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TO STUDY AND ANALYSIS OF ENVIRONMENTAL CHANGES OF JHARKHAND

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Abstract
Nature is a complex collection of physiological, chemical, and abiotic factors that affect living things and ultimately determine their structure and survival. In today's world conditions are often affected by various factors, such as pollution, population, and many other factors. And it destroys native plants and animals. Increased levels of pollution can lead to various diseases such as heart disease and skin diseases. Jharkhand is a very beautiful nature. Coal mining and profitability may be one of the most polluting tests. Pollution is the main reason why Global is heating its impact on our environment. Environmental change harms humans, wildlife, and the environment. Environmental changes can cause climate change, global climate change, and the destruction of natural resources. It also disrupts normal social and economic processes. Humans are cruelly ruining the environment. The mountains are barren. Due to the constant deforestation, this results in frequent flooding. The environment can cause a pattern of low rainfall, drought, and increased mortality rates. It greatly affects agriculture due to low rainfall and increased pollution can make the land less suitable for growing crops. Jharkhand province is already suffering from over-reliance on mineral resources. In addition, the government's water and water resources are under threat due to industrial and urban growth and inequality in temporary and spatial distribution. So, this research work based on the ecological changes in Jharkhand with a holistic view, focusing on other major regions that are experiencing the most environmental changes in that region.

Keywords: Environmental Changes, Resources, Economics, Pollution, Ecological Parameters.

Introduction

Climate change is one of the greatest challenges facing the human race. Expected global warming and associated climate change and rising sea levels will have far-reaching effects on the balance of stocks and natural resources, which could erode a large number of species on the earth's surface. Types of climate change indicate that the short-term direct effects of climate change will be achieved through access to clean water, food security, energy security, biodiversity, and human health. Scientists estimate the level of life-threatening on Earth with each additional level of global warming. Studies have been submitted to international and national levels to determine the potential and potentially significant impacts on the environment. The impact of climate change in India will be huge. India's large and growing population, 7500 km of coastline and population density, and the extent to which its economy is committed to its natural resources put the country at greater risk of the impact of environmental change (Amanita et al). Disturbing styles are evidenced by the rain, low and high temperatures bringing a shocking atmosphere to the country. Farmers are already experiencing the effects of climate change. Significant limitations include the movement of apple fruit to higher altitudes (ADB, 2010). In a country where 60% of fields are dependent on rainfall, changes in rainfall distribution due to climate change will have far-reaching effects on people from agriculture (Dash et al., 2007).

The level of state makes it clear that Jharkhand does not have the necessary resources to place it in a climate-friendly climate. While Jharkhand must plan and bear the brunt of the mitigation and adaptation efforts that need to be made in government, it will not be managed or expected to act aggressively on climate change and climate change as countries enjoying the high NSDP. Therefore, the objectives to reduce and adapt to the conditions defined and adopted by Jharkhand will be based on the principle of 'shared vision but separate responsibility'.

The Jharkhand State Pollution Control Board (JSPCB) presented Vision 2012-2017 and the Strategic Planning Plan on its role and the sustainable use of resources (JSPCB, 2000). The JSPCB, as a regulatory body, encourages industries to switch to new and environmentally friendly technologies (Subash et al., 2011).

The rainfall system in the province has seen significant changes in the past decades. Seasonal rainfall pattern according to data from 1956-2008 ranch region, it is clear that the highest annual rainfall (82.2%, with an average of 1149.3 mm) was received during the Southwest rainfall (June to September) and only 6.5% (estimated rainfall) at 92.3 mm) found during the months of the Northeast Monsoon (October to December) in the province. The remaining rainfall is winter (3.7%, on average 52.4 mm), from January to February, and summer (7.5%, on average 104.7 mm) from March to May, respectively. The state, therefore, receives heavy rainfall during the rainy season and receives only 17.7% of annual rainfall (Anamika Shalini Tirkey et al.).

Materials and Methods

Study Area:

Jharkhand is a province in the eastern part of India. The Jharkhand kingdom was created in 2000 by dividing the hilly regions and plains of the former Bihar region. The state shares its borders with the provinces of Bihar in the north, Uttar Pradesh in the northwest, Chhattisgarh in the west, Odisha in the south, and West Bengal in the east. It has an area of 79,710 km2 (30,778sqmt). It is the 15th largest region by area and the 14th largest by population. Jharkhand is mainly an agricultural sector where 80% of the population still relies on agriculture and integrated industries for economic development and livelihoods. But many of the mineral resources associated with workers shape the future of the state. The government has indicated that it is 40% of the country's resources, and is at the forefront of producing coal, mica, kyanite and copper in the country. In addition, the state is the sole producer of cooking coal, uranium and pyrite (Department of Industry, Jharkhand).

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Figure-1 showing the Political Map of Jharkhand pointing all Districts (Source: www.jharkhand.gov.in)

Jharkhand's climate varies from humid in the tropics of Humid in the north to the tropical wetlands in the southeast. The main seasons are summer, rain, autumn, winter, and spring. Summer lasts from mid-April to mid-June. May, the hottest month, with daily temperatures around 37°C (98°F) and low temperatures around 25°C (77°F). The southwest hurricane, from mid-June to October, generates almost all annual rainfall, ranging from about 40 inches (1000mm) in the western part of the province to more than 1,500 mm in the southwest. About half of the rainy season falls in July and August. The winter season lasts from November to February. Temperatures in December generally vary from 10°C to 50^0C. In this Research, we covered other key regions of Jharkhand and compared the environmental changes that have been observed until 2021, as there are many environmental changes observed in other Jharkhand regions.

Methodology

Changes are taking place in our natural environment in addition to the regions that have been tested for changes in population, size, built environment, industrial population, number of vehicles registered annually, seasonal variation in groundwater availability, increasing air and water pollution, etc. Data relating to these parameters were collected from various sources in the second viz. reports, journals, websites, and JSPCB. The study period is from 1971 to 2010 which is for the past 40 years, Drought Survey means monthly data on average temperature and rainfall for the period 1971 to 2010 collected from the India Meteorological Department (IMD), Pune, and the National Climatic website Data Center (www.ncdc.noaa.gov), January 2020 water pollution data and Jan 2020 air pollution data are both data collected from the JSPCB.

Results and Discussion

Climate Change due to air pollution

Air pollution and climate change are closely linked. As well as driving climate change, the main cause of CO_2 emissions - the extraction and burning of mineral oil - is also a major source of air pollution. In addition, much of the air pollution contributes to climate change by affecting the amount of incoming sunlight reflected or absorbed by the atmosphere, where some pollutants heat up and others cool the Earth. These temporary climate pollutants (SLCPs) include methane, black carbon, earth's ozone, and sulfate aerosols. They have important impacts on climate: black carbon and methane in particular are among the top contributors to global warming after CO_2.

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JHARKHAND STATE POLLUTION CONTROL BOARD
CENTRAL LABORATORY, MANO BALRAM BHWAN, HATIA, RANCHI-843004

Ambient Air Quality Data for RSPM Monitoring by State Pollution Control Board

Parameter	Unit
RSPM	µg/M3

Name of Monitoring Station : Albert Ekka Chowk, Ranchi. Area Class :- Mixed Area. City : Ranchi

State : Jharkhand Station Code : 402, Jan. 2020

RSPM

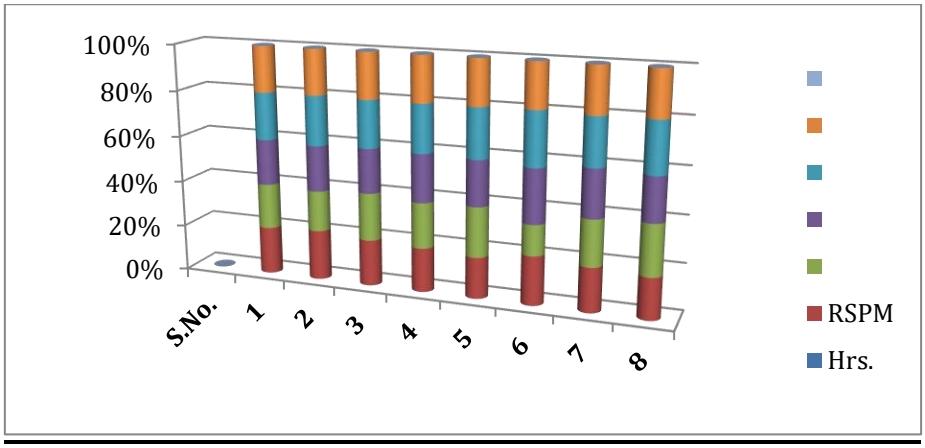
Sampling Date	6-14	14-22	22-06	8 Hourly Max	24 Hourly Avg.	Weather Con**	Remarks Temp. Min.-Max.
02.01.2020	108	122	96	122	108	Clear	7-21
06.01.2020	104	124	90	124	106	Clear	8-22
08.01.2020	100	118	98	118	105	Clear	7-22
10.01.2020	104	118	96	118	106	Clear	8-21
14.01.2020	110	126	98	126	111	Clear	9-23
17.01.2020	112	124	96	124	110	Clear	7-20
21.01.2020	108	120	94	120	107	Clear	8-21
23.01.2020	106	124	98	124	109	Clear	7-22
27.01.2020	108	122	96	122	108	Clear	7-20

Kindly fill in !R! if station falls in Residential area, T if station falls in Industrial area, !S! if station falls in sensitive area.

** Kindly fill in weather conditions as clear/cloudy/Rainy/Dust Storms/Calm condition (one or more may be applicable).
Note ; (i) Kindly indicate reason if monitoring is not carried out for 24 hrs in a day or less than 8 days in month.
(ii) Blank indicates that sampling was not done.

Table shows the Ambient Air Quality Data for RSPM in different date of Jan 2020.
(Data collected from Jharkhand Pollution Control Board in Central Laboratory, Hatia)

	Hrs.	RSPM					
S.No.	**Date**	**06-14**	**14-22**	**22-06**	**8 Hrs. Max**	**24 Hrs. Avg.**	**Weather conditions**
1	04-05/01/2020	248.55	236.36	239.22	248.55	241.38	Clear
2	07-08/01/2020	250.19	203.72	228.83	250.19	227.58	Clear
3	10-11/01/2020	246.40	253.59	238.14	253.59	246.04	Clear
4	17-18/01/2020	249.34	256.75	272.33	272.33	259.47	Clear
5	20-21/01/2020	256.43	310.78	283.32	310.78	283.51	Clear
6	24-25/01/2020	258.29	161.35	284.48	284.48	234.71	Clear
7	27-28/01/2020	233.54	242.45	250.61	250.61	242.20	Clear
8	30-31/01/2020	278.96	341.84	293.92	341.84	304.91	Clear/Cloudy



Graph Shows the Ambient Air Quality Data for RSPM Monitoring by Jharkhand State Pollution Control Board in month Jan. 2020.
(Sampling Location is CGNO, Kusunda, City-Dhanbad)

Agro-Climatic Regions of the State

The state is divided into three regions like **Central North-eastern Plateau, Western Plateau, South-eastern Plateau.**

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Figure 2 showing the Agro-Climatic Regions of Jharkhand

(Sources from Agricultural Technology Modules for Jharkhand, Birsa Agriculture University, Ranchi and ICAR, Kolkata)

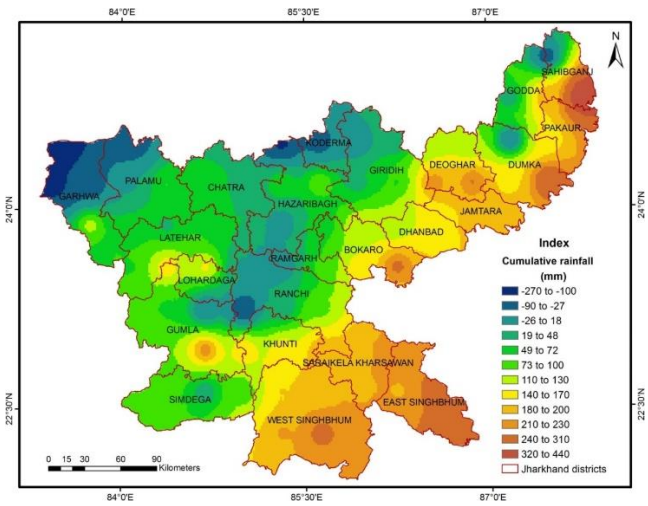

Figure 3 showing the Spatial distribution map of seasonal cumulative rainfall till 2014 in Jharkhand

(Sources from The Egyptian Journal of Remote Sensing and Space Science, Assessment of climate extremes and its long term spatial variability over the Jharkhand State of India)

Rainfall and Climate:

The overall rainfall during the monsoon season (June-October) for the entire state of Jharkhand was found to be decreased especially during 2011-2018. However, the trend analysis of rainfall during the monsoon season shows that rainfall has a fluctuating trend with a decrease of 27–275 mm in the north western districts (Fig 3) to an increase of 20–440 mm in the rest parts of the state.

The spatial distribution of cumulative rainfall shows that the north, northwestern and central regions of the state, particularly, Palamu, Garhwa, and parts of the Ranchi, Ramgarh, Hazaribagh, Kodarma, Giridih and Gumla show a declining trend of cumulative rainfall with magnitude 26–270 mm.

Out of 13 districts in region I, district Pakur receives the highest rainfall of 1732 mm followed by Ranchi (1388.6 mm). Some districts like Giridih, Koderma, Bokaro and

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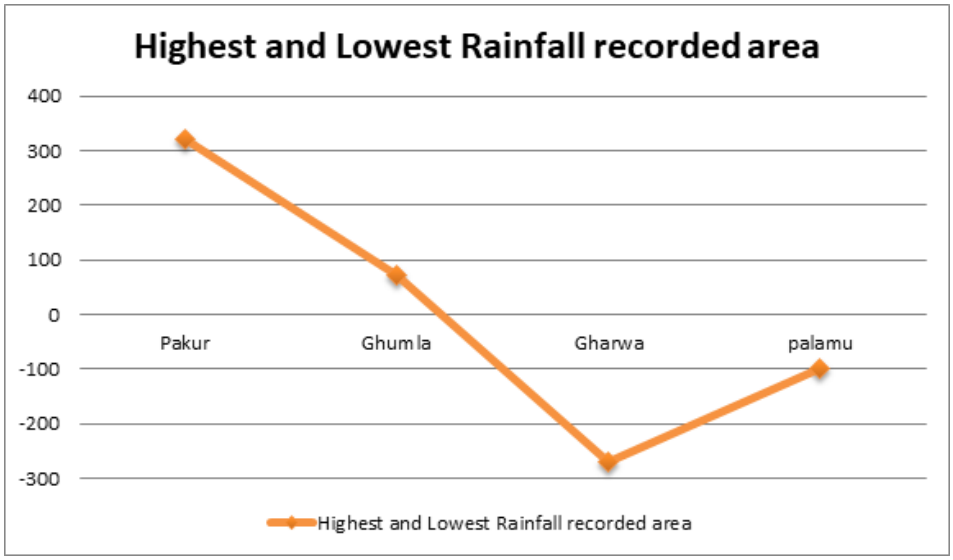
Hazaribagh receive less than 1400 mm rainfall and are prone to prolonged dry spells in July/August compared to other districts of this region, even in good rainfall years.

In Region-II, districts like Latehar, Gumla and Simdega receive fairly good amount of rainfall in normal monsoon years. However, in aberrant monsoon years this region becomes rain shadow area and dry spells of longer duration (more than 20 days) affect the cropping systems very adversely, particularly in Palamu district.

The South-eastern part of the state (Region-III) districts also receive good amount of annual rainfall and its distribution over the months is in the similar pattern (Agricultural Technology Modules for Jharkhand, Birsa Agriculture University, Ranchi and ICAR, Kolkata).

A Palamu and Garhwa district has suffered a lot during summers. The decrease in rainfall, with elevated temperature level, which implies lesser storage and greater water stress, and thereby exaggerates the severity of the extreme climatic conditions and inflicts harsh living situations. Rice being an important kharif crop (May–October) in Jharkhand, the decreasing trend of rainfall is observed to delay/affect the transplanting/vegetative phase of the crop, for which assured irrigation is very much needed to tackle the drought situation (Jharkhand Action Plan on Climate Change, 2014). Owing to the recent increase in extreme climatic events, high rainfall at rice flowering stage has been found deleterious, causing a yield reduction of up to 7 q/ha whereas at grain filling stage the high rainfall was found to be beneficial causing yield increase up to 6.3 q/ha (Jharkhand Action Plan on Climate Change, 2014). The decreasing trend of rainfall and increasing maximum temperatures trend in the north western regions may lead to severe socio-economic consequences, including loss in agricultural productivity, soil degradation, and disasters like droughts.



Graph shows the Highest and lowest rainfall districts compared from the above data.

The whole of Jharkhand is delayed several times instead of the first one in mid-July, the rainy season begins in the first week or 2 June. This has led to torrential rains that have led to major storm events in a short period of time, both inside and Jharkhand. The onset of the season also called for a change in planting season from July to August when a severe storm sometimes destroys crops. This temporary change in climate distribution has also been recorded by other researchers in their studies (Mall et al., 2007, Lal, 2001). The incidence of severe storms destroys crops and production during the Kharif (Kumar et al., 2010), and

produces large quantities of soil and nutrient load that affects water quality. Mahato (2014) pointed out that although the number of rainy days may decrease, their potential is expected to grow in many parts of India, especially in the North East (WHO, 2012, October). The rainfall map (Figure 3) produces an increasing trend of rainfall accumulating in the south-eastern and northeastern regions of Jharkhand, i.e. East Singhbhum, West Singhbhum, Saraikela Kharsawan, Deogarh, Jamtara, Dumka, Pakur, and part of Dhanbad, Bokaro, and Khunti where the increase of 140- 440 mm of accumulating rain. A moderate increase in rainfall is seen in the western parts (Simdega, part of Gumla, Lohardaga, Latehar, Palm, and Chatra), part of the central regions (Ranchi, Bokaro, Hazaribagh, Giridih, and Dhanbad), and areas to the northeast (part of Deoghar, Dumahgan, Dumka, Godka) showed an increase of 19-100 mm (Figure 3). The results of this practice analysis study are consistent with the findings of several other studies (Dash et al., 2007, Subash et al., 2011), which found that north eastern India had significant increases in temperature and rainfall, especially during the rainy season.

Water Resources:

a. Groundwater Scenario

The availability of groundwater in the state is substantial against the demand for water. The groundwater development status is well under control in the state. In overall, it is about 28% and it varies from about from about 14 percent in zone III to 31 percent in zone I.

Districts	Natural Recharge	Natural Discharge During Monsoon	Net Ground water Availability	Annual Ground Water Draft			Allocation for Domestic &Industrial Uses	Net Water Availability for future Use	Stages of GroundWater Development %
				Irrigation	Domestic	Total			
Bokaro	27599	2190	25408	5204	2752	7956	4121	16083	31
Chatra	27290	2527	24762	7363	1299	8662	2197	15202	35
Dhanbad	14945	1453	13492	3232	3807	7039	5780	4480	52
Dumka	30056	3006	27051	5578	1804	7382	2455	19018	27
Pakur	14094	1409	12685	582	1131	1714	1582	10521	14
Giridih	36960	3696	33264	8859	3109	11968	5099	19305	36
Hazaribagh	33438	3250	30188	9480	2264	11744	3392	17316	39
Ramgarh	11323	965	10358	2908	1135	4043	1633	5816	39
Ranchi	37973	2900	35072	10036	3919	13954	5080	19957	40
Zone I	**204325**	**18684**	**185640**	**43771**	**17597**	**613**	**2533**	**116530**	**33**

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						68	**8**		
Gharwa	33912	2839	31073	9257	1710	109 67	2510	19306	35
Gumla	40578	4058	36520	8170	1370	9541	1670	26680	26
Khunti	15955	1596	14360	3350	709	4059	963	10047	28
Latehar	27779	2523	25256	5762	924	6686	1288	18206	26
Lohardaga	10418	1042	9376	3143	575	3718	812	5421	40
Palamu	39472	3392	36080	9182	2510	116 92	3761	23137	32
Simdega	29783	2825	26958	6358	839	7197	1118	19482	27
Zone II	**381192**	**35388**	**345804**	**80860**	**2600 7**	**1068 68**	**3692 6**	**228017**	**33**
Saraikela	20759	1900	18859	912	1298	2210	1731	16217	12
E-Singhbhum	29863	2708	27156	2346	3287	56 33	4966	19844	21
W-Singhbhum	36786	3678	33108	964	1921	28 85	2562	29582	9
Zone III	8740 8	8286	7912 3	422 2	6506	1072 8	9259	6564 3	14

Table 1 shows the Status of Groundwater Resources in the JOHAR Project Districts (Ham)
(Source: http://aps.dac.gov.in/LUS/Public/Reports.aspx)

b. Irrigation

Irrigation facilities are limited in the state i.e. only 12%. The source wise access to irrigation facilities across the regions is presented in the table below.

Features	**Region-I (Central Northern-Eastern Plateau)**	**Region-II (Western Plateau)**	**Region-III (South-eastern Plateau)**	**Overall**
Total Area Irrigated	282629	514539	263146	1060314
Canal %	16.80	17.00	65	32.93
Tank%	30.55	3.65	13.90	16.03
Tube well%	4.75	14.70	2.64	7.36
Tube well & other	47.90	64.65	17.62	43.39

Table 2 shows the Irrigation pattern across the different Agro Climatic Zones in Jharkhand
(Source: http://aps.dac.gov.in/LUS/Public/Reports.aspx)

Drought:
The rainfall in the state also has witnessed significant changes in last decade. Late arrival and early cessation of monsoon is a common phenomenon in the state. Monsoon breaks occur in mid-June. Dry spells for 2-3 weeks and usually occur in July-August. Hathia rainfall failure

(late September to early October) manifests itself once in four years, adversely affecting grain grain growth and affecting second crop in winter season. As a general practice in the state, paddy being the most preferred crop, its sowing season during kharif keeps on extending even to late August /early September depending on the rainfall factors there by affecting the yield of the crop (Jhajharia, D Singh et al). The drought prone districts in the state include Ranchi, Dumka, Dhanbad. The districts declared as drought hit in the year 2016 are - Ranchi, Khunti, Lohardaga, Gumla, Simdega, West Singhbhum, Saraikela, East Singhbhum, Palamu, Garhwa, Latehar, Hazaribagh, Ramgarh, Koderma, Dhanbad, Bokaro, Chatra, Dumka, Deoghar, Giridih which includes all the project districts (Haskett et al).

Period	**Moderate**	**Large**	**Severe**	**Total**	**Drought Proneness (%)**
1971-1980	2	----	1	3	30
1981-1990	3	2	----	5	50
1991-2000	3	1	1	5	50
2001-2010	4	3	2	9	90
Total	12	6	4	22	55
Drought Proneness(%)	57	26	17	55	

Table 3 shows the Drought frequency and proneness according to intensities of Ranchi (1971-2010).

(Sources from Computed by Authors)

Crop Productivity:

An attempt has been made to understand the productivity of certain crops across the agro-climatic zones. The analysis shows that there are variations in agricultural production across the regions. In the region (Central Northern-Eastern Plateau), there substantial proportion of land in term of total geographical area, land put to use for agriculture production. But it is lagging behind in meeting the desire level of production as well as per hectare productivity of agricultural output.

Particulars	**Region-I (Central Northern- Eastern Plateau)**		**Region-II (Western Plateau)**		**Region-III (South-eastern Plateau)**	
	Area (000 ha.)	**Productivity (Qtls/ha.**	**Area (000 ha.)**	**Productiv ity (Qtls/ha.**	**Area (000 ha.)**	**Productivit y (Qtls/ha.**
Rice	836	11.28	328	6.9	330	4.5
Ragi	43.7	7.66	0	0	1.0	3.6
Maize	117	13.11	41.6	8.0	6.7	8.1
Wheat	92	16.00	14	6.5	1.9	6.6
Gram	8.6	11.41	17	7.5	0.6	7.4

Table 4 shows the Zone wise Cropping and Productivity.

(Source: http://www.sameti.org/default1_1sprof.htm)

Climate Change due to water pollution

Water, which forms the basis for human and other organisms, is a major source of sustenance and sustainability. Access to clean water is highly threatened by various human activities and

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interesting environmental issues that affect the environment and cause various climate change. While various methods of wastewater treatment are being tested by various industries and treatment centers, untreated wastewater is still pumped into bodies by other industries. Therefore, the campaign to comply with the environmental protection policy will be of great benefit to the environment and will extend to the individual. Applying these environmental protection policies to the goals and objectives of the various actors involved in environmental degradation will facilitate the implementation of these policies. This will serve as a step forward in managing water pollution.

Pollution of Jharkhand Rivers

Large-scale mining operations in the region have negatively affected the groundwater table in many areas with the result that water yields in nearby village sources have been significantly reduced. In addition, sewage discharged from mining areas has severely polluted streams and groundwater in the area. The flow of acidic mines, liquid contamination from coal-fired power plants, colliery works and mining areas and suspended resilience from coal-fired power plants have created significant water pollution in the region, severely affecting fish and aquatic life.

STN Code	Sampling Date	Name Of Water Body	Dissolved O_2 (mg/L)	pH	BOD (mg/L)	Chlorides (mg/L)	COD (mg/L)	Total Hardness (mg/L)	Total Dissolved Solids (mg/L)
2394	3/16/2020	TOPCHANCHI	7.4	7.5	1.4	42	60	70	468
2402	3/10/2020	HAZARIBAGH MEETHAJHIL	7.2	7.3	1.8	NA	48	NA	255
4741	3/13/2020	RANIBANDH	6	7.3	12.2	69	100	250	508

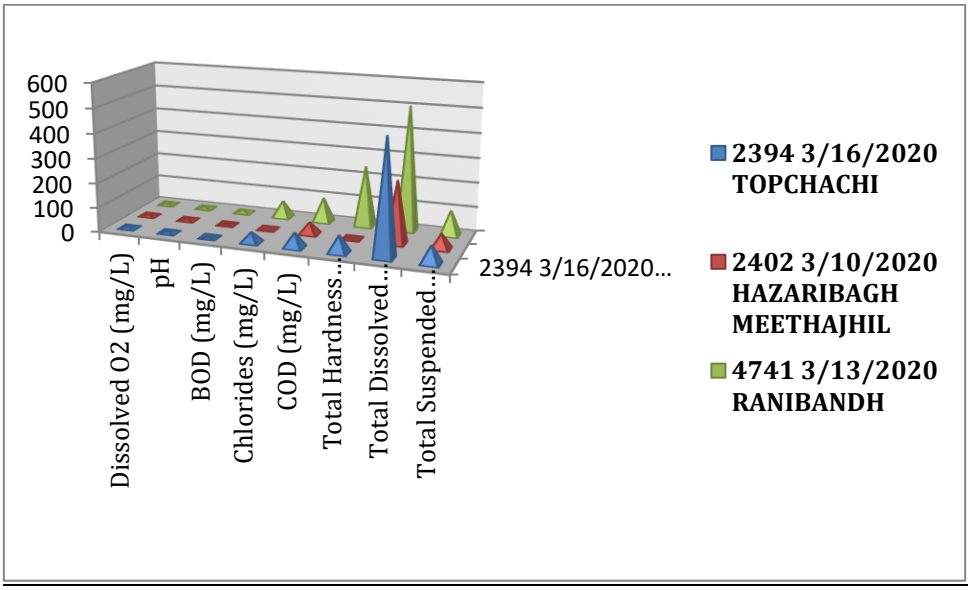

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Table & Graph Shows the data collected in March month of 3 different rivers; TOPCHACHI in DHANBAD District, HAZARIBAGH MEETHAJHIL in HAZARIBAGH District, RANIBANDH in DHANBAD.
Name of Monitoring Location- TOP CHANCHI LAKE, HAZARIBAGH MEETHAJHIL, RANIBANDH TALAB NEAR ISM, DHANBAD.

STN Code	Sampling Date	Name Of Water Body	District	Dissolved O_2 (mg/L)	pH	BOD (mg/L)	COD (mg/L)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)
2393	4/9/2020	SHIV GANGA	DEOGHAR	8.5	7.2	2.1	11.5	165	75
4740	4/13/2020	LOCO	DHANBAD	5.4	7.6	5.2	88	422	88
4741	4/13/2020	RANIBANDH	DHANBAD	5.6	7.1	14	104	534	92

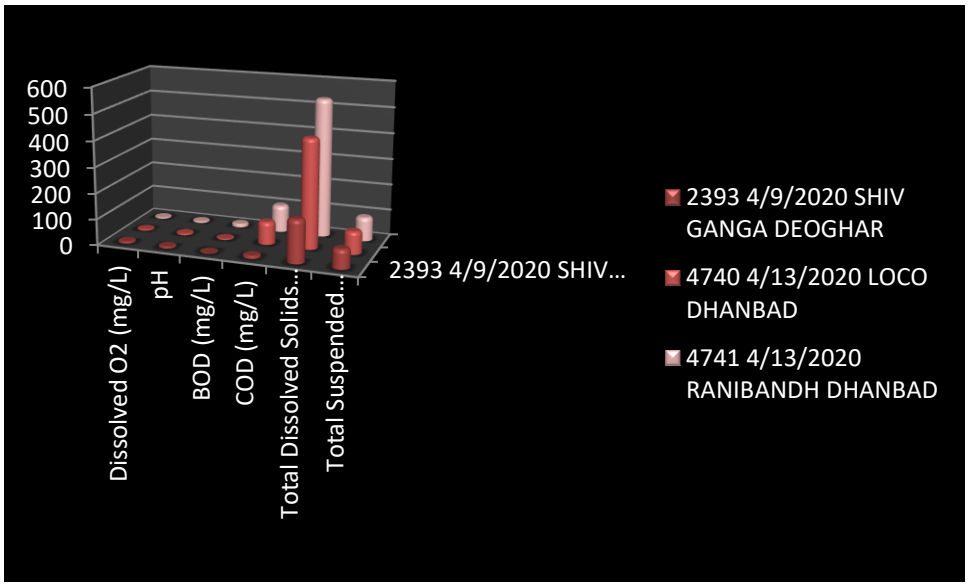

Table & Graph shows the Data collected in April 2020 of 3 river Siv Ganaga River in Deoghar, Loco River Dhanbad, Ranibandh Dhanbad

Different Climate Change and Development Issues Observed in Jharkhand:
The Fourth Scoping Report of the Intergovernmental Panel on Climate Change (IPCC 2007) confirmed much uncertainty about climate change. Various forms of climate change predict a major problem that is inevitable. It is now very clear that greenhouse gases are anthropogenic (especially CO2) are subject to climate change patterns and global warming (UNFCCC, 2007).

As a result of increased GHG concentration, surface temperatures have risen by about 0.74 ° C (plus or subtracted 0.18 ° C) from the end of the 19th century, and a direct trend of the last 50 years of 0.13 ° C (plus or minus 0.03 ° C) in ten years is almost double that of the last 100 years (National Climatic Data Center, 2012). The impact of climate change (as defined by the IPCC) will have far-reaching consequences foreign objects throughout the empire. Areas dependent on natural resources (eg green, water resources, rains and land) will be the poorest

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and some sectors will have to allocate more resources adapting to climate change and temperature rise.

As mentioned, Jharkhand has a large mineral reserve in the country, most importantly the coal reserves of Jharkhand are important for India's energy security and economic development. Industrial development in government to him taken after the division of state and state GDP increases at a rate of 6.35% per annum. In opposition to industrial development, the state is lagging behind in terms of social indicators. Although agriculture is the backbone of the rural economy, it lacks modern resources and suffers from low levels productivity.

CLIMATIC INDEX ANALYSIS

Summer Days (SU)

The present study shows the status of the dynamic news index of the SU index, wherever the average range of summer days is found to be the highest (336-348 days) in the southern and north eastern regions of West Singhbhum, East Singhbhum, Saraikela Kharsawan and Sahibganj respectively (337-346.8) and Simdega recorded the average range for summer days (340-348 days). The north eastern districts of Bokaro, Dhanbad, Jamtara, Dumka, Pakur, and Godda have 329.8-336.2 summer days on purpose. The Palms and Garhwa regions have an average mid-summer range (323.4-336.2 days), while, in the middle and half of the northern regions have a chillier with a minimum summer day range (277.5-316.1 days).

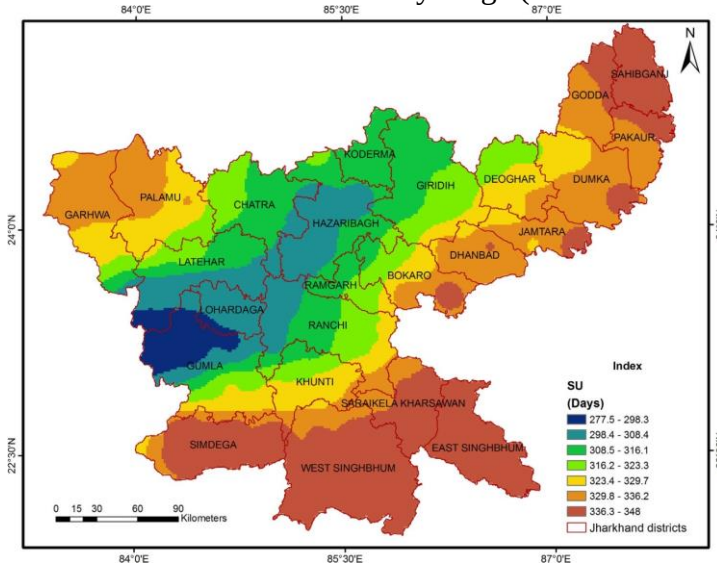

Figure 5 shows the Spatial distribution map of average number of summer days (SU index) during 1984–2014 in Jharkhand

(Source: Anamika et. Al.)

CONSECUTIVE DRY DAYS(CDD):

After observing a decreasing trend of rainfall and an increasing trend of maximum temperature in the north western districts of Palamu and Garwah which shows increasing no of consecutive dry days were also observed.

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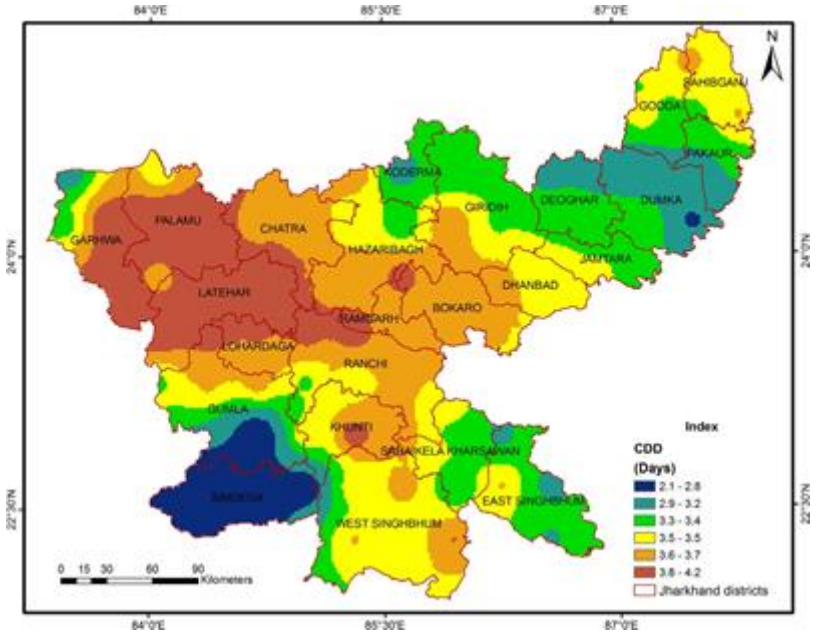

Figure 6 shows the Spatial distribution map of average number of consecutive dry days (CDD index) during 1984–2014 in Jharkhand.
(Source: Anamika et. Al.)

CHANGING WEATHER PATTERNS

Rising temperature:

Mining process require power to cool underground mines and surface facilities. A rise in temperature increases power demand and associated costs. This could also constrain future expansion of mining operations. The temperature fluctuations can increase strain on transmission and distribution facilities due to shifts in power demand. Increasing temperature might increase cases of malaria, dengue, heat stress or other health-related illness, thus causing health hazards among the mine workers. Increased mineral extraction requires removal of top soil. Top soil is later required in abandoned mines for vegetation and reclamation. Increased temperature can reduce soil moisture which affect plantation. Heavy rainfall can also lead to runoff of top soil and causing heavy silting as well as pollution downstream (Ghosh and Banerjee, 2012).

Extreme rainfall:

The geology of the state has predominantly hard rocks (East and West Singhbhum, Ranchi, Gumla, Dhanbad, Lohdarga, Palamu, Giridih, Hazaribagh, Chatra, Ramgarh, Godda, Deogarh, Dumka) 43 Mining on hard rock requires use of sulphur which increases the possibility of release of sulphuric acid when the mine tailings (the material left over after separating minerals from the ore) come in contact with water. Changing rainfall especially extreme rainfall can cause the release of sulphuric acid if the tailings are not managed properly on site and create environmental problems for the local population.

Heavy rainfall also causes other environmental impacts which include heavy silting downstream. Damodar River Basin, which is the repository of 46% coal reserves in India, is one of the most industrialized and mineralized regions. Damodar River, which runs through the mineral rich regions of Jharkhand Coal Fields (JCF), Dhanbad, has witnessed heavy pollution load caused by the mining industries. Heavy rainfall combined with faulty waste management practices on site can lead to an enhanced increment of pollutants in the river.

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IMPACT OF ENVIRONMENTAL CHANGES ON DROUGHTS IN RANCHI

Ranchi is they are at greater risk of drought. Before the big scale climate change, Ranchi was at high risk of drought with only medium power. But with a rapid change in the environment. Ranchi is threatened not only by the general thirst of all the energy but also the ongoing drought. This can create a challenge to drought forecast and implementation of mitigation measures. Water The extra months of July and September are also threatened drought, which had been without a drought in the past. Therefore, the Studies have shown a negative impact on the amount of water more than the Ranchi. As the drought begins heavily from October, any rainwater remains during the southern and western moons the moons should also be found used during drought. Increasing green spaces, is increasing green on the streets and in residential areas, which increases the value of reservoir reservoirs, water use wisely, limits or regulations for deep water harvesting, high rain harvesting compulsory apartments and other similar structures etc. May also be helpful in combating drought conditions.

FUTURE SCOPES OF THIS RESEARCH

In this Research Work, we have deals with the major districts which are strongly affected by decreasing environmental conditions After doing this review work, proper planning must be done to improve the climatic as well as environmental conditions. Also, for this few Preliminary steps taken by various boards and policies which was introduced by the Government of Jharkhand like **Jharkhand Energy Policy, 2012-** To reduce GHG emissions, Jharkhand adopted the Energy Policy, 2012 which specifies the production of electricity from unconventional energy sources. It provides for a 50% tax rebate for a period of 10 years for businesses that generate electricity from renewable sources and continue to have access to the Transmission and Distribution (T&D) network. Also to promote renewable energy in government, the Jharkhand Renewable Energy Development Agency (JREDA) was established in 2001, which is a leading institution in the implementation of programs of the Ministry of New and Renewable Energy (MNRE) and the Indian Renewable Energy Development Agency (IREDA); **Jharkhand State Water Policy, 2011-** Jharkhand has launched its State Water Policy in 2011. It lays down approaches for 'better and more equitable and productive water resources management in an environmentally sustainable manner for promoting growth reduction in poverty and minimizing regional imbalance' (WRD, 2011); **Private Initiatives in Jharkhand**- Private entities have also taken keen interest in reducing their Green House Gas (GHG) emissions and generating revenues as a co-benefit. CDM registry at UNFCCC has seen many clean energy projects being launched in Jharkhand including waste-to-energy, GHG reduction through use of super critical technologies or biomass based cogeneration project.

FUTURE IDEAS FOR REDUCING AIR POLLUTION

We take idea decrease during closures as a tool and based on the information provided by the JSPCB changes in Jharkhand air quality was analysed before and after Lockdown.

CONCLUSIONS

After doing this project, we had highlighted the climate variability over the state of Jharkhand. The distribution of long-term trends of seasonal averages of maximum temperature, minimum temperature and rainfall evaluated for Jharkhand on monthly basis, illustrates different rates of increase and decrease of the climate parameters in the state. This research showed that the average maximum temperature had a significant increasing trend over the past 30 years and is particularly prevalent in the north western districts of Jharkhand (Palamu and Garwah) where an increase is observed from 1–1.5 °C to a decrease of 0.82–0.14 °C in the north eastern and south eastern districts. The trend analysis of minimum temperature projects acolder drift in the central regions,

(particularly in Ranchi, Ramgarh, and Khunti) where the decrease is observed from 0.39–0.79°C to an increase of 0.59–0.41°C in the northeastern districts. The analysis of cumulative rainfall shows that rainfall has a fluctuating trend with a decrease of 26–270 mm in the north western districts (particularly Palamu and Garwah) to an increase of 19–440 mm in the rest parts of the state. The SU index analysis showed that the average number of summer days was highest (336–348 days) in the southern and north-eastern districts particularly Simdega which recorded the highest average number of summer days (340–348 days). The north eastern regions recorded an average of 329.8-336.2 days of summer days. The Palamu and Garhwa districts also depicted moderately high average number of summer days (323.4–336.2 days). Intermediate CDD was also found to have increased during the study period. The scenarios particularly serious for Palamu, Garwah, and Latehar districts, with 3.8– 4.2 day son an average without any consecutive number of rainy days during monsoon. In case of rainfall in the state, it was seen that the overall rainfall during the monsoon season (June-October) for the entire state of Jharkhand was found to be decreased especially during 2011-2018. Also, after reviewing many articles and government data it was found that Pakur receives the highest rainfall whereas Palamu had received lowest rainfall in comparison to all the districts in Jharkhand.

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