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TRENDS IN CLIMATE CHANGE AND SOME OF ITS DETERMINANTS IN BANGLADESH

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ABSTRACT

BANGLADESH IS A COUNTRY COMPRISING OF SIX SEASONS SUCH AS SUMMER, RAINY, AUTUMN, LATE AUTUMN, WINTER AND SPRING. BUT WE ARE IN DANGER OF LOSING A FEW OF THEM DUE TO THE NEGATIVE CONSEQUENCES OF EVER INCREASING GLOBAL WARMING. WE HAVE BEEN NOTICING SOME UNUSUAL SEASONAL PATTERNS FOR LAST FEW YEARS. THE EXTENT OF WINTER HAS DECREASED DRAMATICALLY. ON THE OTHER HAND, THE MONSOON IS SHIFTING MORE AND MORE. IN THE YEAR 2017, WE HAVE EXPERIENCED UNWARRANTED RAINFALL THAT CONTINUED UP TO LATE OCTOBER. IN THIS STUDY, I HAVE TRIED TO ASSESS THE CLIMATE CHANGE IN BANGLADESH OVER THE YEARS BASED ON HISTORICAL DATA AVAILABLE. AT THE SAME TIME, I HAVE ALSO ANALYZED THE TRENDS IN DEFORESTATION, URBANIZATION AND CARBON DI OXIDE (CO_2) EMISSIONS IN BANGLADESH OVER THE YEARS. SIGNIFICANT CORRELATIONS HAVE BEEN FOUND BETWEEN TEMPERATURE AND RAINFALL AS WELL AS BETWEEN DEFORESTATION AND CO_2 EMISSIONS. THE FINDINGS OF THE STUDY ARE IMPORTANT SINCE THE PATTERN OF THE SEASONS OF BANGLADESH DETERMINE ITS ECONOMY AS WELL AS ENTIRE LIFESTYLE OF THE PEOPLE.

KEYWORDS: RAINFALL, TEMPERATURE, DEFORESTATION, CO_2 EMISSIONS, CLIMATE CHANGE.

INTRODUCTION

Bangladesh is a country decorated lavishly by its nature with the contribution of its six seasons. But the seasonal chain is being disturbed every now and then. The seasonal pattern of recent years is a proof of that. Winter is getting shorter and monsoon has been shifting further as well as lasting longer. According to Global Climate Risk Index (GCRI) 2017 developed by German watch, Bangladesh is ranked sixth among the disaster-prone countries in the world.

According to Bangladesh Bureau of Statistics (BBS), the population density for Bangladesh was 976 persons/kilometer^2 in 2011. The national urban density was 3785 persons/kilometer^2 at the same period. Rapid urbanization is creating adverse impacts on the environment. More people

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means more consumption of natural resources including land and forest and if it continues, it would trigger the discharging rate of CO_2 in the atmosphere, affecting the environment.

The ever-increasing population is causing deforestation. The area covered by natural hill forests declined from 128630 hectares in 1990 to 79160 hectares in 2015 in Bangladesh according to Bangladesh Forest Department. Forests engross greenhouse gases that cause global warming. Deforestation diminishes the accumulation of CO_2 in the exterior atmosphere. It also increases the amount of water vapor in air. Both the issues are related to climate change.

As per World Bank database, CO2 emission per capita in Bangladesh has increased from 0.2 Metric Tons (MT) in 1995 to 0.4 MT in 2010. According to Intergovernmental Panel on Climate Change (IPCC), CO_2 emission has been the highest contributor of global warming so far. IPCC also estimated that about fifty percent of the CO_2 emissions happened in last forty years. Heat being ensnared in the atmosphere by CO_2 increase the average temperature of the earth.

METHODOLOGY

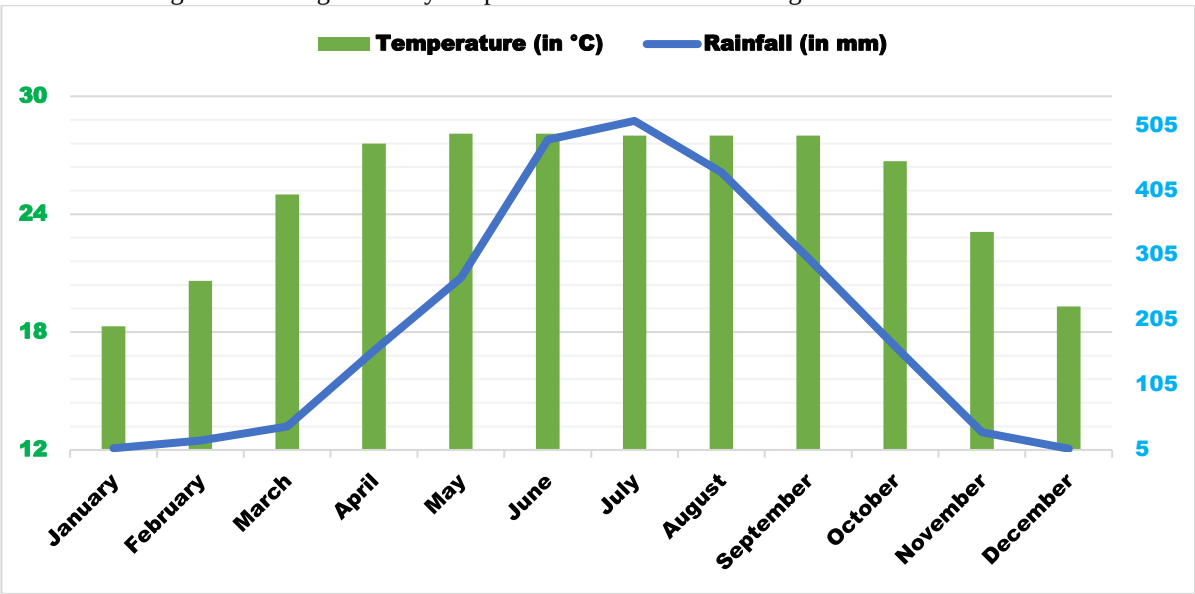
Information regarding both average monthly temperature and rainfall from 1901 to 2015 and forest area percentage with respect to land area from 1990 to 2015 in Bangladesh were collected from the website of World Bank. Data of deforestation trends from 1990 to 2010 in Bangladesh were collected from the website of World Bank along with mongabay.com. Data about urbanization trends in Bangladesh between 1901 to 2016 were collected from the website of banglapedia.org. Finally, information about trends in CO_2 emissions in Bangladesh from 1972 to 2016 was collected from the website of World Bank and ychart.com. We have performed graphical analysis of the data using Microsoft excel 2016. Also, some relevant statistical analyses like Pearson's correlation coefficient, test of significance etc. were performed using SPSS (Statistical Package for Social Science). Significance was determined with p-value ≤ 0.05. Mathematically, Pearson's correlation coefficient,

$$r = \frac{Cov(x\,y)}{\sqrt{V(x)V(y)}} = \frac{\frac{1}{n}\Sigma(x-\bar{x})(y-\bar{y})}{\sqrt{\frac{1}{n}\Sigma(x-\bar{x})^2\ \frac{1}{n}\Sigma(y-\bar{y})^2}} = \frac{\Sigma xy - \frac{\Sigma x\,\Sigma y}{n}}{\sqrt{[\Sigma x^2 - \frac{(\Sigma x)^2}{n}][\Sigma y^2 - \frac{(\Sigma y)^2}{n}]}} = \frac{SP(xy)}{\sqrt{SS(x)\,SS(y)}}$$

RESULTS AND DISCUSSION

We can see the patterns of average monthly temperature and rainfall in Bangladesh from 1901 to 2015 in figure 1. The Climatic Research Unit (CRU) of University of East Anglia (UEA) produced the dataset using which the figure was developed. This figure is telling us that the maximum average temperature occurs between April to October varying from 27.6°C to 28.1°C.

Figure 1: Average monthly temperature and rainfall for Bangladesh from 1901-2015



On the other hand, as we can see from figure 1 is that the maximum average rainfall occurs between June to August varying from 4327.6 mm to 512.1 mm. Analyzing the data in SPSS, we got highly positive correlation (r = 0.795) between temperature and rainfall which was significant as well (p-value = 0.002).

But it is the picture of last few years which has now become an issue of serious concern. Take this January for example. On 8th January 2018, the country experienced its lowest ever temperature (2.6°C) in Panchagarh district breaking the previous record of 4th February 1968 (2.8°C). Even the average temperature of the country was the lowest ever according to Bangladesh Meteorological Department. The cold wave is being happened very frequently than before. This is a clear shift in the usual winter people of Bangladesh have been used to experience before.

According to World Meteorological Organization (WMO), there was an increase of about 1.1°C in the mean universal temperature from January to September 2017. Its record also showed that the year 2016 was the warmest ever, followed by 2015 and 2017 respectively. One noticeable point in this period was the unusual weather of Asia where the maximum temperature readings were hitting the high forties in many countries. According to Bangladesh Meteorological Department, the average temperature in the country has increased by 0.5% in last 50 years. The maximum temperature readings of the country for last couple of years have been far away from the above-mentioned range of 27.6°C to 28.1°C. Dhaka, the capital of Bangladesh, experienced its highest temperature (40.2°C) on 24th April 2014, only the second highest ever since 1960 (42.3°C). Heatwaves have become very common in the summer in Bangladesh for last few years. An upsurge in frequency as well as concentration of heatwaves was very much expected (Kirtman et al. 2013).

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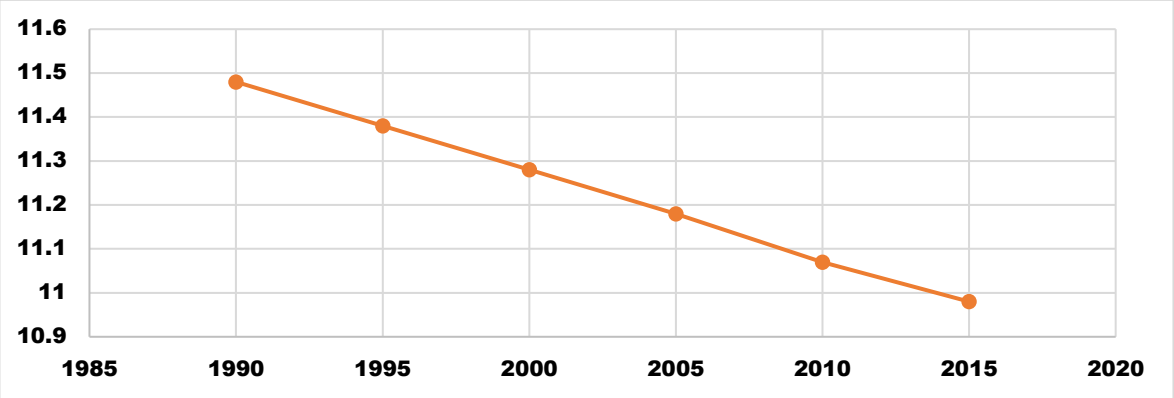
Data of Bangladesh Meteorological Department shows that in the year 2011, the country witnessed its highest rainfall (66762 mm) during the monsoon period since 2005. Four years later, this record was broken as 63987mm rainfall was recorded during the monsoon period in 2015. Last year the country experienced its highest ever rainfall for the month of April since 1981. Within the first three weeks, 8904 mm rainfall was recorded which was 119.7% higher than the expected one for the same period (4053 mm). Even at the ending part of the year 2017, we witnessed rainfall around the country which was very unusual.

Figure 2: Forest area percentage with respect to land area from 1990-2015 in Bangladesh



As we can see from figure 2, forest area percentage with respect to land area continued to decline over the years in Bangladesh. Moreover, this current percentage of forest area is not enough for us. Table 1 gives us a clear idea how drastically deforestation occurred in the country over the years. Urbanization along with industrial development without proper planning are the main contributors of this fast deterioration of natural forests. Deforestation plays an important role in climate change scenario of a country as it increases the amount of CO_2 in the atmosphere.

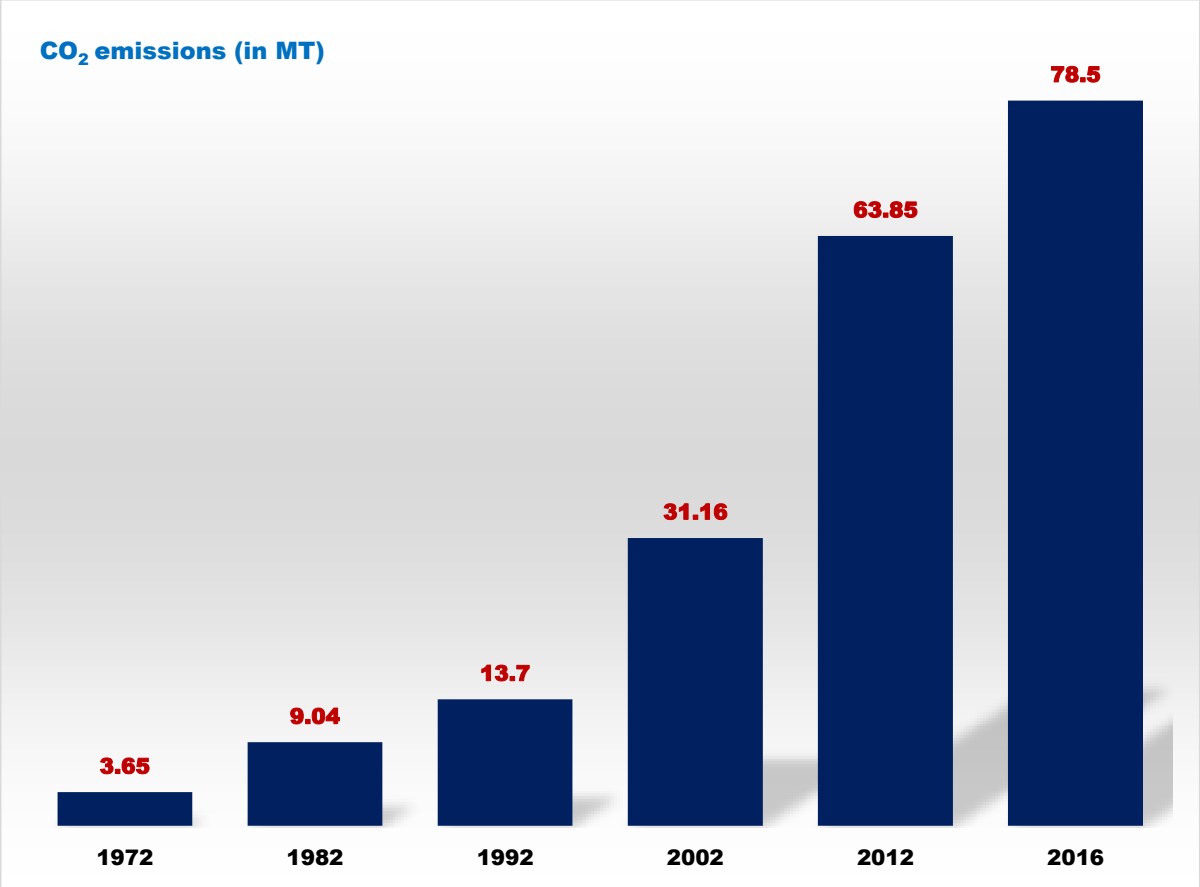
Analyzing the data in SPSS, we got highly negative correlation (r = - 0.952) between forest area percentage with respect to land area and CO2 emission which was significant as well (p-value = 0.003). This means, if we have more forest, then there will be less CO2 emission and vice versa.

Table 1: Trends of deforestation in Bangladesh between 1990-2010

	Forest covered area (in 1000 hectare)		
	Natural	Planted	Total
1990	1255	239	1494
2000	1197	271	1468
2005	1177	278	1455
2010	1205	237	1442

Figure 3 gives us a clear indication how rapidly the amount CO_2 emissions has increased over the years in Bangladesh post the liberation war in 1971. Urbanization is one of the main reasons behind this. Figure 4 shows how swiftly the level of urbanization has increased between 1901 to 2016 in Bangladesh. There seems to be a positive correlation between the two but unfortunately, we could not check that as the data of these two variables were available in two different types of series (not similar year).

Figure 3: Trends of CO_2 emissions in Bangladesh between 1972-2016



It is quite evident from both figure 3 and figure 4 that it is the ongoing millennium during when urbanization as well as CO_2 emissions increased extraordinarily. The more urbanization, the more CO_2 emissions, consequently, the more increase in temperature and so the climate change.

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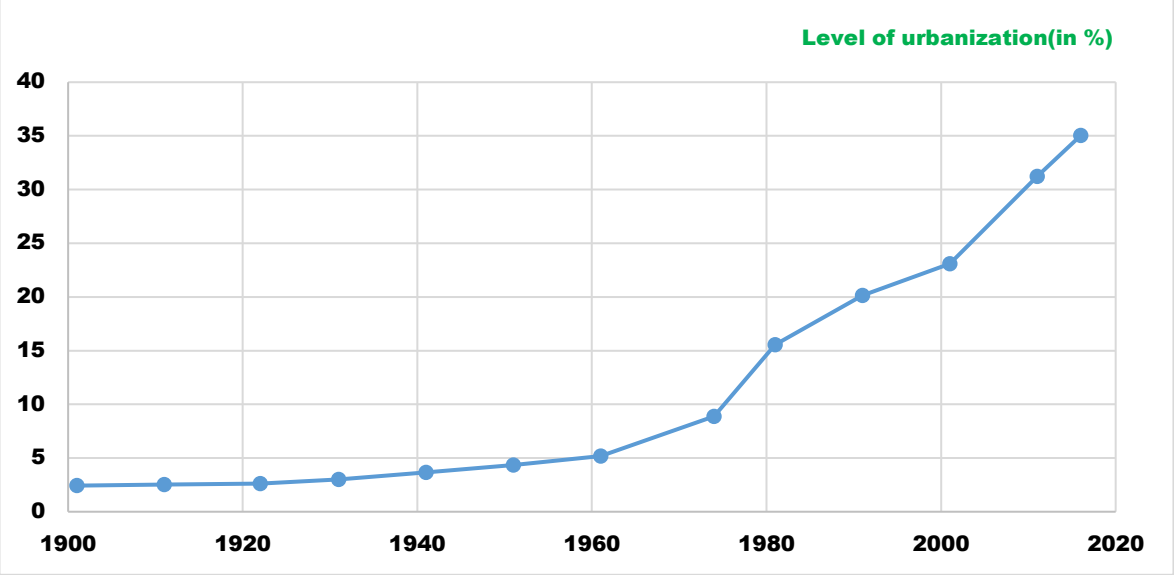
Figure 4: Trends of urbanization in Bangladesh between 1901-2016



CONCLUSION

After analyzing the mentioned datasets regarding different parameters of climate change, it is quite clear that this change has not happened over night. It is the outcome of a process that has been developing for years. The findings of this study will help the respective policy makers to have some idea regarding the trends as well as determinants of climate change in Bangladesh over the years and adopt necessary actions.

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