International Journal of Scientific Research in Science, Engineering and Technology
Print ISSN: 2395-1990 | Online ISSN : 2394-4099 (www.ijsrset.com)
doi : https://doi.org/10.32628/IJSRSET229519

A Geographical Study on the Effect of Climate on the Concentration of Rice Crop in Bhandara District

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Article Info
Volume 9, Issue 5
Page Number : 126-136

Publication Issue :
September-October-2022

Article History
Accepted : 10 Sep 2022
Published: 30 Sep 2022

ABSTRACT

The present study is geospatial modeling in the assessment of environmental resources for sustainable water resource management in a Bhandara district, India, using by geographical information system (GIS) and remote sensing (RS) techniques. The study will be based on secondary data. Secondary data was collected during the time period between are 1971 to 2013. The major crop of Bhandara district is rice, to study its crop concentration the total cultivated area, area under rice crop and index of concentration in each taluk of the district are given in the following table. To illustrate the changes over time, rice concentration figures from 1991 to 2011 are grouped by index and shown in a map. The average concentration of rice in the district in 1991 is moderate with values of 0.86. High concentration of rice crop is found in three taluks namely Mohadi, Tumsar and Sakoli in the district. The values of centralization in this taluka are more than 1.00 and are 1.10, 1.18 and 1.11 respectively. Whereas three talukas namely Bhandara, Pavani and Lakhandur have moderate concentration of rice cultivation. This concentration falls in the range of 0.80 to 1.00. The value of centralization in these taluks is 0.88, 0.85 and 0.94 respectively. In the year 2011, the average high concentration of rice is found in the district and its values are 1.02. Four taluks namely Mohadi, Tumsar, Sakoli and Lakhani have high concentration of rice with values of 1.08, 1.18, 1.08 and 1.12 respectively. Whereas in three taluks namely Bhandara, Pavani and Lakhandur medium concentration of rice is found and its values are 0.91, 0.86 and 0.90 respectively.The data can be used for area management, utilized in restoration and conservation of natural resources studies in the future.

Keywords :- Agriculture, Environmental Resources, Sustainable Water Resource Management

I. INTRODUCTION

Agriculture is the oldest occupation of human civilization. The most basic human needs like food, clothing, fuel and fodder for animals are met through agriculture. Agriculture as a profession has developed multifaceted and many practical dimensions have become apparent
[1,2,3,4,5]. Agriculture is one of the most ancient occupations of man. Agriculture means tilling the land

and sowing seeds in it and taking care of the sown seeds and their seedlings to get grain from them [6,7,8,9]. In intensive rice-growing areas of the world, temperatures are high throughout the year and annual rainfall exceeds 200 cm. Rice is cultivated three times a year due to favorable geographical conditions. This method of paddy cultivation is known as 'Savah' farming. Monsoon Asian countries produce about 90% of the world's rice [10,11,12,13,14]. The main rice producing countries are China (30%), India (21%), Indonesia (8.5%), Bangladesh (5.6%), Thailand (3.8%), Vietnam (3.7%), Myanmar (2.5%) and Japan (2.5%).) are is 2.3%) [15,16,17,18].

In all the above countries, rice is grown in deltaic areas, flood plains, terraces and lowlands. Ganga, Brahmaputra, Irrawaddy Mimang, Sikyang, Yangtiseikyang, lowland and deltaic areas are the main rice producing areas [19,20,21,22,23]. Since it is basic agriculture, it is very important to bring maximum land under irrigation in order to get maximum production from agriculture, irrigation facilities are being developed on a large scale in Bhandara district. Choosing the right irrigation method is very important. The particular method chosen for a farm should be determined by the water retention capacity of the soil. There is no problem in understanding the important stage of management.

II. STUDY AREA

Geographically, Bhandara district (**Figure 1**) is located in the central part of India, in the eastern part of Maharashtra state, in the interior of the continent away from the ocean and in the central part of the Wainganga river basin [24, 25, 26, 27, 28]. The latitudinal extent of Bhandara region is 20039' North to 21036' North and the longitudinal extent is 79027' East to 80007' East. The north-south length of this region is 103 km. And the east-west length is about 45 km. Bhandara district has a total area of 3779.25 square km. The area is occupied. Bhandara may be a corruption of the word 'Bhanara'. Because in the excavations at Ratanpur AD. In an inscription found in 1100, the term 'Bhanara' is found. A.D. From 1818 to 1890, the region was ruled by royal families. At this time the district headquarters was at 'Lanji'. A.D. During 1827, the headquarters of 'Lanji' was changed to 'Bhandara'. A.D. In 1767 Balaghat district of Madhya Pradesh was created by cutting off a part of Bhandara district. The headquarters of Sangadi taluka in Bhandara district was changed to the headquarters of Sakoli. On 1 May 1999, the newly created Gondia district came into existence by bifurcating the district. Bhandara district is the eastern part of the Deccan Plateau and is isolated by the mining activities of the Wainganga, Kanhan, Maru rivers. In the north of this region are the Ambagad hills, Chandpur hills and Gaikhuri hills in the Satapuda range, in the north-west the Ramtek uplift region, in the west the border of Nagpur district, in the south the Pavani hills and the borders of Gadchiroli and Chandrapur district and in the east the border of Gondia district. Bhandara district includes 7 taluks.

III. OBJECTIVE

1) To observe the effect of rainfall and temperature on paddy crop in Bhandara district.

2) To see centralization of paddy crop in Bhandara district.

3) To observe the effect of irrigation on various factors affecting the yield of paddy crops.

IV. DATABASE & METHODOLOGY

These studies are mainly based on secondary materials. For Secondary Information District Gazetteer, District Census Handbook, Social and Economic Review Report, Census District and Regional Statistics Department, Regional Meteorological Center Nagpur, Agriculture Department, Land Survey Department, G.P., Research Papers of Geography Experts, Newspapers, Google Application as well as published by Govt. And unpublished information has been used. Bhatia's (1965) method has been used to derive the index of production concentration. Also, the information obtained has been displayed through maps

and diagrams at appropriate places through scientific methods [29, 30, 31, 32].

V. RESULT

a) Rationale for study selection:-

Geologically Bhandara district is mainly covered by Archaean rocks. It mainly consists of metamorphic igneous and metamorphic rocks. It includes sist, phyllite, neisses and granite etc. Includes rocks. Alluvial region (**Figure 2**) is found in the areas along the banks of rivers in Lakhandur and Pavani talukas. It is called "Chairas Patta". Bhandara district is known as the district of ponds because the district is irrigated through wells, ponds, large and medium irrigation projects. Wainganga river (**Figure 3**) and its tributaries Bawanthadi, Sur, Chulband, Vagh apart from Ambagad Bodalaksa, Gadhvi, Maru etc. have been used for irrigation since ancient times. Rainfall, temperature and soil are factors that are useful for rice cultivation. The district has suitable temperature and rainfall for the paddy crop and under the crop conservation campaign, seeds are distributed to the farmers of the district under the rice development programme.

b) Bhandara District : Climate

Climate has a direct effect on geomorphic processes, natural vegetation, cropping systems, human occupations, types of housing, living conditions, etc. Hot and dry summers, cold and dry winters, and extensive rainfall in monsoons are the salient features of the climate of Bhandara and its adjoining region. Winter is from December to February, summer is from March to mid-June, monsoon is from June to September and post-monsoon is from October to November.

The temperature soil (**Figure 4**) rises rapidly from March to May. The monthly average maximum temperature (**Table 1**) rises to 47.50 Celsius in the month of May. In summer, the nights are cool compared to the scorching heat of the day. Afternoon heat is pleasant due to occasional gusts of wind. The climate is very hot and dry as there is no rain during this period. Also the relative humidity of the air is also low. The average maximum and minimum temperature in May is 47.50 Celsius and 21.60 Celsius respectively. The average daily temperature is around 25.90 Celsius. The monsoon season begins after mid-June and ends by the end of September due to the southwest monsoon. Bhandara region received an average monthly rainfall of 280 mm during this period. It's raining. Due to this, the humidity in the atmosphere increases and the temperature decreases. After June till July the maximum monthly temperature decreases by 100 Celsius. After that, the decrease in maximum temperature decreases in the months of August and September. But the average monthly minimum temperature remains constant throughout the monsoon season.

The weather in Bhandara region is very pleasant as the monthly average maximum (31.80 Celsius) and minimum (9.70 Celsius) temperatures decrease during the winter season from November to February. December is the coldest month. When a cold wave comes from North India, the temperature drops considerably. At that time the minimum temperature drops to 7.40 Celsius.

Rainfall:-

Rainfall is a very important factor in terms of irrigation. The average annual rainfall (**Table 2**) in Bhandara is 1246 mm. is While the median value is 1250 mm. That's it. This shows that it is not significantly different from the average [33, 34]. The table shows the total average of rainfall in 5 years from 2011 to 2015. Bhandara district receives more rainfall than other districts of Maharashtra. The main crop here is paddy (rice). And 70% of agriculture is rain dependent. Total average rainfall for five years in seven districts of Bhandara district was recorded. Considering the total average rainfall in 5 years, Lakhandur taluka has the highest rainfall while Tumsar taluka has the lowest rainfall. Overall, all the seven talukas have recorded more rainfall than the average.

C) Form of rice cultivation:-

Rice is a hot and humid subtropical crop. Water and warm temperature are essential for this crop. Growing crops usually: Temperature of 24°C.Rainfall above 1400m and 1500 to 2000mm Rainfall is required. In addition to this irrigation makes it more beneficial. Soil is an important factor and generally alluvial soil to a depth of two to three feet from the surface and chicken soil below it is excellent for paddy cultivation.

VI. INDEX OF CONCENTRATION OF RICE PRODUCTION IN BANDARA DISTRICT

Bhatia in 1965 has used the following formula to break down agricultural divisions on the basis of crop density. In this study, the crop concentration of rice crops in Bhandara district has been calculated using the above formula of 'Bhatia'. The major crop of Bhandara district is rice, to study its crop concentration the total cultivated area, area under rice crop and index of concentration in each taluk of the district are given in the following table. To illustrate the changes over time, rice concentration figures from 1991 to 2011 (**Figure 5**) are grouped by index and shown in a map [35, 36, 37, 38, 39]. The average concentration (**Table 3**) of rice in the district in 1991 is moderate with values of 0.86. High concentration of rice crop is found in three taluks namely Mohadi, Tumsar and Sakoli in the district. The values of centralization in this taluka are more than 1.00 and are 1.10, 1.18 and 1.11 respectively. Whereas three talukas namely Bhandara, Pavani and Lakhandur have moderate concentration of rice cultivation. This concentration falls in the range of 0.80 to 1.00. The value of centralization in these taluks is 0.88, 0.85 and 0.94 respectively. In the year 2011, the average high concentration of rice is found in the district and its values are 1.02. Four taluks namely Mohadi, Tumsar, Sakoli and Lakhani have high concentration of rice with values of 1.08, 1.18, 1.08 and 1.12 respectively. Whereas in three taluks namely Bhandara, Pavani and Lakhandur medium concentration of rice is found and its values are 0.91, 0.86 and 0.90 respectively. From 1991 to 2011, the centralization of rice cultivation has gradually increased and agriculture here is moving towards specialization [40, 41, 42, 43, 44, 45, 46]. As the net cultivated area in Bhandara district has increased over the past 30 years, there has also been a large increase in the irrigated area. As irrigation allows for more than one cropping, there is a greater difference between net and gross cultivated area. The percentage of irrigated area out of net area under crop in Bhandara district taluka wise is shown in the following table. The taluk-wise change in irrigation during the 30-year period from 1981 to 2011 means that in 1981 almost all taluks had less than 50% irrigation. By 2011, the ratio has increased from 50% to 70%. In 1981, the irrigation ratio was less than 50% in most parts of the district. In 1991, there was an increase in the irrigated area of Mohadi Taluka. While some other talukas have increased and decreased (**Figure 6**). During the thirty year period from 1981 to 2011, there has been a progressive increase in the irrigated area, which has definitely had an impact on agricultural productivity.

d) Impact of Irrigation Project:-

In the year 2010-11, there are 4 major projects and 4 medium projects in the irrigation sources in the district and their irrigation capacity is 33,659 respectively. and 13,071. That's it. Apart from this, there are 32 projects at the state level and 220 projects at the local level under minor projects and their irrigation capacity is 16425 respectively. And 17835. That's it. Also, there are 19 sub-irrigation projects in the district through which 57962 ha. It has the potential to bring the area under irrigation. Also the total number of K.P. Dams 310 (Kolhapuri style) and thereby 9897. The area has potential to come under irrigation.

VII. CONCLUSION

Bhandara district has 589 irrigation projects and its irrigation capacity is 148849. is Only 89759 of them. The area is actually under irrigation. That means 60.30%

area has been brought under irrigation and another 39.70% area is about to come under irrigation.

1) It can be seen that geographical factors soil temperature and rainfall are affected in paddy production in Bhandara district.

2) The average concentration of rice in the district in 1991 is moderate with values of 0.86. In the year 2011, the average high concentration of rice is found in the district and its values are 1.02.

3) During the period 1991 to 2011, the concentration of rice crop has gradually increased and the agriculture here is moving towards specialization.

4) Bhandara district includes talukas with concentration of paddy in the irrigated area.

5) During the 30 year period from 1981 to 2011 in Bhandara district, there has been a progressive increase in irrigated area and its impact on agricultural productivity is evident.

In terms of paddy crops in Bhandara district the following remedial schemes have been given. Adoption of hybrid planting technology and disease management etc. to increase the productivity is orderly. The yield and quality of paddy can be increased by using improved methods using important cultivation formulas.

Table 1: Annual Maximum and Minimum Temperature – 2011 (Temperature in 0C)

Sr.No.	Months	Maximum Temperature	Minimum Temperature	Average Temperature
1	January	31.7	10.9	21.3
2	February	32.7	11.8	22.25
3	March	38.9	13.4	26.15
4	April	43.1	18.2	30.65
5	May	47.5	21.6	34.50
6	June	46.1	21.6	33.85
7	July	36.1	21.8	29.35
8	August	34.8	21.8	28.3
9	September	34.2	21.4	27.8
10	October	35.5	17.4	26.55
11.	November	32.6	8.5	20.55
12	December	30.5	7.4	18.95
	Annual average	37.04	16.33	26.69

Table 2: Average Rainfall - 2011-2015 (Rainfall cm)

Sr. No	Taluke	2011	2012	2013	2014	2015	Average Rainfall
1	Tumsar	948.80	985.60	1499.50	1260.80	1002.70	919
2	Mohadi	955.30	1043.40	1488.80	1260.80	803.70	1110
3	Bhandara	974.90	1216.90	1773.60	1260.80	955.30	1236
4	Sakoli	1186.50	1385.90	1921.80	1399.10	1050.30	1389
5	Lakhani	1027.80	1270.30	2014.00	1451.30	945.80	1342
6	Pawani	1195.70	1304.70	1824.30	1227.40	822.40	1275
7	Lakhandur	1416.60	1553.40	1912.80	1451.30	784.30	1424
	Total	1086.80	1251.50	1809.80	1330.20	909.20	12420

Table 3: Taluka Wise Net Area Under Crop and Total Irrigated Area: 1981-2011

1981					1991			2001			2011		
Sr. No.	Taluke	pica empty area	Total Irrigated Area	%	pica empty area	Total Irrigated Area	%	pica empty area	Total Irrigated Area	%	pica empty area	Total Irrigated Area	%
1	2	3	4	5	9	10	11	15	16	17	15	16	17
1	Bhandara	32600	9104	27.93	32818	7718	23.52	32715	17186	52.53	33633	23873	70.98
2	Mohadi	32400	10550	32.56	25247	16642	65.92	34399	30745	89.38	39168	26147	66.76
3	Tumasar	29800	14438	48.45	31238	12947	41.45	31198	27127	86.95	29160	19927	68.34
4	Sakoli	31400	16748	53.34	32418	17047	52.58	21827	15305	70.12	19969	14265	71.44
5	Lakhani	-	-	-	-	-	-	-	-	-	24458	12529	-s
6	Pawani	36700	6922	18.86	35461	8097	22.83	33464	14892	44.50	33519	14689	43.82
7	Lakhandur	29500	8247	27.96	30495	7387	24.22	27681	18414	66.52	28461	16735	58.80
Total		192400	66009	34.31	34.31	69838	37.21	181284	123669	68.22	208368	128165	61.51

Table 4: Irrigation potential of projects and area under irrigation : 2010-11 (Area in. Hectars)

Sr. No.	Type of Project	No. of Projects	Irrigation Potential (Area)	Area under Crop
1	Major Projects	4	33659	33659
2	Medium Project	4	13071	13071
3	Small Reservoirs (State Level)	32	16425	13512
4	Small Watersheds (Local Level)	220	17835	16863
5	Upsa Irrigation Scheme (State Level and Local Level)	19	57962	4339
6	Ko. W. Dams (State Level)	1	400	400
7	7 Ko. W. Dams (Local Level)	309	9497	7915
	Total	589	148849	89759

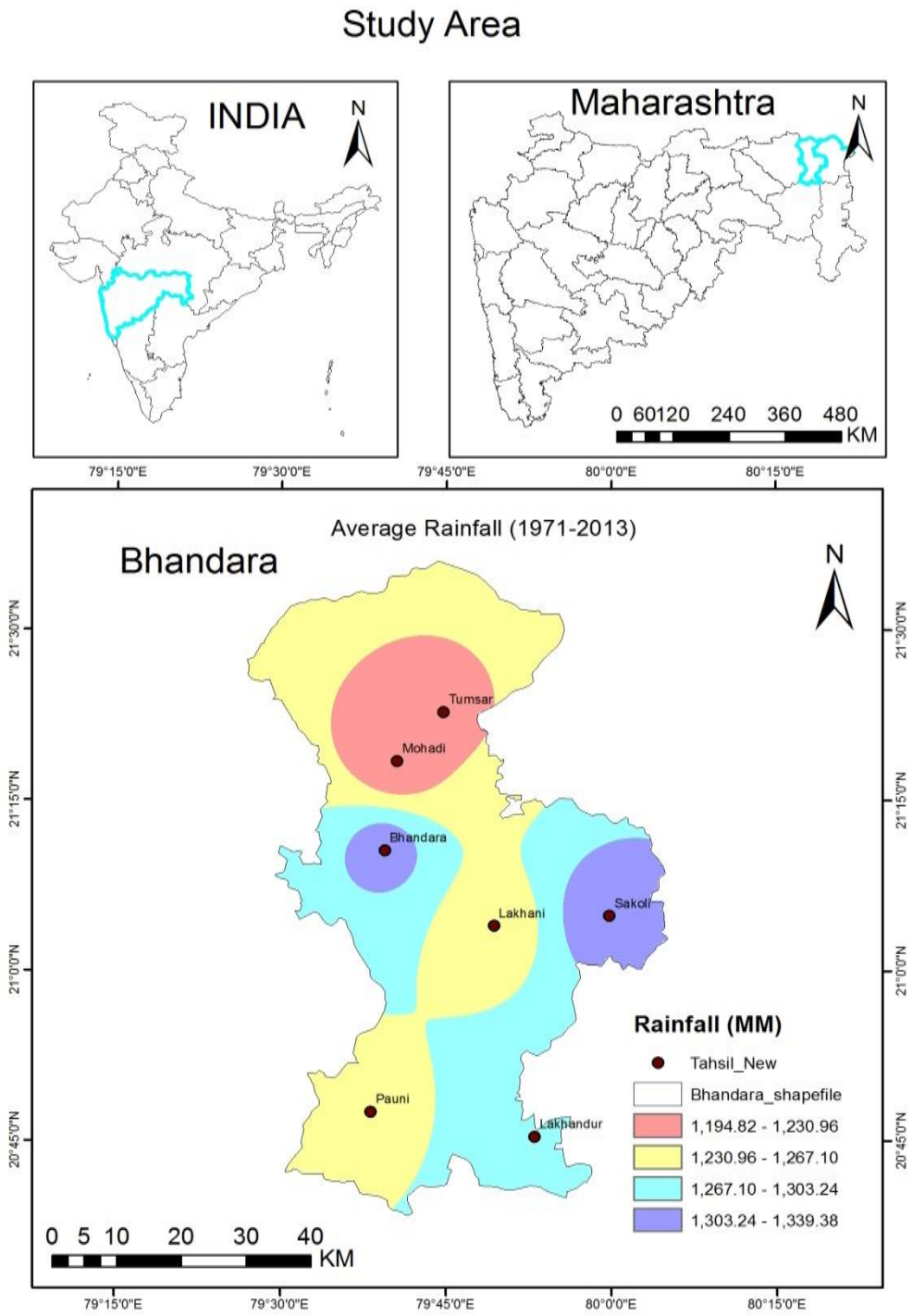

Figure 1: Study area

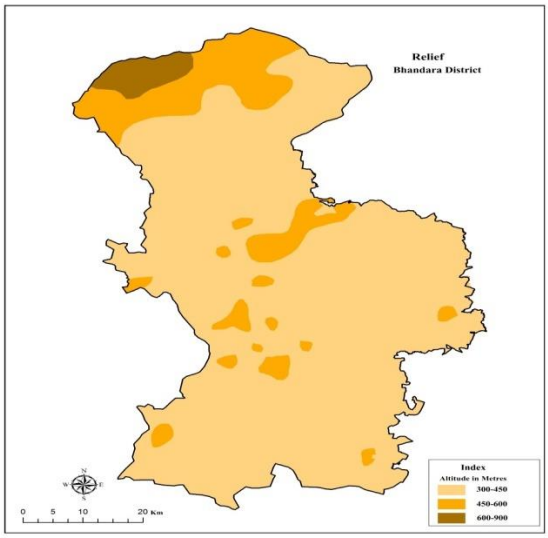

Figure 2: Relief

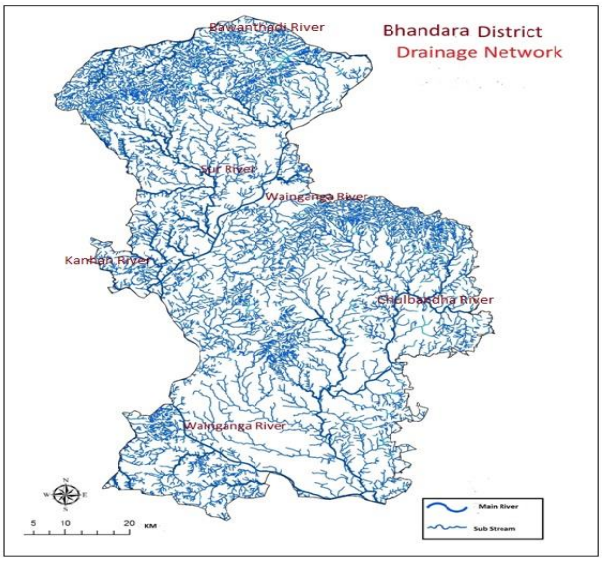

Figure 3: Drainage

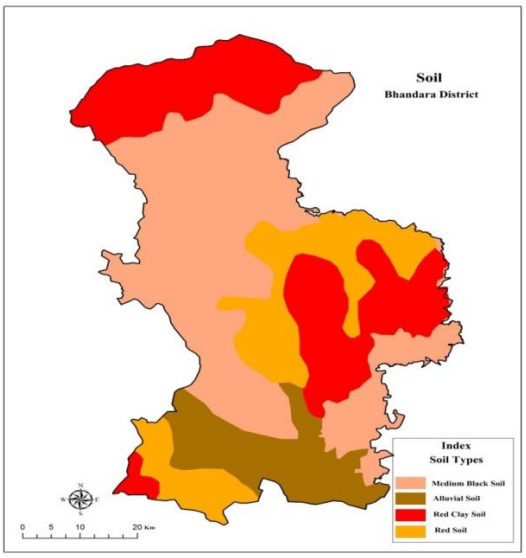

Figure 4: Soil

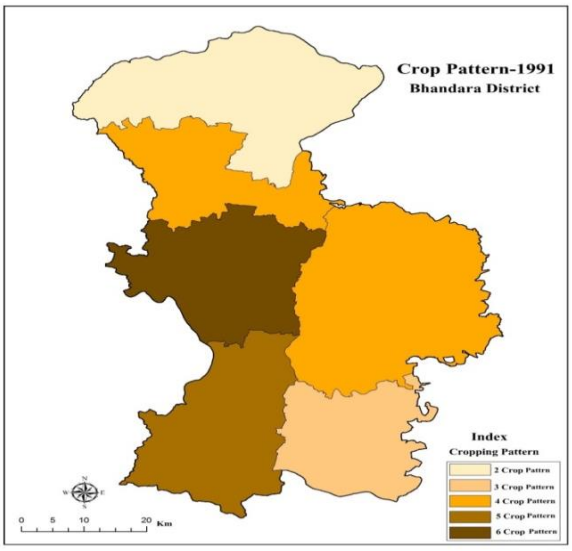

Figure 5: Crop Pattern-1991

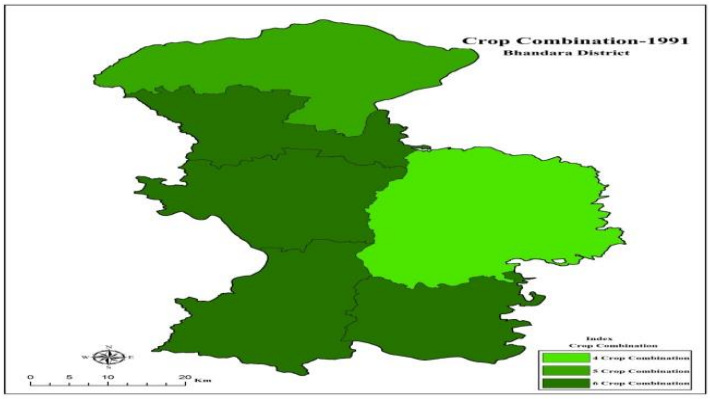

Figure 6: Crop Combination

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Cite this article as :

Dr. Ganesh Motiram Kapse, "A Geographical Study on the Effect of Climate on the Concentration of Rice Crop in Bhandara District", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Online ISSN : 2394-4099, Print ISSN : 2395-1990, Volume 9 Issue 5, pp. 126-136, September-October 2022. Available at doi : https://doi.org/10.32628/IJSRSET229519
Journal URL : https://ijsrset.com/IJSRSET229519