

Impact Of Land Use Change On Rainfall: A Case Study Of Mysore City

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Abstract- Cities create their own microclimates through influencing the surrounding atmosphere and interacting with climate process. The growth of the economic development resulting strongly accelerated urbanization and industrialization. During the past several thousands of years, humans have taken an increasingly large role in the modification of the global environment. The main aim of the study is to analyze the impacts of land use change on rainfall of Mysore city. The article studies the land use changes the period of 2001 and 2011 and monthly average rainfall of period from 1981 to 2011 and 30 years of average annual rainfall (1981 to 2010). In the study period farmland, water bodies significantly decreased and on the other hand annual average rainfall of the Mysore city fluctuate from year to year and also rainfall during south west monsoon season decline by period to period.

Key words - Drought, Rainfall, Moderate, Monsoon, Variability

INTRODUCTION

Land use change as one of the main driving forces of global environment change. Climate change can be understand an opposite of expected weather. During the past several thousands of years, humans have taken an increasingly large role in the modification of global environment. In the past century human population has increased to more than 7 billion and atmospheric concentration of carbon dioxide increased by 25% to greater than 350%, water quality, soil fertility, rainfall in many regions of the world have been severely degraded, and the biotic system has been dissected, depleted, and endangered by increasing human demands. Human activities are a major factor contribution to global change and they are overriding natural changes ecosystems brought on by climatic variations of the past few thousands years. Industrial emissions during the last century have rapidly altered atmospheric composition on evidenced most dramatically by the increasing atmospheric concentration as green house and ozone depleting gases such as carbon dioxide and chlorofluoro carbon. These human activities are threatening the long term stability of the earth system. The urban centres of India characterized by high density of population, housing stock, poor infrastructure, poor sanitation which leads to modifications of India's environment. All these factors responsible for the changing land use and variation of the rainfall.

STUDY AREA

Mysore city is the second fastest growing city of Karnataka state. It is one of the famous, historical, cultural and tourist centre of Karnataka State and also situated at a distance of 140km away from Bangalore city. It is a former capital of the kingdom of Mysore. The city lies at an altitude of 762 meters above mean sea level. The city is drained by Cauvery and Kabini rivers. It is popularly known as cultural capital of Karnataka. Recently the government of Karnataka promoting Mysore as an alternative destination for the Information Technology (IT) industry and developing it is a counter magnet city to Bangalore. The total land use area of the city is 15669.49 hectares with the total population of 9.14 lakh (2011). The latitude and longitudinal extent of the city is 12°18' between North latitude and 76°39' east longitude. The salubrious climate of the Mysore city is due to its elevation on the plateau surface and it's situated in the rain shadow region of the Western Ghats.

METHODOLOGY

The analysis of land use pattern of Mysore city using GIS of a period of 2001 and 2011. Hence the data pertaining to the study includes average monthly temperature of period from 1981, 1991, 2001 and 2011 and 30 years of average annual rainfall of the Mysore city. The study is mainly based on the secondary data collected from various sources such as Mysore district statistical office, Mysore city corporation (MCC) and Mysore urban development authority (MUDA) reports. The data has been analyzed to identify the influence of changing land use on rainfall of Mysore city over a period of time.

RESULTS AND DISCUSSION

Annual Rainfall

The data on mean annual rainfall, Deviation from normal, coefficient of variation, standard deviation and its classification are given in the table 1. The mean annual rainfall of Mysore city during the period from 1981-2010 is 23.33 mm. The minimum by 1069.30 mm in 2010 and the minimum was 269.40 mm in 2002 and 319.00 mm in 1982. The normal range i.e between + or - 19

of mean annual rainfall was 630.40 to 883.10 mm. Out of 30 years, five years such as 1981,1983,1994,1996, and 2010 received excess of rainfall (more than + 19%). Where as 4 years such as 1992,1993,2000 and 2003 received less than – 19.92 to – 28.60 % rainfall than the normal range these four years are declared as slight drought years, In 1984,1988,1990 these three years received – 36.50 to 58.53 % and declared as moderate drought years. In 1982 and 2002 received – 58.53 and – 64.97 % of rainfall these two years declared as severe drought years.

The rainfall of 30 years (1981- 2010) was ranged from 269.40 to 1598.30 mm with a mean of 727.33 mm. The 10 years decadal analysis indicated that the mean annual rainfall was varied consistently with alternative decades with slightly high coefficient variation of more than 25%. During better rainfall years 1991-2001 (11years) mean rainfall was 801.13 mm with higher S.D (312.19) and CV (38.96%).

While during the period of 1981-1991 the Mysore city experiences low mean rainfall 654.23 mm with S.D (205.34) and CV (31.38%). In general the annual rainfall of Mysore city was not normal and varied significantly from 1 year to another year.

Table 1 Year wise mean rainfall and % rainfall departure from normal at Mysore city

Years	Rainfall in mm	% R F departure from normal	Situation
1981	884.80	+21.65	E
1982	319.00	-58.53	SD
1983	973.80	+26.59	E
1984	504.30	-34.44	MD
1985	706.40	-8.16	N
1986	729.30	-5.19	N
1987	734.00	-4.58	N
1988	457.10	-40.57	MD
1999	745.20	-3.12	N
1990	488.40	-36.50	MD
1991	798.20	+3.76	N
1992	572.50	-25.57	SLD
1993	549.20	-28.60	SLD
1994	1598.30	+107.74	E
1995	630.40	-18.08	N
1996	995.30	+29.38	E
1997	826.30	+7.41	N
1998	647.20	-15.86	N
1999	777.80	+1.11	N
2000	616.10	-19.92	SLD
2001	735.20	-4.42	N
2002	269.40	-64.97	SD
2003	605.60	-21.27	SLD
2004	640.00	-16.80	N
2005	837.30	+8.84	N
2006	690.50	-10.23	N
2007	883.10	+14.80	N
2008	709.80	-7.72	N
2009	827.10	+7.52	N
2010	1069.30	+39.00	E

Mean = 727.33 IMD Classification

E= Excess RF (more than 19%) N= Normal RF (+ or – 19%) SLD= Slight Drought (more than – 19 to – 25%) MD= Moderate Drought (– 26 to – 49%) SD= Severe Drought (– 50% and above)

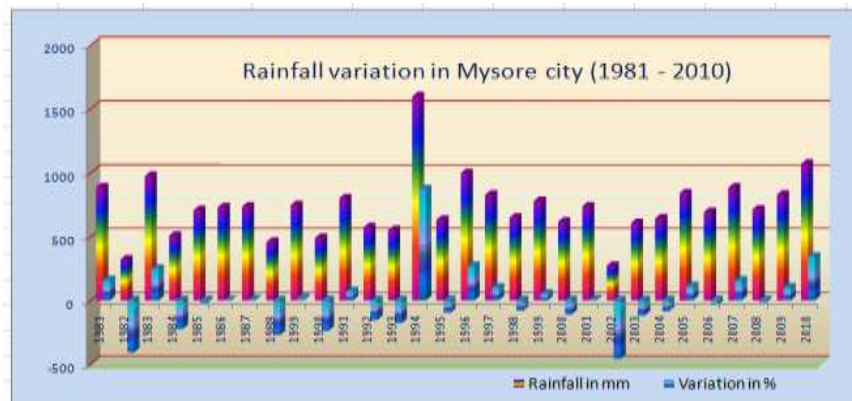
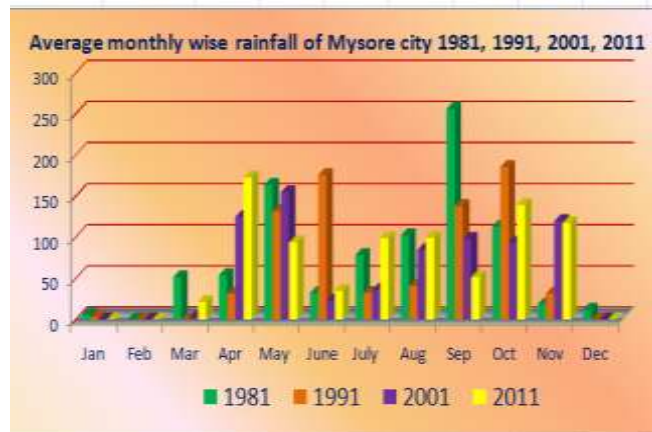


Table 2: Annual rainfall (mm) variability between 1981 to 2010 (30 years) at Mysore city

Decades	1981 to 1991	1991 to 2001	2001 to 2011
Mean in mm	654.23	801.13	726.73
S.D in mm	205.34	312.19	210.05
CV in %	31.38	38.96	28.90

Table 3: Average monthly wise rainfall of Mysore City 1981, 1991, 2001, 2011

Months	1981	1991	2001	2011
January	5.4	2.5	0	0
February	0	0	0	0
March	51.3	0	2.8	21.1
April	53.6	31.0	124.4	172.4
May	163.5	131.4	154.5	93.7
June	32.0	175.2	22.8	34.4
July	78.3	32.2	35.6	98.6
August	102.2	40.8	84.5	99.2
September	256.0	137.6	97.9	51.1
October	112.5	185.0	93.3	138.9
November	18.2	31.4	119.4	116.9
December	11.8	0	0	0
Total	884.8	761.1	735.2	843.3



Source: Indian Meteorological Department

Seasonal Rainfall

The table 3 and 4 and graph illustrate the monthly wise and south-west monsoon rainfall in the years of 1981, 1991, 2001 and 2011 at Mysore city.

During the month of January to February the city experiences a cold season. It is also called as dry season. The city is not getting rain fall of this season.

During the March to May city experiences summer season. In this period Mysore city receive the convectional rain fall. The average rain fall in this season is 80 to 100 mm. The city receive normal average rainfall from study period. However, the energy exchange between the underlying surface and atmospheric air was influenced by land use and land cover change which may have influenced the horizontal gradient force and impacted the air circulation. This could also be a reason why land use and land cover changes have greater impacts on summer rainfall.

In the month of October and November, the city receive the rainfall from Northeast monsoon. The average rain fall this period is 50 to 100mm. During this period Mysore city received normal rainfall from 1981-2011.

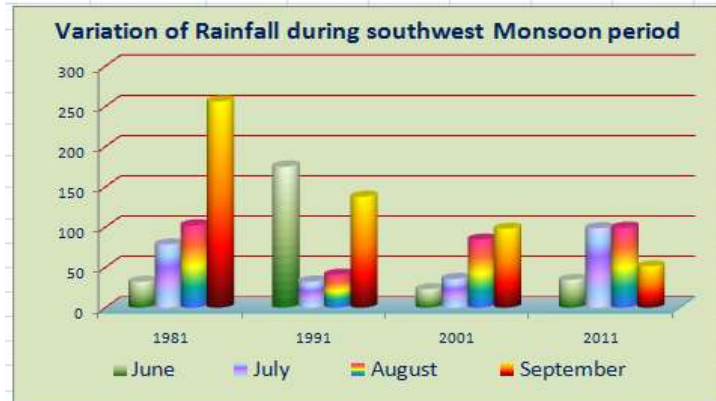
The months of June, July, August and September very important to city. Mysore city receive highest rainfall from South west monsoon period. The average rainfall of South west monsoon period is 450 to 500mm. According to the data of study period, shows the rain fall of the south west monsoon declining from 1981 to 2011. Only in 1981 the city get average normal rainfall remaining periods such as 1991, 2001 and 2011 the rainfall of the city gradually decreases. This is the major set back to the Mysore city environs. This is may due to increasing surface roughness during urbanization would weaken low level air circulation resulting in a rainfall reduction. On the other hand land use and land cover changes also affected on the direction of the air circulation. Due to roughness of the underlying surface, the air circulation was blocked in some places, which changed the direction and flow of the wind field in to the channels (Lichenn).

Table 4 Variation of Rain fall during Southwest Monsoon period

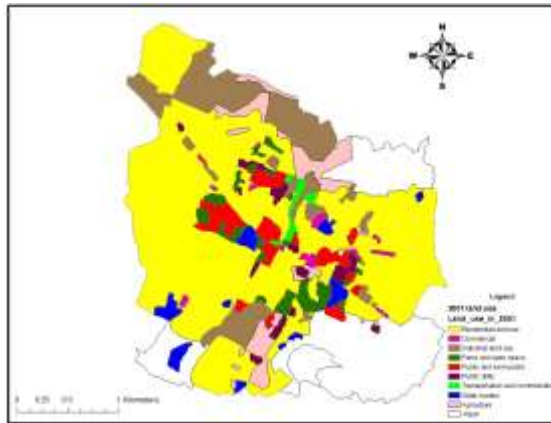
Months	1981	1991	2001	2011
June	32.0	175.2	22.8	34.4
July	78.3	32.2	35.6	98.6

August	102.2	40.8	84.5	99.2
September	256.0	137.6	97.9	51.1
Total	468.5	385.8	290.8	283.3

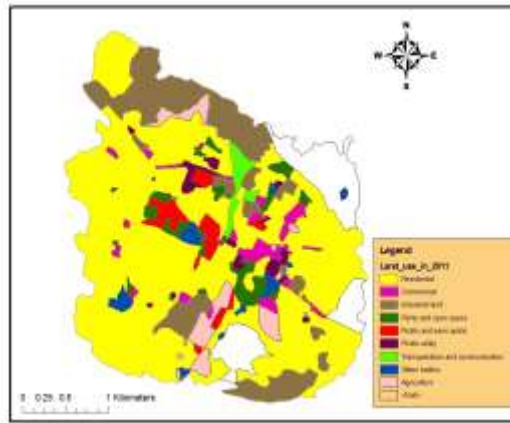
Source: Indian Meteorological Department



Land use map of Mysore city 2001



Land use map of Mysore city 2011



Category	Land use in (2001)		Land use in (2011)	
	Area in hectares	% Area	Area in hectares	% Area
Residential	2849.91	39.9	6097.87	43.45
Commercial	215.95	3.02	344.07	2.45
Industrial	962.61	13.48	1855.05	13.22
Park and open spaces	981.7	13.74	1055.05	7.52
Public and semipublic	639.69	8.96	1180.78	8.41
Traffic and transportation	1150.27	16.1	2380.56	16.96
Public utility	36.48	0.51	43.35	0.31
Water sheet	143.99	2.02	178.95	1.22
Agricultural	162.33	2.27	898.99	6.41
Nehru loka	2078.14	-	1634.82	-
Total	9221.07	100	15669.49	100

Findings

After completion of the study the following findings have been recorded

- The land use area of the city largely increases from 2001 to 2011. Within a span of one decade the land use area will be increased almost nearly 75%.
- The Mysore city mainly received rainfall from the South west monsoon season. But it is decreases from period to period. This is mainly due to the changing land use pattern and roughness of the underlying surface, the air circulation was blocked in some places, which changed the direction and flow of the Wind field in to the channels.
- The annual average rainfall of the city is fluctuating from one year to another year. Among the study period the city receive average annual rainfall of 15 years another 15 years it receive low average rainfall. In some of the year the city receive very low rainfall it may causes the draughtiness in the city.
- The natural vegetation of the city declining year to year. So the Government of Karnataka and local administrative bodies should take necessary steps to growing plants in around the city area.

Conclusions

Land use changes in the Mysore city has undergone significant changes over the past 16 years (1995-2011) urbanization is the main feature of development in the region, and a large area of cropland has been transformed into built-up land. Mysore city is a region with a concentrated population, where land use constantly changes in ways that are beneficial to man kinds. Mysore city gets most of its rainfall during south west monsoon between June to September.

Rainfall was also significantly affected by land use change. The amount of rainfall in south west monsoon season significantly reduced and average annual rainfall of the city fluctuate from one year to another which may have been caused by the expansion of urban land.

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