Climate Change and Its Impact of Environment in the Kota District, Rajasthan

***Suman Bharti Meena**
****Dr. D.C. Dudi**

Abstract:

Since the beginning of industrial revaluation human activities have led to unprecedented changes in the chemical composition of the Earth's atmosphere. There is now credible evidence that shows that such changes carry signification potential to influence Earth's climate, however owing to complex interactions within the climate system it is difficult to differentiate the characteristics of climate change associated with natural anthropogenic forcing. In Rajasthan, climate change will put additional stress on ecological and socio-economic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development. Kota district is an important physiographic unit of the state. The district is located in the south-east (Hadoti Region) of Rajasthan state. The land slopes gently from south to north and is drained by the Chambal and its tributaries. Hills are seen in north, south and eastern portion. Kota city has good fertile land , rich mineral resources, well irrigation facilities etc but Climate change is arguadly the most important issue threatening our existence. Therefore environmental degradation represents the greatest challenge facing kota district. . Climate changes in kota district affected by such as in the nature of rainfall, increasing temperature , industrial wastage , increasing population, depletion of environmental resources etc.

Keywords : Kota district, Hadoti region, climate change and its impact of environment, industrial waste , natural resources.

1. Introduction

Since the beginning of industrial revaluation human activities have led to unprecedented changes in the chemical composition of the Earth's atmosphere. There is now credible evidence that shows that such changes carry signification potential to influence Earth's climate, however owing to complex interactions within the climate system it is difficult to differentiate the characteristics of climate change associated with natural anthropogenic forcing. The global atmospheric concentration of GHGs like carbon dioxide, methane and nitrous oxide have increased considerably on a global scale. Discernible human influence have now extended to other aspects of climate; including ocean warming, continental-average temperatures, temperature extremes and wind patterns. In Rajasthan, climate change will put additional stress on ecological and socio-economic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development. Rajasthan with its climate ranging from arid to semi-arid and rapidly depleting natural resources, is already experiencing the effects of climate change. The regions climate is projected to become harsher with increased intensity of rainfall events, and increased variability in space and time of monsoon rains being consistently projected for the region. The vicissitudes of climate are likely to have a considerable impact on the physical and socio-economic fabric of the state.

Kota district is an important physiographic unit of the state. The district is located in the south-east (Hadoti Region) of Rajasthan state. The land slopes gently from south to north and is drained by the Chambal and its tributaries. Hills are seen in north, south and eastern portion. The Mukundara range of Vindhyan hills, which is 145km long , is located in the district . At many places, it has a ridges , running parallel to each at a distance of more than 2 km. Administratively 5 tehsils namely Ladpura, Ramganjmandi, Digod, Pipalda, Sangod. The district is also a part of South-East Rajasthan. This paper is an attempt to study the causes and impact of climate change in Kota district.

2. Climate Change

Climate is usually defined as the "average weather "in a place. It includes patterns of temperature, precipitation (rain or snow), humidity , wind and seasons. Climate patterns play a fundamental role in shaping natural ecosystem and the human economics and cultures that depends on them.

2.1 What are the reasons of climate change

Here is lots of reasons for a climate change. Rising levels of carbon dioxide and other heat trapping gases in the atmosphere have warmed the earth are causing wide-ranging impacts, including rising sea levels , melting snow and ice. More extreme heat events fires and drought.More extreme floods etc.

Kota district is such as mini industrial hub. Here is 425 micro, small and medium enterprises in kota district [MSME]. Here is thebiggest problem of generate pollution by industrial area, mining , thermal power plant, population etc. these things affectkota district climate. However industrial activities without proper precautionary measures for environmental protection are known to cause pollution and associated problems. If ecological and environmental criteria are forsaken "industrial and perish" will be nature's retort.

3. Climate in the Kota District

The maximum temperature was recorded 47.4^{0}C and minimum temperature 6.1*c and average humidity as 48% during year 2011. The district has a dry climate. The coldest months last for about three and a half months from November to the mid of February. The period from April to the end of June constitutes the hottest months. The monsoon season starts in the middle of July. The hottest wind blows in the months of may and June. The weather becomes moisturised and slightly cold during rainy season.

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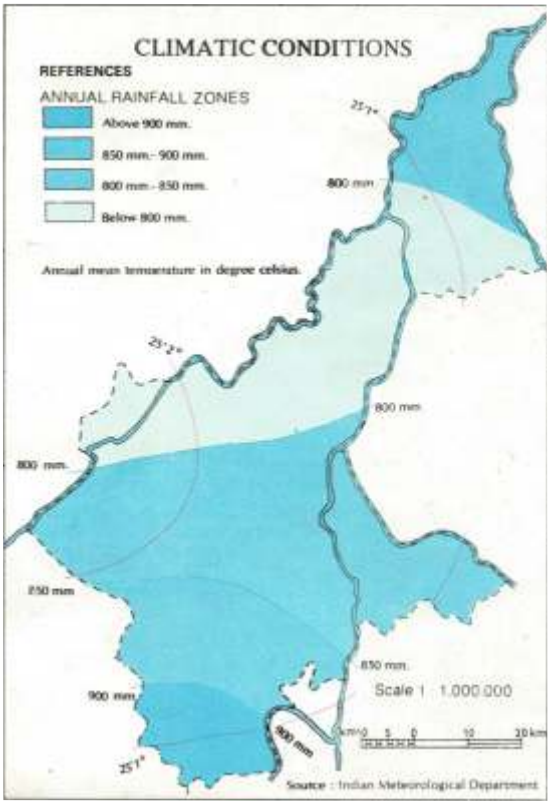


3.1 Temperature

The following table shows the unevenness in the temperature (in *Celsius)

Year	Maximum	minimum	Mean	Humidity%
2007	44.9	7.7	27.6	45
2008	44.4	6.2	27.0	46
2009	46.5	9.1	28.2	45
2010	48.4	7.5	28.4	47
2011	47.4	6.1	27.3	48

3.2 Rainfall

Normal rainfall in the district for the period1951-2000 is 807.9mm. However, average annual rainfall for the period 2001 to 2011 is 652.17 mm. the average annual rainfall is maximum at Digod 778.03 and minimum at Pipalda 660.80mm.

Average annual rainfall data of the district for the period 2001-2011 is given in table.

Annual Rainfall Data (2001-2011)

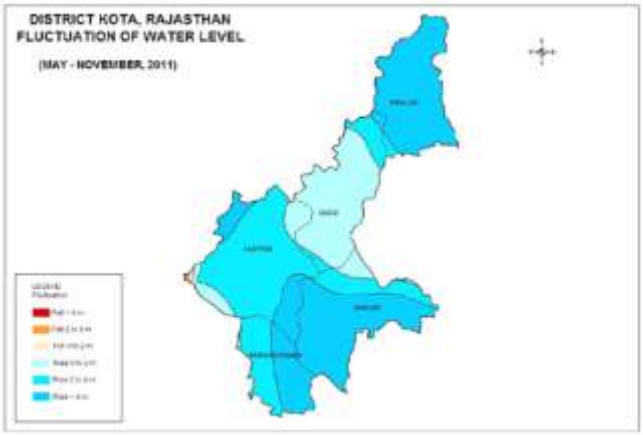
S. No.	Tehsil	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average
1.	Digod	851.0	382.0	572.1	840.0	324.7	1253.0	721.0	1067.0	796.0	638.5	113.0	778.03
2.	Ladpura	1081.2	463.0	525.5	572.5	458.0	679.0	800.5	712.0	648.0	571.0	968.0	679.84
3.	Pipalda	745.0	2390	714.0	686.0	483.0	574.0	587.0	1019.0	468.0	484.8	1269.0	660.80
4.	Ramganj mandi	1016.0	458.4	685.5	911.0	463.0	1232.0	892.0	699.0	645.0	847.0	1234.0	825.72
5.	Sangod	1232.0	438.2	557.0	841.0	477.0	989.0	650.0	567.0	473.0	413.0	1634.0	752.12

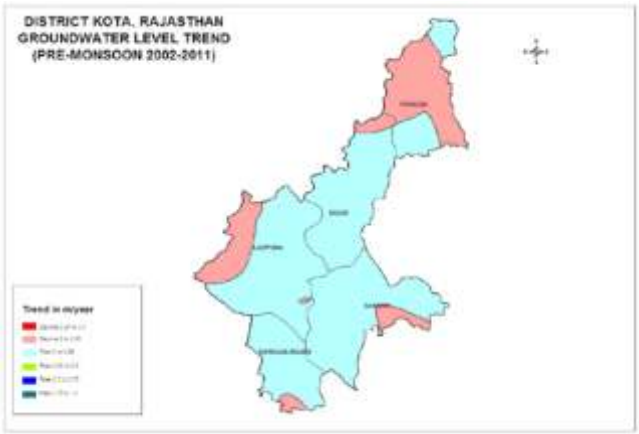
4. Location of Study Area

District kota forms south-eastern part of rajasthan state. It is between 24*25' to 25*51' north latitude and 75*37' to 77*26' east longitude.It is bounded on the north district SawaiMadhopur and north east Madhya Pradesh state in east district baran and north west district Bundi side in east side Madhya Pradesh state in west south Rawatbhata part of district chittaurgarh and in south district Jhalawar and in east side Madhya Pradesh state. The area of the kota district is 5217 sq. k.m. Kota rank 24th in area in comparision to other districts of the state The maximum leanth of the district from north to south is 153 kms and maximum width from east to west 84kms.

5. Water Level Fluctuation

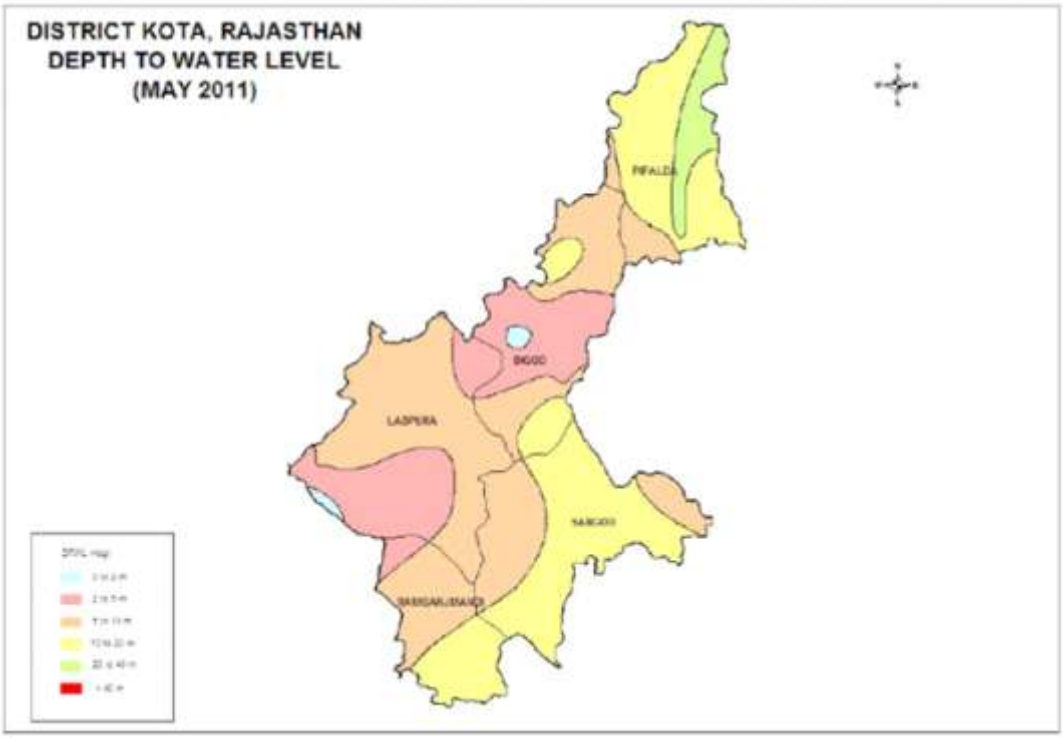
Occurrence of ground water depends upon topography, physiography and structural features of the geological formations. The movement of the ground water in hard rock areas is governed by size, openness, interconnection and continuity of structurally weak planes, while in unconsolidated rocks, ground water movement takes place through pore spaces between grains. In the district, ground water occurs under water table condition both in unconsolidated and consolidated formations.





The main hydrogeological units are alluvium, limestones, sandstones and shales. Shale also occurs an intercalations with both limestones, sandstones and shale. Cover an area of 5123.17 km^2 out of which 2111.77 km^2 area falls under command area. Most of the command area is irrigated by Chambal canal and comparatively small area by canals of alniya, Sawan Bhadon and Harish Chandra Sagar Dams.

Depth to water level (pre monsoon 2011) – The depth to water level varies widely depending upon topography, drainage, bedrock geology etc. The depth to water level during pre monsoon (May, 2011) varied form 1.92 mtr. 20.72 mbgl in major part of the district water levels were between 2 and 10 mbgl were observed in southern half of Kahirabad block, major parts of Sangod and Itawa blocks and some parts of Sultanpur block. Deeper water levels (20-40 mbgl) have been observed in localised pocket along the eastern border of Itawa blocks.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DEPTH TO WATER LEVEL
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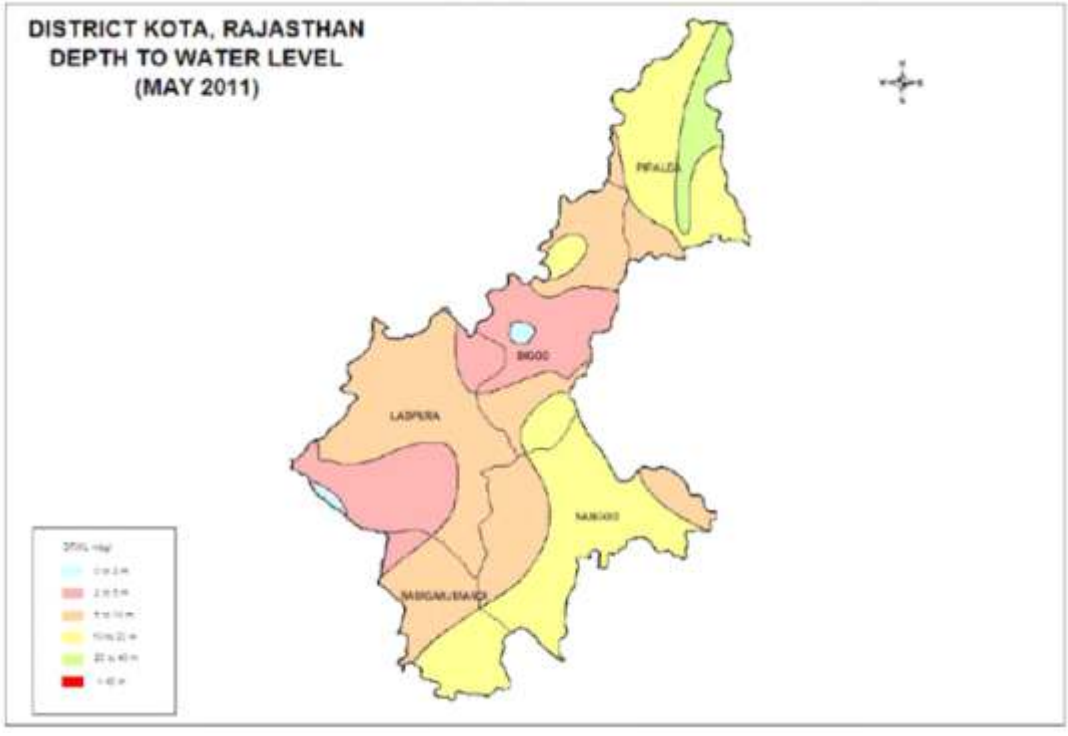
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5.1 Status of Ground Water Development

Rainfall in the district is the main source of ground water recharge. Due to less rainfall and increased ground water withdrawals, groundwater levels are declining in some parts of the district particularly in the northern part. Increasing urbanization and change in lifestyle have led to increased demand of water. Increasing urbanization also leads to reduced recharge. Further groundwater is also an important source of irrigation in the district. The stage of ground water development for the district as a whole has recharged 90% as on 31/03/2009 out of five blocks in the remaining three blocks viz. Itawa, Ladpura and Sultanpura fall under semi critical category. There is practically no scope left for further ground water development in over exploited blocks in the district.

Block wise replenishable ground water resources (As on 2009)

Block	Annually replenishable Ground Water Resource (MCM)	Net Annual Ground Water Availability (MCM)	Annual gross ground water draft for irrigation (MCM)	Annual gross ground water draft for domestic and industry (MCM)	Annual Gross Ground Water Draft (MCM)	Stage of Ground Water Development (%)	Category
Itawa	131.7617	118.5856	84.7811	5.7616	90.5427	76.35	Semicritical
Khairabad	56.1431	50.5288	55.1957	8.8568	64.0525	126.76	OE
Ladpura	146.7295	132.0565	93.8767	12.2623	106.1390	80.37	Semicritical
Sangod	97.1389	87.4249	96.7827	6.1648	102.9475	117.76	OE
Sultanpur	187.6729	168.9056	131.3203	8.2509	139.5712	82.63	Semicritical
Total	619.4461	557.5014	461.9565	41.2964	503.2529	90.27	Critical

5.2 Ground Water Quality

The range of chemical constituents of ground water in Kota district during pre-monson 2011 is given in table

S.No.	Chemical constituent	Range
1	pH	7.35 - 8.5
2	Chloride	25 - 740 ppm
3	Electrical conductivity at 25°C	320 - 3650 µS/cm at 25°C
4	Total hardness as $CaCo_3$	90 - 710 mg/l
5	Calcium	16 - 192 mg/l
6	Magnesium	12 - 95 mg/l
7	Iron	0.12 - 2.6 mg/l
8	NO_3	9 - 125 mg/l
9	F	0.10 - 1.96 mg/l

5.3 Groundwater related issues and problems

Two blocks in the district are overexploited, where stage of groundwater development. These blocks require judicious development of groundwater. Quality of groundwater is generally potable, except for a few pockets, where high electrical conductivity, nitrate and iron have been reported.

6. Status of Forest Area

This indicates that the district has a rich forest belt . These forests are concentrated mainly in the south western and central portions on the mukundara hills. The main sub-types of forests viz.

1. Anogeissuspendula forest.
2. Miscellaneous forest.
3. Babul (Acocia Arabica wild) exist in the district,But actual forest area has declined due to socio-economic activities.

The main species of flora found in Anogeissuspendula forests are Dhokramixed with GurjanBel,Tendu Tomentosaroxb etc. Miscellaneous forests include khejra ,khair , Bel , kalam, Amaltas, khora, balera, Amaltas , Khora, bahera , Gurjanetc. likewise the main flora found in forests of the third sub-type is babul mixed with khejra. A part from the above, there are certain other trees found in the district namely dhau, bahera,mahua,karaya or kara,salar,chhola, shisham,sadaria, gular,jamun,neem,pipal,aam and semal. Morak and Kanwasrages are famous for many grasses with occur in darah valley and some blocks of ladpura range are lapla.

Kota district forest area cover (in Sq km)

Geographical area	Very dense forest	Mode. Dense forest	Open forest	Total	Percentage of G.A.	Change	Scrub
5443	0	155	460	615	11.30	3	102

*Change compare to 2005 assessment (Forest survey of India)

7. Increase in Flood and Drought Prone Area

Kota is known educational as well as industrial city of rajasthan and is one of the fastest growing city in country rapid urbanization and industrialization has led to immense pressure on resources and has resulted disaster in kota district.

7.1 Flood

Flooding may occur as an overflow of water, water bodies , such as river or lake in which the water overtops or breaks levees resulting in some of that water escaping its usual boundary. Flooding is the common natural disaster and also very common in many places where heavy rainfall occur. There is no acute flooding problem in this district. Some problem of flooding in this district. At low lying areas like Sangod(area near Ujar and Prawan) are comes under flood prone region.

Year	Average annual rainfall	Departure from average rainfall	Percentage of departure	Category of flood
2006	818.55	294.97	56.34	Sever flood
2007	660.33	136.75	26.12	Moderate flood
2008	692.81	169.23	32.32	Moderate flood

2009	449.21	113.24	19.18	Moderate flood
2010	550.2	120.68	21.9	Moderate flood
2011	1060	312.18	60.8	Sever flood
2012	615	132.91	25.24	Moderate flood
2013	1267.12	362.84	64.18	Sever flood

The table shows in 2006,2011 and 2013 district have very heavy rainfall was 818.55mm and percentage of water departure was 56.34% in 2011 average annual rainfall was 1060mm and percentage of water departure was 60.8%in 2013 average annual rainfall was 1267.12mm and percentage of water departure was 64.18% . All three years suffered from severe floods.

7.2 Drought

Drought is an extended time when a region receives or deficiency in its water supply, whether atmospheric, surface or ground water. Generally this occurs when a region receives constantly below average precipitation. The kota district has alternate drought year during 1987 and 1989 and consecutive drought year during 1997,1998 and 1999. The moderate drought year are 1987,1993,1999,2002 and 2005 with average respectively. The severe drought years are 1989,1997,1998 with average annual rainfall below the average by 52.6,55.8 and 76.8 % respectively.

District	Number of years with droughts of different intensity				Percentage of all drought years in the period
	Very severe	Severe	Moderate	Light	
Kota	8	16	11	11	45.5

10*Frequency and intensity of droughts in Rajasthan during (1901-2002) (Rathor2004)

8. Status of Industrial Area

However industrial activities without proper precautionary measures for environmental protection are known to cause pollution and associated problems.CFC are the primary cause of ozone depletion when industrial processes release these chemicals, they rise into stratosphere and degrade the ozone. Acid rain, smog and poor air quality have been the result of air pollution. If ecological and environmental criteria are forsaken "industrial and perish" will be nature's retort.

9. Conclusion

Climate change is arguably the most important issue threatening our existence. Therefore environmental degradation represents the greatest challenge facing kota district. While abrupt displacements may happen, we primarily expect to see climate change causing a gradual population growth. Humans are introducing toxic gases into the atmosphere .this is not only gaseous form but also in liquid and solid

states. To a certain extent, climate change may intensify sewage problems if intensive rainfall becomes more frequent, increasing the risk of the sewage contaminated flooding of low lying land areas inkota district. Flash floods may, therefore add to the climate change related water problems which need to be addressed in kota in the near future. Average temperatures are feared to increase. Industrial operations and automobiles have released gigantic amounts of emission that have intensified these problems. Climate changes in kota district affected by such as inthe nature of rainfall, increasing temperature , industrial wastage , increasing population , depletion of environmental resources etc.

Head, Department of Geography
Govt. P.G. College, Sambhar Lake, Jaipur
****Research Scholar Ph.D., Department of Geography***
University of Rajasthan, Jaipur

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