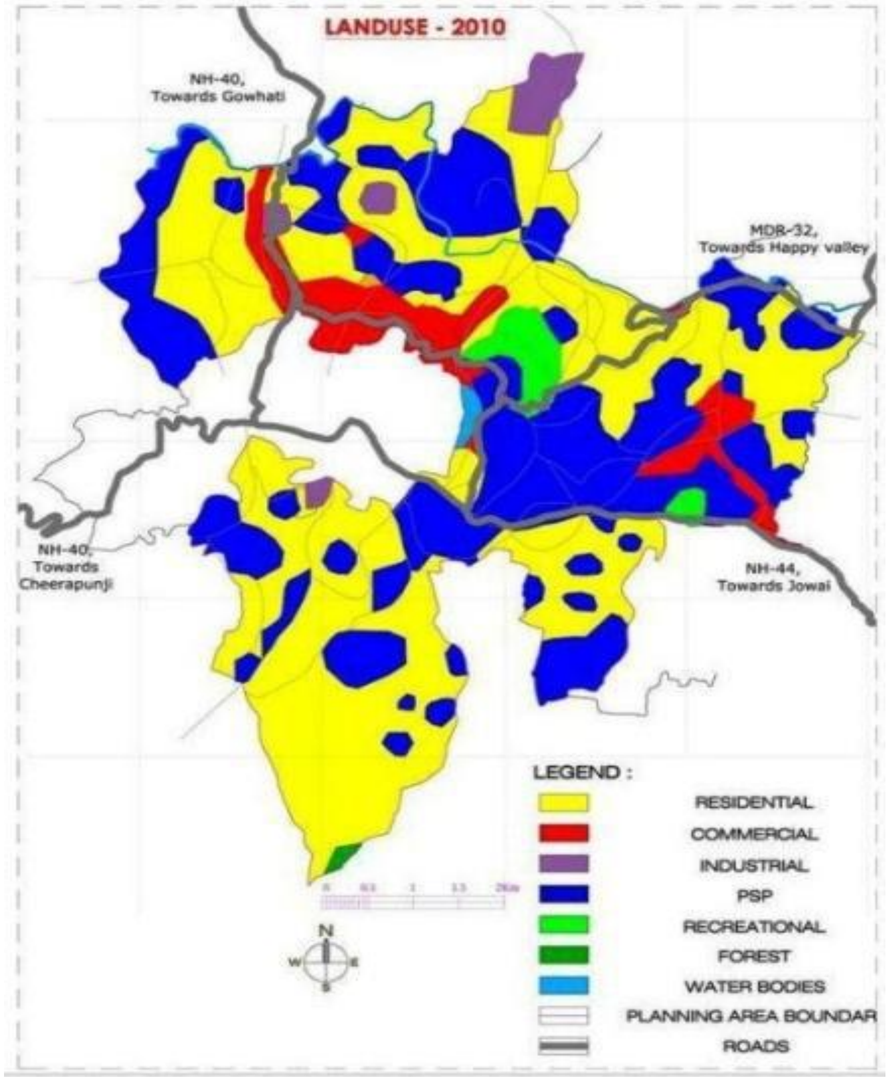

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Selected Stations

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Selected Stations

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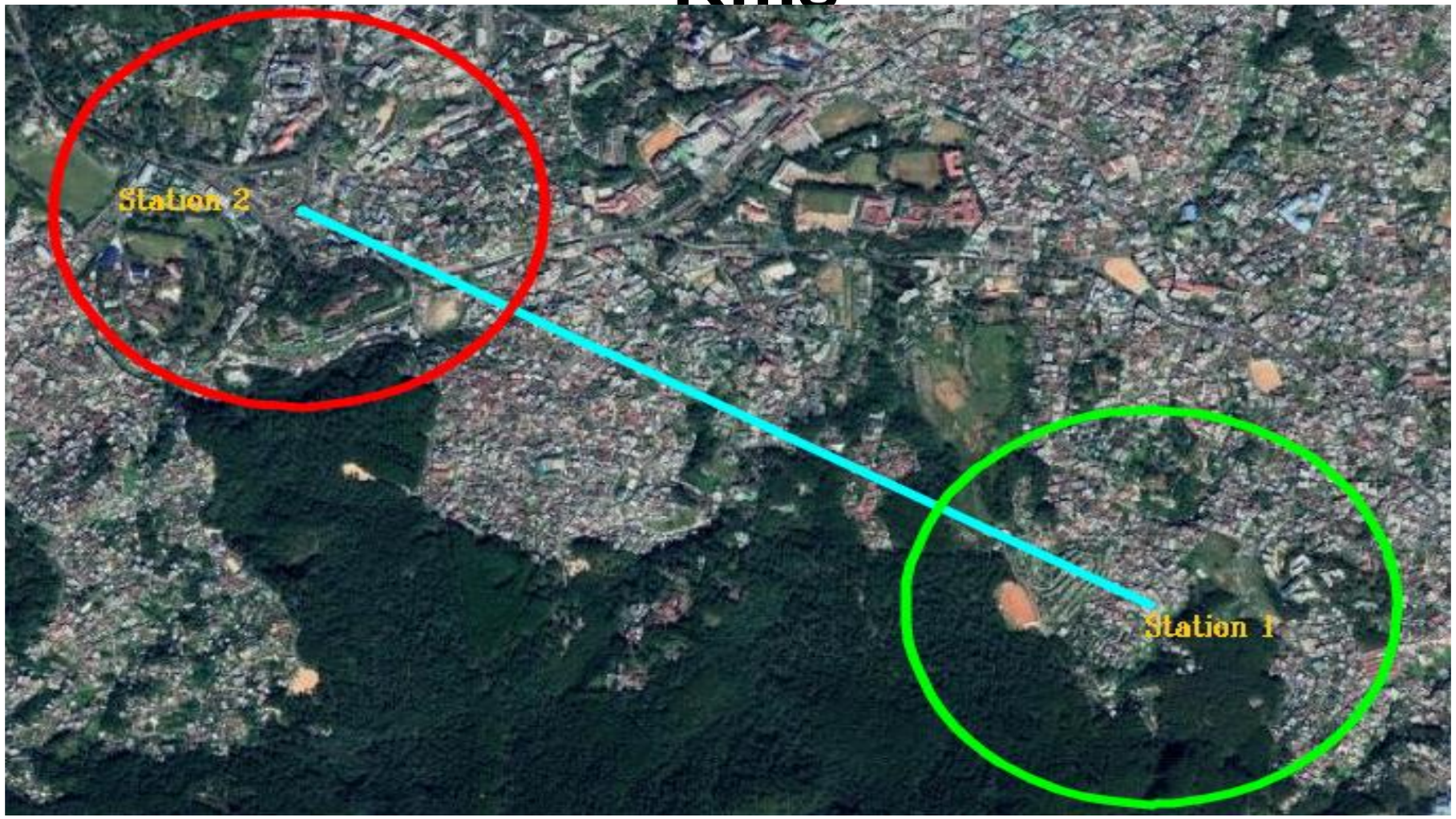
Distance between the two stations (Station 1 and Station 2) is approximately 2 Kms



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Respirable dust Sampler (RDS) Machine for Air Quality Measurement

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Air Quality Data of the two Stations

Station 1

- The average PM10 concentration varies from 28 to 35 (µg/m^3) from January 2015 till March 2018 (under the permissible limit, permissible limit is 60 µg/m^3)
- The concentration of SO_2 and NO_x has always been under the permissible limit (40 µg/m^3)

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Air Quality Data of the two Stations

Station 2

- The average PM10 concentration varies from 45 to 90 (µg/m^3) from January 2015 till March 2018 (permissible limit is 60 µg/m^3)
- The concentration of SO_2 and NO_x has also abeen under the permissible limit (40 µg/m^3) but higher compared to station 1.

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Air Quality Index for the July 2016

July 2016					
Station	**Weekly Avg.**			**AQI**	**Rating Scale**
	PM10	**SO2**	**NOx**		
1	27.3	2.0	4.5	27	Good
2	70.7	2.0	20.5	71	Satisfactory

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The Exceedence Factor of PM10 for the two stations is calculated for the year 2016.

Station	PM 10 (μ/m^3) Avg. Annual Concentration	E_x	Results	Remarks
1	33.3	0.56	E_x between 0.5 - 1.0	Moderate Pollution (M)
2	78	1.3	E_x between 1.0 - 1.5	High Pollution (H)

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Comparison of Air Quality between the two Stations

- Concentration of PM10 at station 1 < Concentration of PM10 at station 2
- Concentration of SO_2 at station 1 < Concentration of SO_2 at station 2
- Concentration of NO_x at station 1 < Concentration of NO_x at station 2

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Urban Cover of the two stations

Station 1 (radius cover-500m)

Station 2 (radius cover-500m)

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Comparison of Urban between the two Stations

- In station 1 it is observed that the area within the 500 meters radius has about 40 percent of urban forest cover.
- In station 2 it is observed that the area within the 500 meters radius has about 15 percent of urban forest cover.

Temperature difference between the two Stations

	Station 1	Station 2
Winters (average minimum temp)	5 degree celcius	6 degree celcius
Winters (average maximum temp)	13 degree celcius	15 degree celcius
Summers (average minimum temp)	15 degree celcius	17 degree celcius
Summers (average maximum temp)	19 degree celcius	22 degree celcius

Conclusion

- It can be recommended that the presence of an urban forest cover mitigates pollution and also makes a cooler and pleasant temperature environment of the urban setup.

- As the duties of Urban Development in India is being carried out by the Urban Affairs Department , forest technical experts may be deputed from other departments to strengthen urban forest development.

- A separate urban forestry policy has to be adopted in India at the earliest as there is none till date and India is urbanizing in a very fast rate (as per the statistics, by 2030 about 40.76% of the country’s population is expected to reside in the urban area)

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Thank you

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