An Assessment of Microclimatic Variations: A Study in Dhaka City

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Objectives and Motivation

The specific objectives are

to find out spatio-temporal variation of air temperature and relative humidity in Dhaka city
to provide a better understating of the causes and consequences of microclimatic condition and heat island in Dhaka city

Methodology

Study Area

Four sites were selected in Dhaka City to measure Atmospheric temperature and relative humidity there. From them Agargaon, where weather station of Bangladesh Meteorological Department is located was chosen as reference site.

Other three study sites were: Motijheel, Segunbagicha-Kakrail and Dhaka University Campus Area.

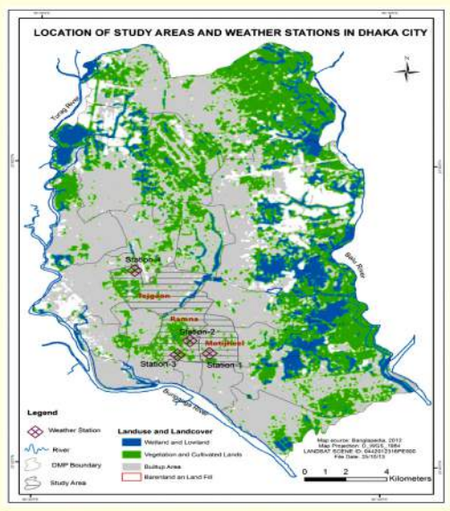

Fig 1: Location of Study Areas

Methods of Data Collection

Air temperature and relative humidity data were collected twice in a day (at 12pm and 6pm) in November, 2013.

Digital hygrothermometer was used and the instruments were placed 5 feet (1.5 meters) above ground surface according to the rule of United States Environmental Protection Agency (US.EPA,2012).

Findings

Figure 2 to 5 shows the trend of air temperature and relative humidity at four study sites.

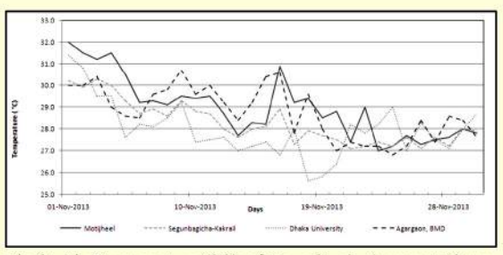

Fig 2: Air Temperature (°C) of Four Study Areas at 12 pm
Source: Field Data, November, 2013

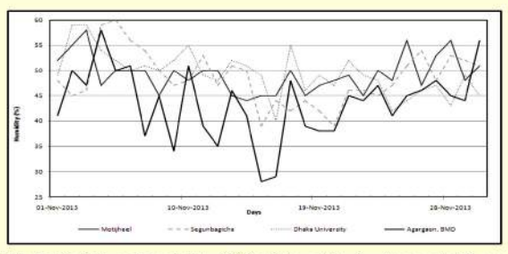

Fig 3: Relative Humidity (%) of Four Study Areas at 12 pm
Source: Field Data, November, 2013

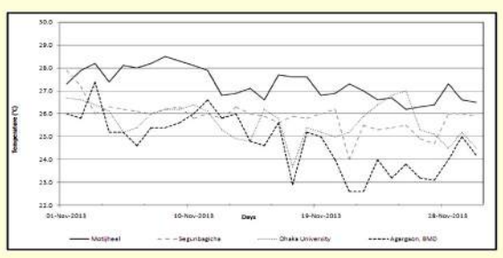

Fig 4: Air Temperature (°C) of Four Study Areas and 6 pm
Source: Field Data, November, 2013

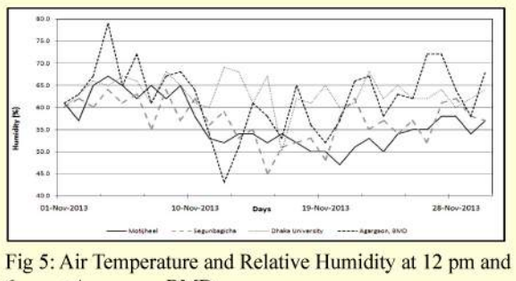

Fig 5: Air Temperature and Relative Humidity at 12 pm and 6 pm at Agargaon, BMD
Source: Field Data, November, 2013

Trend of Air Temperature

Both at 12 pm and 6 pm highest mean temperature for the month of November were found at Motijheel area .

Table 1: Mean Air Temperature at 4 Study Stations at 12pm and 6pm

Station No.	Area	Mean Temperature (°C) at 12pm	Mean Temperaure (°C) at 6pm
1	Motijheel	29.0	27.3
2	Segunbagicha	28.3	25.9
3	Dhaka University	27.8	25.7
4	Agargaon, BMD	28.8	24.8

With in a distance of 2 km 4% difference of temperature has been identified in the research. It brings the testimony of heat island formation in Motijheel area. This difference increases at the evening.

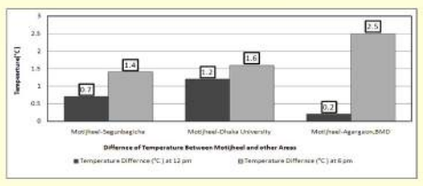

Fig 6: Difference of Temperature Between Motijheel and Other Areas

Trend of Relative Humidity

Surprisingly at the noon same mean relative humidity was recorded at the three sites.
High increasing rates of relative humidity were recorded at Dhaka University and Agargaon.

Table 2 : Mean Relative Humidity at 4 Study Stations at 12pm and 6pm

Station Number	Area	Mean Relative Humidity(%) at 12pm	Mean Relative Humidity(%) at 6pm
1	Motijheel	49	56
2	Segunbagicha	49	57
3	Dhaka University	49	63
4	Agargaon, BMD	44	62

Mean Air Temperature Range

Air temperature differences indicate cooling rate and heat environment of an area (Aguado and Burt,2008).

Mean air temperature difference is highest at Agargaon, BMD area an lowest at Motijheel area.

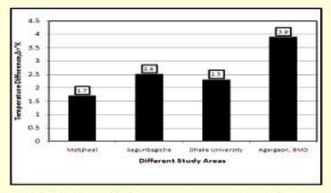

Fig 7 : Mean Range of Air Temperature (Between 12 pm and 6 pm)
Source: Field Data and BMD, November, 2013

Statistical Significance

Air temperature difference is significant in the evening as the research has identified five pairs with significant relationship. The tests results suggest that our null hypotheses are rejected.

Table 3 : Statistically Significant Pairs (Air Temperature)

Pairs	t-value(df;sig: 2 tails)
Motijheel-Segunbagicha (12pm)	5.502(29;000)
Motijheel-Dhaka University (12pm)	3.874(29;.001)
Segunbagicha-Agargaon,BMD (12pm)	-3.188(29;003)
Motijheel-Segunbagicha (6 pm)	10.019(29;000)
Motijheel-Dhaka University (6 pm)	9.482(29;000)
Motijheel-Agargaon,BMD (6 pm)	13.569(29;000)
Segunbagicha-Agargaon,BMD (6 pm)	6.40 (29;000)
Dhaka University-Agargaon,BMD (6pm)	4.014(29;000)

Discussion

Fig8: Probable Causes of Microclimatic Conditions in Dhaka City (source: Raja,2012)

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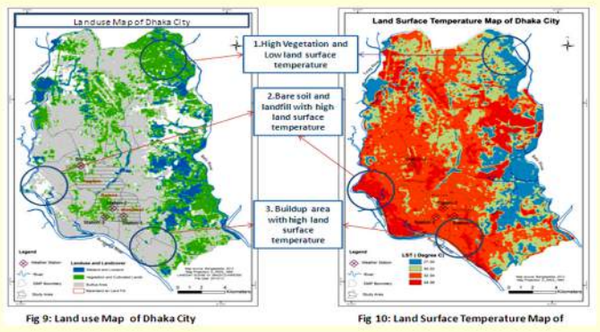

Fig 9: Land use Map of Dhaka City

Fig 10: Land Surface Temperature Map of

Recommendations

Mills (2006), Emmanuel (2003,2005) proposed several techniques and based on their work following recommendations have been put forward

Short Term
Plantation of trees in open spaces, plantation of trees around buildings, keeping spaces around buildings while constructing new ones, keeping small plants inside the houses etc.

Mid-Term
use of heat environment friendly materials in constructing new ones, protection of water bodies, change of design of buildings that have poor heat environment, change in street geometry .

Long -Term
Proper land use policy, new building code, utilization of peripheral area of Dhaka city, establishment of new green areas around Dhaka city

Conclusion

The main urban microclimatic condition that our research has found is urban heat island condition.

From this study it is evident that Motijheel, the commercial area and CBD of Dhaka city has worst heat environment among the four study areas.

The mean temperature difference of Motijheel from other three study areas is about 1.8°C at 6 pm or at evening and it is 0.7 °C at noon or more precisely at 12pm.

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