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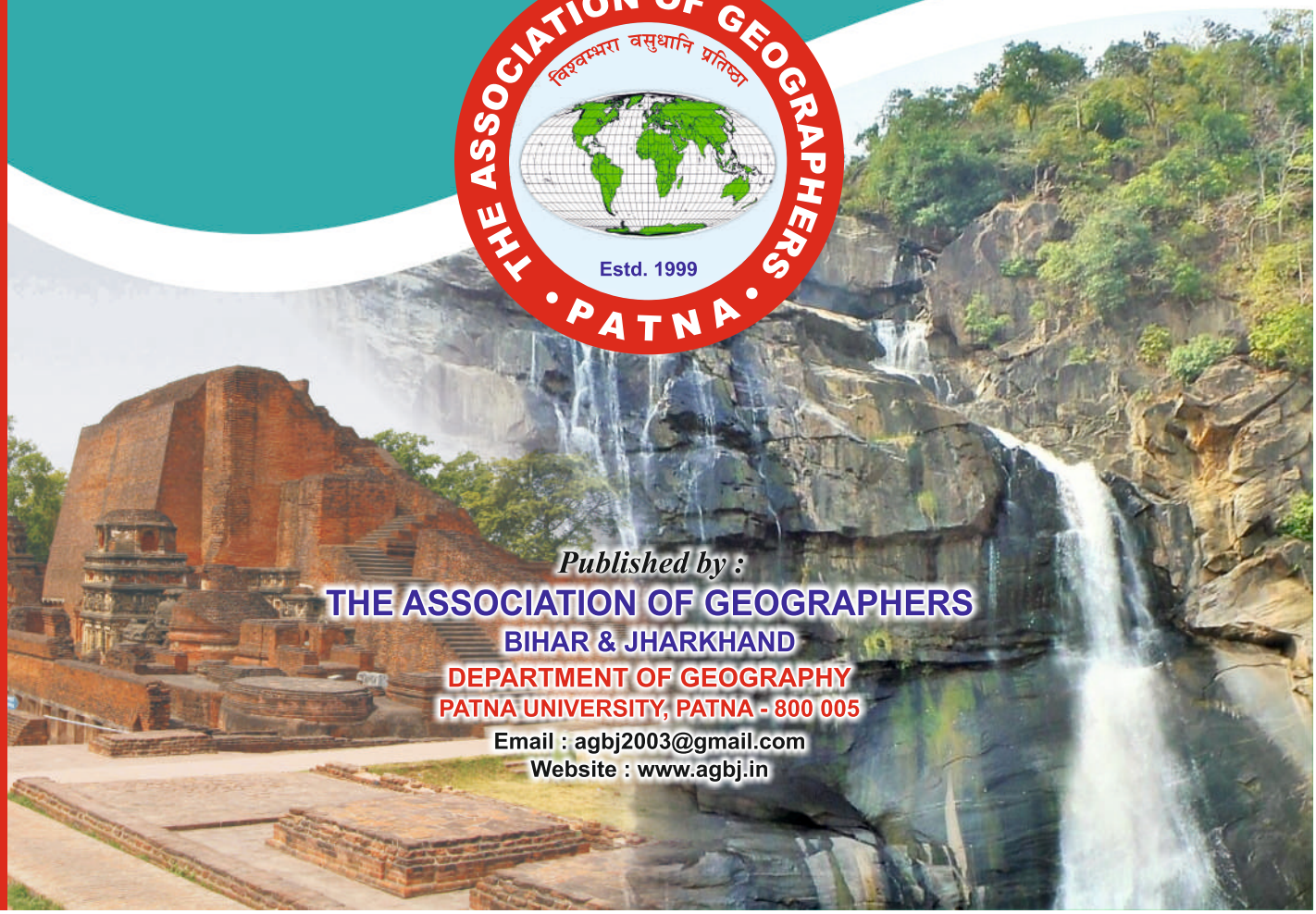

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Hindi Section

Editorial Column

Dear Fellow Readers

It gives me immense pleasure in presenting the 23rd volume of ***'Geographical Perspective'*** before you at the time of the Annual Conference of the Association of Geographers, Bihar and Jharkhand at V.K.S. University, Ara, Bihar. This annual bilingual peer reviewed journal has established its credibility across the country. The members of the Editorial Board have been very careful in selecting the research papers for publication. We take the scholarly views of external reviewers on each submitted paper. Thereafter, only those papers are selected for publication who are cleared by the reviewers and also carry original thought and views of the research paper writer.

This is the year of 'Azadi ka Amrit Mahotsav' where research and innovations are emphasized as priority area of campus activities. Altogether 16 research papers including 2 papers in Hindi script are published in this issue of the journal. Published research papers cover new frontiers of research in geography where inter-disciplinary approach, environmental issues, population related issues, displacement of persons, land use changes etc have received space in the journal. The quality and originality of published papers fulfill the research and innovation objective of the "Azadi ka Amrit Mahotsav".

I hope that the readers will appreciate our academic efforts. At the same time, constructive and positive criticism will always be welcome. If needed, due space will be given to such constructive and critical remarks in the selection of research papers in the next issue of the journal.

At the end, I wish to seize this opportunity to express my sincere thanks to the members of Advisory Board, Editorial Board and external reviewers for their warm and holistic support in the completion and publication of this volume of the journal.

Rash Bihari Pd. Singh.

(Rash Bihari Pd. Singh)
Editor-in-Chief

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MIGRATION FROM JHARKHAND AND ITS CONTEMPORARY ISSUES

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ABSTRACT

Migration is the movement of a person or a group of persons from one place to another place. It may be permanent or temporary. It may also be local, regional, national and international levels. So far as the migration of people from Jharkhand state is concerned, it is principally local, regional and national levels. Contrast to out-migration, Jharkhand itself has received large scale migration from outsides, declining local/primitive tribal population to only about 27 percent out of the total population of the state. Migration from Jharkhand is principally form rural areas. They have left the state to seek work in different parts of the country. The gravity of the migration and related issues were exposed when about 10 lakh migrant labourers returned to Jharkhand due to Covid-19 panademic between March 2020 to October 2020. Although Covid-19 effect is almost over, but the return of such labourers, particularly unskilled labourers to outsided work place are not taking place encouragingly. Hence, providing them job has become a big challenge for the state government. It is also interesting to note that females had out numbered males and job opportunities to largely unskilled female labour force was a bigger challenge than simply creating gender bias free job opportunities.

Keywords : Migration, Unemployment, Covid-19, Pandemic.

Introduction

Human migration is the movement of people from one place to another with intentions of settling, permanently or temporarily, at a new location (geographic region). The movement often occurs over long distances and from one country to another (external migration), but internal migration (within country) is also very common. Indeed, this is the dominant form of human migration globally. Migration is often associated with better human capital at both individual and household levels, and with better access to migration networks, facilitating a possible second move. Age is also important for both working and non-working migration. People may migrate as individuals, in family units or in large groups. Migration, has a special significance in population analysis. It is the most volatile component of the population growth and sensitive to economic, political and cultural factors at the national and international level.

The Constitution of India guarantees freedom of movement for all citizens. The foundational principles of free migration are enriched in clauses (d) and (e) of Article 19(1) of the Constitution, which guarantee all citizens the right to move freely throughout the territory of

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India, and reside and settle in any part of the territory of India. Article 15 prohibits discrimination on the basis of place of birth, while Article 16 guarantees equality of opportunity for all citizens in matters of public employment, and in particular prohibits the denial of access to public employment on the grounds of place of birth or residence.

Migration of labour is an important factor affecting the course of socio-economic development in India. Data from the National Sample Survey (NSS) (2007-08) reveals that about 28.3% of the workforce in India are migrants. Migrants fuel the Indian economy by carrying human capital to regions where it is needed, and enabling the acquisition of new skills and a better standard of living. Rural-urban migration has also historically played a significant, if not primary, role in the urbanization process. At the same time, the economic, social and political marginalization of these migrant workers has been an area of concern.

Data source, Methodology and Approach

The author has used both primary and secondary data. Primary data is collected by interacting with such migrants (55 respondants) who had returned back to Jharkhand during the covid-19 period. Again self-help group workers were also interacted, who had worked with migrants, to know the mindset and migrants' reaction over the immediate support given to them. Secondary data were collected principally form the census records of Jharkhand 2011. Some data were also collected from the office of National Sample Survey and State Livelihood Promotion Society (JSLPS). The basic objective of the collection of these data was to process them statistically and cartographically in such a way that the history and present status of migrants could be known holistically. The analysed data will help in creating job opportunities and promoting skillness not only among the returned migrants but also create such an environment where further migration from Jharkhand is practically discoursed.

Rural migrants belonging to tribal groups need empirical approach so far as studying their attitude, immediate need, welfare and development programmes and readings to work with non-tribal persons. This is how the Covid-19 impact may give a new insight over the causes, censequences and planning needs of migrants in new situation.

Historical perspective of migration in Jharkhand

Topographically, the state of Jharkhand is a land locked territory. It came into existence on 15th November, 2000 and presently there are 24 districts in the state. It is mostly covered by forests, known as Chhotanagpur plateau and is rich in mineral resources such as coal, mica, iron, bauxite, uranium and copper etc. Contemporary patterns of migration are not merely a result of modernization but have long been a central feature of life within the subcontinent. Migration from Jharkhand to other states is no exception. Indeed, De Haan (2002) has argued that circular out-migration from Bihar, the state from which Jharkhand seceded in November 2000, is at least a hundred years old. In the late 1800s, West Bengal, the Andaman and Nicobar Islands, Assam, Bhutan and even Burma attracted migrants from Jharkhand. These 'aboriginal', 'tribal' or 'jungli' hill people of Chotanagpur were preferred in railways and road-building projects, and specially in tea plantations, where they were considered 'more industrious and tractable'

than other workers. By 1895, at least 50 percent of workers in Assamese tea plantations came from Chotanagpur. Weiner estimates that by 1921 nearly a million tribals, one third of Chotanagpur's tribal population, has emigrated. With the saturation of tea plantation labour, many of the offsprings of Assam and Bhutan migrants went to the new brick kilns of West Bengal, Uttar Pradesh and Bihar. They joined a stream of seasonal migrants from across the Indian landscape in search of work. Although it is difficult to estimate Jharkhand's annual migration, sauttal the figure is at least several hundred thousands. Mainly the Munda, Oraon, Maheli, Badaik and Lohra, classified by the government as either Scheduled Tribe (ST) or Scheduled Caste (ST), used to migrate overwhelmingly.

Demographic Profile and Migration Status of Jharkhand

As per the census of 2011, the proportion of rural population of Jharkhand is 76% out of which 31% are in the age group of 20-39 years whereas, 16.3% are in the age group of 40-59 years. Thus, more than 47% of rural population fall in age group of working population. The estimates on internal migration suggest that 43.6% of rural males migrate from rural areas to urban areas in Jharkhand. The proportion of rural to urban migration is 12.1%. It is also noticeable that 15.6 % migration of rural males is due to employment- related reasons. The number of migrants is reported as 96,59,702 persons on 01-03-2011. This records an increase from the previous number of 74,28,159 persons for 01-03-2001. Jharkhand data is updated by decadal averaging 85,43,930 person from Mar, 2001 to 03-01-2011, with 2 observations. The data reached an all-time high of 96,59,702 persons in 01-03-2011 and a record low of 74,28,159 persons on 01-03-2001 (See Fig. 1).

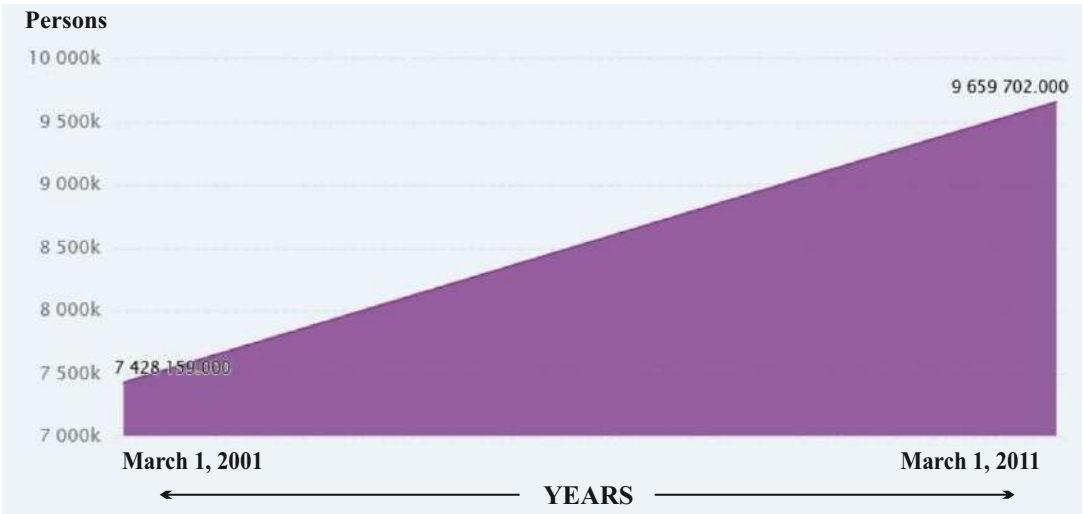

Figure 1 : Number of Migrants in Jharkhand from 2001 to 2011.

Figure 1 gives an impression about the nature of internal migration and migration by regions. These two tendencies of migration have also affected rural-urban composition and age-group composition of rural and urban populations.

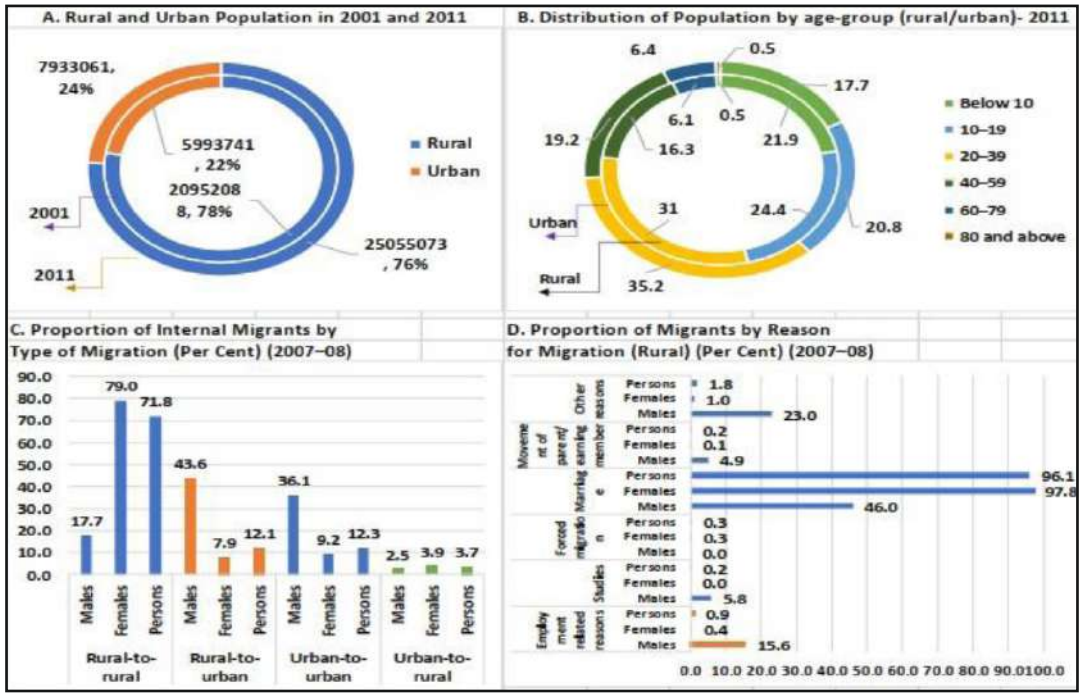

Figure 2 : A demographic profile of rural economy of Jharkhand

Source : Census of India, Jharkhand, 2011

Contemporary Causes of Migration

Recent studies in Jharkhand, with the support of International Labour Organization, found that changing agricultural practices have also aggravated distress migration. People are forced to migrate as there is only single cropping in agriculture and there is no work for about half the year. The size of landholdings per household too has decreased over generations, and in some districts like Palamau, it is less than one hectare. Upland cultivation of nitrogen fixing pulses like kurthi, gundli, sargujja, madua, which required less water and no fertilizers, is also vanishing.

The study also found that tribal society is female dominant and many women migrate alone with brokers without any safeguards or information about the work and wages. Even when they go with their family, they are low paid, as compared to men. For instance, in the brick kilns in Mandar block, Ranchi district, women are paid Rs 85 per day and men Rs 200 per day for the same work. Very few tribal migrants knows about minimum wages, they are entitled to get. They never negotiate with the employer. The women mostly work as domestic workers in nearby cities, but do not like to reveal this in their village fearing stigmatization, as trafficking of girls and women for domestic work and then exploitation is a common phenomenon.

Due to increasing urbanization, forest cover is vanishing, affecting the lives of tribal communities. The Santhal, Munda, Ho, Oraon, Kharia and other tribal communities living here have for long been dependent on forest and its produces for their livelihood. Urbanization

and the resultant deforestation have robbed them of their self-sustenance sources such as firewood and food sources. Landless labourers are the worst affected who have no livelihood options in non-agricultural periods and are forced to migrate. Sometimes the families migrate together and the children accompany them, spending their time at worksites where they are neglected, and are often subjected to exploitation. They usually work in brick kilns or as agricultural labourers in Bihar.

Development policies have also played a part in the dietary transition. The 1990s saw major reforms in the public distribution system and these communities gained access to rice and wheat. This gradually altered their food habits. The new generation has got used to eating rice, while consumption of traditional foods has come down. Further, the government distributes paddy and wheat seeds, which are water intensive, and this has changed traditional cultivation practices. But rains have become erratic; 2015 was a drought year and this has increased widespread migration. Traditional water harvesting structures like small check dams, which used to tap and store rain, are gradually disappearing or are built without proper survey of the area and requirement. Government initiatives to provide irrigation facilities are being carried out in a non-integrated manner. For instance, there are cases where wells have been built in one village under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), but the pumps to draw the water for irrigation are installed in another village.

Promotion of utilization of Jharkhand's natural resources like coal and mica has not taken off yet due to resistance of tribal community to part with their land for industrial establishment. Maoist insurgency infestation is also a huge deterrent.

There is paucity of skilled workers and technical training institutions. Rearing cattle is an important source of livelihood, but there are no government schemes to support poultry and goat rearing. For instance, the National Rural Livelihood Mission is providing broiler grade hens to women Self Help Groups (SHGs), but training on immunization and feeding recommendations are not provided. The non-integrated approach of government programmes seems to be the key cause for the negligible impact of otherwise well-intended schemes. It is evident that planning is done without a participatory approach and without an understanding of community needs and existing community resources. For instance, there is now a provision for providing eggs in the mid-day scheme in government schools across the state, but there is a lack of vision in terms of linking the purchase of eggs with poultry reared by local SHGs. Multi-cropping needs to be promoted so that farming can be sustained throughout the year. Currently, less than 10% of total cropped area in the state is irrigated. This can be increased to 25-30 % through various methods like integrating digging of wells with pump set distribution.

Migration cannot be curbed totally, as seeking a better life is a right of all, but there is an urgent need to make migration safe. The state government has made provisions for registration at the panchayat office, under the Interstate Migrant Workmen Act, 1979, which provides insurance coverage of Rs 150,000 in the event of an accident or death at the workplace. However, the potential migrants are largely unaware of this provision. Increasing utilization of abundant natural resources through the promotion of industries can be a key strategy to curb distress migration.

Return of migrants during Covid-19

About 10 lakh migrant labourers have returned to Jharkhand between March, 2020 and October, 2020 and the state government took steps to resolve their salary-related problems and other issues. Giridih district saw the return of the highest number of migrants at 1.58 lakh. With large scale inflow of migrant workers in wake of lockdown or restriction imposed by many states in the country, Jharkhand is in for double challenge-providing livelihood to the returnees and protecting villages from Covid spread. In a bid to provide livelihood to the migrant workers according to their choice, state rural development department has started a survey through Jharkhand State Livelihood Promotion Society (JSLPS) like the skill mapping drive. Jharkhand Government has launched the Mission Saksham app for skill mapping of migrant workers. They have been placed in 49 categories under 14 sectors, with most workers engaged in construction. District collectors in district such as Bokaro have created online databases of migrant workers with their contact details, which have been shared with business establishments and industries in the area, in hopes of these establishments hiring the workers.

However, skill mapping will not be enough for Jharkhand's 5.5 lakh migrant worker returnees, for two reasons:

1. Unemployment rate in the state is already high for its resident worker: Jharkhand's unemployment rate was 7.5% in 2017-18 against the national average of 6%.
2. The pandemic has created a demand for new set of skills, such as online education platforms, virtual consultations, home delivery of goods and services, etc. Thus, there is a need to ramp up efforts for skill development in line with the current demand, and skill-mapping databases can serve as a promising starting point to gauge gaps in skillsets.

The State rural work department is also working to engage people in MGNREGA works. State urban development department is expecting large number of people would also get jobs under Mukhyamantri Shramik (Shahri Rozgar Manjuri for Kamgar) Yojana (MSY), a 100-day job guarantee scheme for urban unskilled workers.

Migrants have desire to stay back in the state and help make it a manufacturing hub, replicating the success of various hubs across the country where they had been working for many years. So Govt. is giving a lot of employment to the migrants who have returned in sectors like textiles, footwear, food processing and electronic manufacturing as these are sectors where we would like our labour and our skilled manpower who have come back from the western and southern region to stay and contribute. Migrants were initially given job cards to help them find employment under NREGA while a separate monitoring cell was set up to find out how many of the returned migrants had been given jobs in one day.

Most of the migrants who have returned to the state are unskilled. But there are many among migrants who have returned from cities like Mumbai and Surat who are skilled having worked in different trades like hotel business, factories, etc. So a skill mapping was done to find out the trade they had been working in before integrating them into the skill development mission. The selected people are being provided adequate training in tie-up with banks. The unskilled migrants who have opted not to work in other states are also being offered a chance to get

trained in various vocations. Skilled workers who do not want to migrate again will be given priority in employment particularly in the new projects where Jharkhand hopes to see new investment inflow over the next three to five years as per Govt.

The state government is however continuing to work on a three-pronged strategy-focus on rural employment, skill development mission and creating employment, skill development mission and creating employment opportunities in the new manufacturing units coming up even as its grapples with the sensitive issue of making wages more attractive to prevent talent outflow. A major challenge in the implementation of the scheme is that while jobs are available and more will be created soon, the wage rate in Jharkhand is low compared to those in many cities like Mumbai, Delhi, Surat etc. The difference is over Rs. 300 per day in many.

Conclusion

It has been observed that the newly created state of Jharkhand is very prone to all types of problems related to migration. So far as the inter-district migration is concerned, all the districts are more or less affected by migration and interestingly females out number the males. So far as the number of migrants is concerned the districts like Dhanbad and East Singhbhum are able to attract more people from other districts and thus are gaining population. On the contrary, industrially backward districts like Gumla, Dumka, and Palamu are the major losers. Regarding male migration only three districts viz. Dhanbad, Ranchi and West Singhbhum are able to catch hold of their male population from migrating to other districts. In case of female migration Ranchi, Dhanbad and West Singhbhum are the major gainers. It has been found that 86 percent of the total inter district migrants are from rural origins. Interestingly West Singhbhum, East Singbhum and Ranchi are the districts that attract people from urban centres of other districts. Census data suggest that inter-state migration has been on the rise and migration has also been more feminised, primarily due to marriage- migration.

Studies based on alternative sources such as the National Sample Survey show that temporary and seasonal migration for employment purposes is seven times larger than permanent and semi- permanent migration. Temporary and seasonal migration is a poverty-alleviation strategy used mainly by the poor and lower socioeconomic segments of the Indian population, in contrast to permanent and semi- permanent migrants who are drawn from more affluent segments of the community. As there is a large number of migrants who maintain links with their birthplaces and who also return and circulate to and from these places of origin, the contribution of migration to the urbanisation and redistribution of the population remains much lower than the historical experience of western countries and of countries in Asia at similar levels of development. The impact of migration on the development of India has been positive, but there is no effective policy support to migration, in general and seasonal migration in particular.

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A GEOGRAPHICAL ANALYSIS OF CROP DIVERSIFICATION IN SAHARSA DISTRICT OF BIHAR

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ABSTRACT

The concept of crop diversification is opposite to crop specialization or concentration. It means competition among various crops grown in a particular area. It also means raising a variety of crops involving its intensity amongst field crops in an arable land. It is an indicator of multiplication of crops which obviously shows the awareness and agricultural development. The magnitude of crop diversification is largely based on the physiographic, climatic, socio-economic conditions and technological development in a region. Crops are diversified in the field due to erratic nature of rainfall and insufficient irrigation. Farmers grow many crops in order to sustain the agriculture. Crop diversification is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops e.g. growing of rice in high water table areas replacing oilseeds, pulses and cotton with the advent of modern agricultural technology especially after green revolution because rice gives maximum economic returns. Government policies, market, infrastructure, price, attitudes of farmers and transport facilities are also responsible for crop diversification. Several techniques have been developed by different geographers for measuring crop diversification. In this study however, the methods proposed by Bhatia and Jasbir Singh have been applied for the delineation of crop diversification regions in Saharsa district. It is based on secondary sources of data for the year 2017-18 obtained from the department of agriculture and statistics.

Keywords: Crop diversification index, Cropping pattern, Flood plains.

Introduction

Crop diversification is an opposite concept of crop specialization. It means the farmers try to grow numerous crops in their land in an agricultural year. On the other hand, crop diversification means competition among various crops grown in a particular area. It also means raising a variety of crops involving its intensity amongst field crops in an arable land. It is an indicator of multiplication of crops which obviously indicates the status of agriculture. The magnitude of crop diversification is largely based on the physiographic, climatic, socio-economic conditions and technological development in a region. Crops are diversified in the field due to erratic nature of rainfall and insufficient irrigation. Farmers grow many crops in order to sustain the agriculture. Crop diversification is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops e.g. growing of rice in high water table areas replacing oilseeds, pulses and cotton with the advent of modern agricultural technology especially during the period of green revolution because rice give

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maximum economic returns. Government policies, market, infrastructure, price, attitudes of farmers and transport facilities etc. are also responsible for crop diversification. Crop diversification also takes place in the areas having distinct soil problems. Crop diversification also gives more employment opportunities for small farmers as well as for agricultural labourers throughout the year. It is however an outcome of the interactive effect of many factors. In general, higher the development of agricultural technology, lesser the degree of crop diversification while lower the levels of agricultural technology higher the degree of crop diversification. Socio-economic conditions are also important factors affecting crop diversification and such as the rich farmers prepare to specialise crop in our agricultural enterprise while the poor and marginal farmers are generally more interested in the crop diversification. Competition in market has also its influence on the crop diversification in a region. It depends upon the interests of the farmers and the facilities available to them on the basis of which they take decision of going on for multi crops or mono crop.

Siddiqui, Akhtar and Ahmad (2014) have examined the variations in cropping pattern using Bhatia's method of crop concentration. The physical and socio-economic aspects largely determine the agricultural pattern in which terrain, temperature, moisture and pedological conditions are the predominant factors. Khan and Khan (2015) measured the carrying capacity of agricultural land in relation to population pressure and tried to find out the present and future surplus or deficit of population food balance. Manjhi (2016) has explained the contribution of agricultural diversification to the regional development of Arwal district in Bihar. Rasmhi and Kumar (2019) highlighted the problems of agriculture in the flood prone areas of Bihar with special reference to Kosi flood plain. They also described the potentials of agricultural development in the flood problematic area of north Bihar.

Thus, the study of spatial patterns of crop diversification is of vital importance and indispensable to know the preference of crops by the farmer. Recently, agricultural diversification is almost a normal feature of stable agriculture and progressive farm management in most of the agricultural parts of a region. The main advantage of crop diversification includes a correlation between the relative areal strength of the crops grown in a region. Several techniques have been adopted by the geographers for measuring the crop diversification.

In a region, farmer grows many crops. In some plots, he/she may grow wheat and in some others, barley, gram, potatoes, and pulses; in summer and rainy season he/she could grow maize, sugarcane, millets and pulses. Only in areas where adequate rainfall are available, farmers practice monoculture while in other areas, a variety of crops are grown. In fact, those farmers who are of average means generally practice crop diversification.

Objectives of the Study

The main objectives of the present study include;

(i) To examine the pattern of crop diversification in the study area.

(ii) To analyse the impact of crop diversification on the agricultural status of the concerned area.

(iii) To suggest some measures for improving the status of agriculture in the area.

Study Area

Saharsa is one of the important districts of Bihar and ranks 31st with respect to its geographical area. It is located between 25°35' to 26°28' North latitudes and 86°18' to 86°51' East longitudes occupying an area of 1,687 km^2 (Fig. 1). It has a flat alluvial plain and forms a part of the Kosi river basin. This makes the land very fertile. However, frequent changes in the courses of the river cause soil erosion. Flooding is a major reason for the poor connectivity of the area. It is comprised of 10 Community Development Blocks. A large population of Saharsa district (about 84 % of the total population) depends on agriculture as the area has vast tract of agricultural land (about 69 per cent). But, the agricultural productivity of the area is much lower than the other agricultural areas of Bihar. Poverty, illiteracy, lack of agricultural facilities are some of the basic reasons which should be investigated further to find the drawback so that measures could be taken up to improve the status of agriculture in the area.

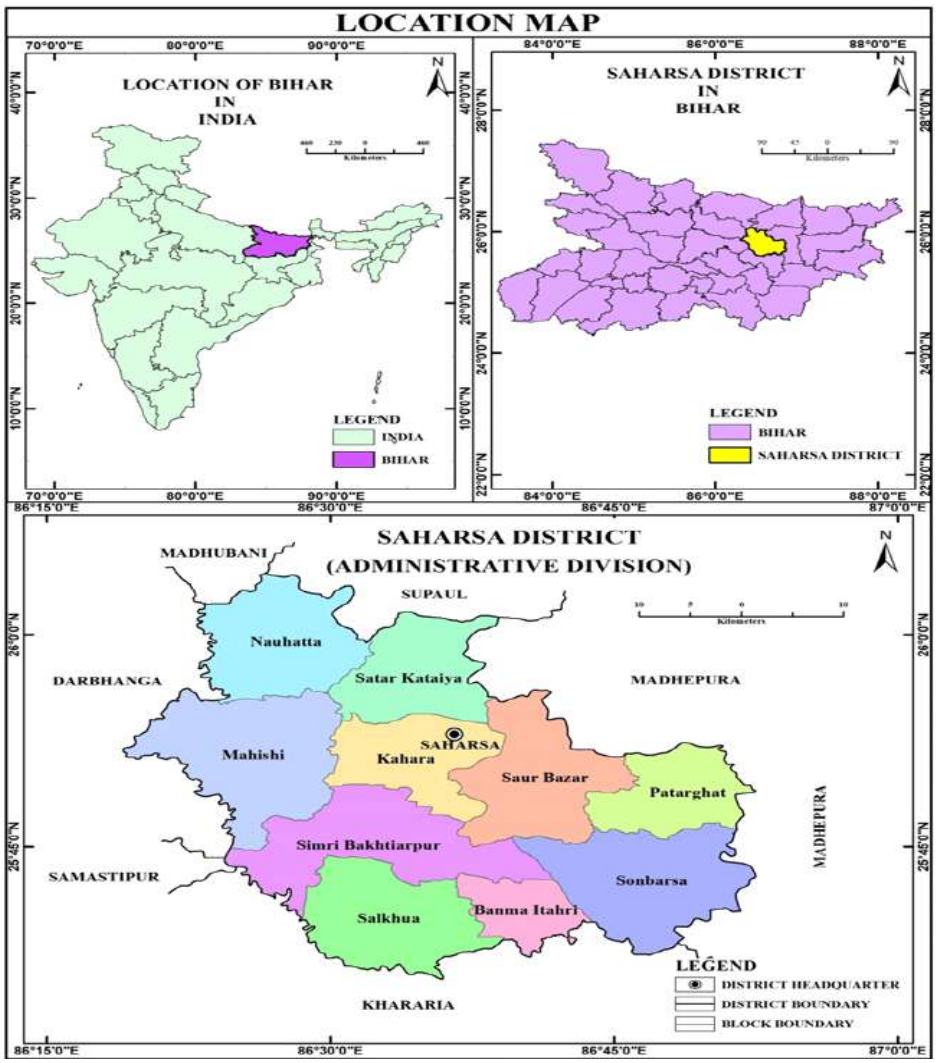

Figure - 1 : Study Area

Sources of Data and Methodology

The present work is mainly based on secondary sources of data which have been collected from various offices like Department of Statistics, Saharsa district, 2018, Economic Survey 2016, Directorate of Statistics and Evaluation, Government of Bihar and annual reports, Government of Bihar. Maps published from District Planning Map of Saharasa, NATMO, Salt Lake City, Kolkata, Reprint 2019, have been used as base map.

To analyse the status of crop diversification in the study area, crop diversification techniques of Bhatia and Jasbir Singh have been applied. The pattern of crop diversification has been determined by applying statistical methods of correlation and standard deviation. The results obtained have been represented through suitable maps and diagrams. Choropleth maps have been drawn to present the spatial pattern of diversification of agriculture. Arc GIS features info techniques have been used to prepare chorochromatic maps and other diagrams.

Results and Discussion

For the agricultural regionalization process, various methods and techniques have been used to represent the diversification of crops and cropping pattern. Bhatia (1965) has evolved a simple formula by taking into account the total cropped area to make an objective measurement of crop diversification. He has taken the ratio between the areas under all those crops which cover up to 10% of the cropped area. Jasbir Singh (1984) has modified the technique of Bhatia. In this modified technique, the crop which occupy individually less than 5% are not considered for calculating the index of diversification.

The formula for measuring crop diversification is,

$$\text{Crop Diversification} = \frac{\textit{Percent of sown area under N corps}}{\textit{number of N crops}}$$

Index of crop diversification (CDI) is inversely proportional to the degree of diversification i.e. higher is the value of index, lower will be the degree of diversification and vice-versa.

Bhatia's Method of Crop Diversification

For the measurement of crop diversification, Bhatia (1965) adopted a formula based on the gross cropped area as;

$$\textbf{Crop Diversification Index} = \frac{\textit{Percent of Net Sown Area under X corps}}{\textit{number of X crops}}$$

Where, **X** crops are those crops that individually occupy 10 per cent or more of the gross cropped area in a region.

On the basis of this formula, Crop Diversification Index (CDI) for each block has been calculated (Table 1) and plotted (Fig. 2). The table reveals the highest value of diversification index in Kahara block and the lowest in Sonbarsa block as 33.1 and 24.8 respectively.

Table –1: Crop Diversification Index in Saharsa District, 2017-18
(Bhatia's Method)

S.N.	Blocks	Percentage of Net sown area			∑ all Crops	CDI
		Paddy	Wheat	Moong		
1	Nauhatta	51.78	17.21	9.88	78.87	26.3
2	Satar Kataiya	51.15	41.40	5.05	97.60	32.5
3	Mahishi	62.55	17.24	8.64	88.43	29.5
4	Kahara	57.97	27.23	13.98	99.18	33.1
5	Saur Bazar	53.85	33.63	2.03	89.51	29.8
6	Patarghat	20.39	29.95	29.91	80.25	26.7
7	Sonbarsa	49.31	17.89	7.11	74.31	24.8
8	Simri Bakhtiarpur	67.64	18.43	5.42	91.49	30.5
9	Salkhua	32.30	37.18	10.29	79.76	26.6
10	Banma Itahri	46.66	19.65	15.47	81.79	27.3
	District's Total	52.95	26.21	10.04	89.20	29.7

Sources: Calculated on the basis of Bhatia's Method.

Table - 2: Crop Diversification Regions in Saharsa District, 2017-18

S.N.	Degree of Crop Diversification	Index	No. of Blocks	C. D. Blocks
1	High	Below 27.39	5	Nauhatta, Patarghat, Sonbarsa, Salkhua, Banma Itahri,
2	Medium	27.39 – 30.04	2	Mahishi, Saur Bazar
3	Low	Above 30.04	3	Satar Kataiya, Kahara, Simri Bakhtiarpur

Sources: Compiled on the basis of crop diversification index obtained from Table -1.

Based on the crop diversification index calculated for each block, three distinct crop diversified regions have been identified. Three blocks of Satar Kataiya, Kahara, and Simri Bakhtiarpur have the highest degree of crop diversification index and hence they are placed under low crop diversification region. Two blocks of Mahishi and Saur Bazar have moderate degree of crop diversification index and therefore they are placed under moderate crop diversification region. Rest of the five blocks of Nauhatta, Patarghat, Sonbarsa, Salkhua and Banma Itahri having lowest degree of crop diversification index and hence they are placed under high crop diversification region.

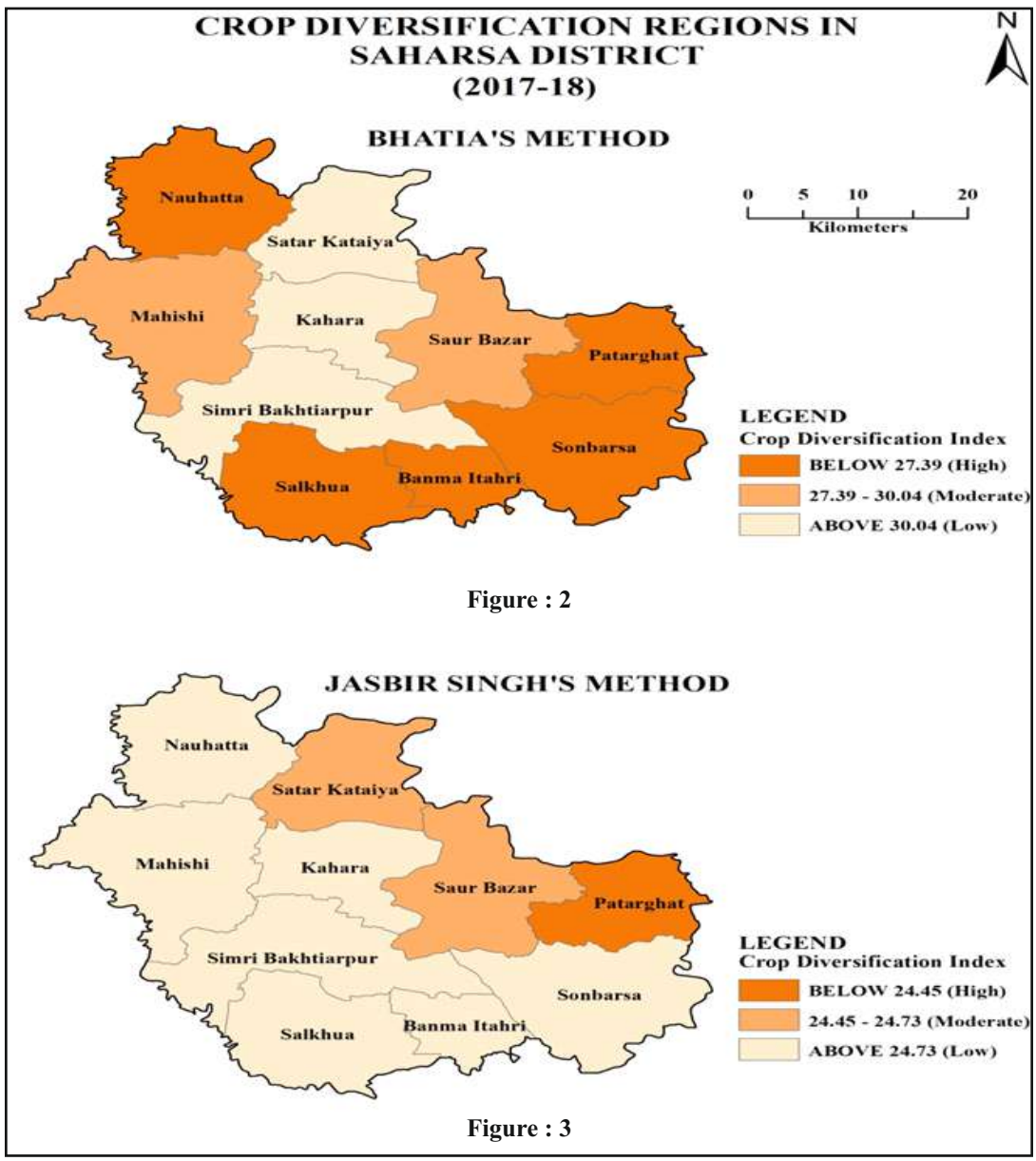

Figure : 2

Figure : 3

Jasbir Singh's Method of Crop Diversification

For measuring crop diversification, Jasbir Singh (1965) developed a formula based on the gross cropped area which is expressed as;

$$\textbf{Crop Diversification Index} = \frac{\textit{Percent of Net Sown Area under X corps}}{\textit{number of X crops}}$$

Where, **X** crops are those crops that individually occupy 5 per cent or more of the gross cropped area in a region or area of study.

On the basis of this formula Crop Diversification Index (CDI) for the each block has been calculated (Table 3) and plotted in Fig. 3. The table reveals the highest value of crop diversification index in Salkhua block and the lowest in Patarghat block as 25.00 and 24.17 respectively.

Table – 3: Crop Diversification Index in Saharsa District, 2017-18

(Jasbir Singh's Method)

S.N.	Blocks	Percentage of Net sown area				∑ all Crops	CDI
		Paddy	Wheat	Moong	Maize		
1	Nauhatta	51.78	17.21	9.88	21.06	99.93	24.98
2	Satar Kataiya	51.15	41.40	5.05	0.69	98.29	24.57
3	Mahishi	62.55	17.24	8.64	10.86	99.29	24.82
4	Kahara	57.97	27.23	13.98	0.14	99.33	24.83
5	Saur Bazar	53.85	33.63	2.03	8.89	98.40	24.60
6	Patarghat	20.39	29.95	29.91	16.44	96.69	24.17
7	Sonbarsa	49.31	17.89	7.11	25.23	99.54	24.88
8	Simri Bakhtiarpur	67.64	18.43	5.42	7.63	99.12	24.78
9	Salkhua	32.30	37.18	10.29	20.23	99.99	25.00
10	Banma Itahri	46.66	19.65	15.47	17.15	98.94	24.74
	District's Total	52.95	26.21	10.04	9.92	99.12	24.78

Sources: Calculated on the basis of Jasbir Singh's Method.

Table - 4: Crop Diversification Regions in Saharsa District, 2017-18

S.N.	Degree of Crop Diversification	Index	No. of Blocks	C. D. Blocks
1	High	Below 24.45	1	Patarghat,
2	Medium	24.45 – 24.73	2	Satar Kataiya, Saur Bazar,
3	Low	Above 24.73	7	Nauhatta , Mahishi, Kahara, Sonbarsa, Simri Bakhtiyarpur, Salkhua, Banma Itahri

Sources: Compiled on the basis of crop diversification index obtained from Table -3.

Based on the crop diversification index calculated for each block, distinct crop diversified regions have been identified. Seven blocks of Nauhatta, Mahishi, kahara, Sonbarsa, Simri Bakhtiyarpur, Banma Itahri and Salkhua have the highest degree of crop diversification index and hence they are placed under low crop diversification category. Two blocks of Satar Kataiya and Saur Bazar, have moderate degree of crop diversification and hence placed under moderate crop diversification category. The rest one block of Patarghat has the lowest degree of crop diversification index and hence it is placed under high crop diversification region.

Impact on Agriculture

The analysis of the nature and extent of crop diversification in the present study shows broadly a low level of diversification indices in most of the community development blocks of the district of Saharsa. The prerequisite infrastructural facilities like cheap sources of irrigation due to erratic and scanty rainfall and extension of technological know- how for quality seeds and fertilizers may act as catalyst in the diversification of agriculture towards high valued crops. Crop diversification is one of the means to minimize the risk due to uncertainty of rainfall and floods and maximize the use of land and measured by proportion of area under various crops. It also provides better economic viability with value added products and improve the economic conditions of the farmers. The diversification of crops is also adopted for avoiding or minimizing the adverse effect of current system of crop specialization and monoculture for better use of resources, recycling of nutrients and regaining soil fertility.

Conclusion and Suggestions

On the basis of the present analysis it may be concluded that the crop diversification is found in almost all the blocks of the study area and hence it has a diversified cropping pattern. In subsistence economy farmers use to cultivate a large number of crops depending on their needs for consumption. This is the manifestation of the fact that the farmers are aware of the benefits of it and reduces the fear of loss from floods or other natural hazards. The other reason may be the suitability of soil for different crops from one farm to other farm. The cropping pattern of

Saharsa district is cereal oriented towards rice, wheat, maize and moong etc. Based on both the diversification methods applied and analysed in the present study, it is clear that very high level of crop diversification occurs in Patarghat, Nauhatta, Sonbarsa, Salkhua and Banma Itahri blocks. Comparatively low level of crop diversification is found in Satar Kataiya, Kahara and Simri Bakhtiyarpur blocks.

Some major facts related to the nature of cultivation of the area have been observed by the researchers and are being presented here to be included as suggestions for the positive change in the cropping pattern and condition of agriculture. They are;

1. The contribution of crop diversification in agriculture is significant. The study reveals that crop diversification is the ultimate solution to many problems like, floods and uncertainty of rainfall.
2. Farmers in this area should be guided and trained for the advanced method of irrigation such as drip, sprinklers etc. which may decrease the threat of uncertainty of rainfall.
3. Farmers should be made to refuse their traditional culture by suggesting adopting various zaid crops like vegetables and seasonal fruits suitable for the sandy loam soil of the diara areas.
4. Scientific crop diversification with proportional and justified shares of different crops would make a satisfactory solution for these blocks.
5. Along with the government initiative, local people must come forward to change the cereal dominant agricultural pattern and making them more remunerative.

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UNDERSTANDING WEB MAP USING MATLAB SOFTWARE

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ABSTRACT

In this paper the structure and applications of web map is presented using MATLAB software. Web maps are now being used widely to display geographical data everywhere on digital gadgets. Now gone are the days of static traditional maps on paper as the Web maps are dynamic, interactive, multilayered, updatable on demand, self-telling, impressive in display, and are accessible ubiquitously through internet and browsers. It is of very much use in web cartography and web GIS for the analysis of purpose specific or general geographical data. Thus, familiarity with the concept, structure, use and understanding of web-based display of geo-data in a digital framework, crystal clear understanding of its technical stems and forming familiarity with software tools are vital strengths for anybody in modern digital era to use and exploit analytical capacity of web maps and GIS. In the present paper such technical aspects and applications of web maps are presented using tools available in a very popular scientific software MATLAB, a commercial product of MathWorks Pvt. Ltd., so that students can get familiarity with different components, use and display of web maps.

Keywords: MATLAB, Webmap, Software, Geographical Information System (GIS), Synographic Mapping, MapQuest

Introduction

The advent of computer and boundless span in its applications in almost every sphere of life in the last couple of decades has brought miraculous changes. Wherever the digital ways of computation and ICT in general have crossed a pre-existing subject of knowledge, at least a new overshoot of subject has sprung out for further study, innovation and research. The subject of geography and its whole canvas is also not an exception. Subjects of Geoinformatics, Geographical Information System (GIS), Digital Earth, Web Cartography etc. are some examples of such overshoots having blend of geography and computation science. For geographers maps are very important tool since antiquity as they provide a visual representation of the spatial relationships between various features of the earth's surface. Maps help geographers to understand and analyze the distribution of natural and human activities, such as landforms, climate, population, and economic activities etc that can be easily analyzed, understood and communicated for better planning and developments [4], [5]. In the modern digital era, digital maps have almost replaced static traditional maps on paper. Digital maps are

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created, stored, and displayed using computer technology. They have become increasingly popular in geography due to their convenience, flexibility, and interactivity. Digital maps offer several advantages over traditional paper maps, including the ability to zoom in and out, switch between different map layers, and access to real-time data through internet [6],[7],[8]. Digital maps are interactive and allow users to manipulate the map data in real-time which ensures that users can change scale of map, rotate the map, and switch between different map layers to view different data sets. The displayed data set can be updated in real-time to reflect changes in the environment or other geographic phenomena. It can be customized and focused as per need. For example, a city planner might create a digital map that shows the locations of public transportation routes, schools and colleges to help planning of the related place. Digital maps can be accessed from anywhere with an internet connection, making them a convenient tool for researchers, planners, and others who need to access geographic data in solo or shared manner for collaboration by multiple users in different locations which can be highly useful for collaborative research projects or community planning initiatives for the inclusive growth.

The history of digital maps in geography can be traced back to the mid-20th century when computers began to be used for scientific research. In the early days, digital maps were limited by the technology of the time, which made them difficult to create and access. The first digital map was created using punch cards, which was used to store and process data. These early digital maps were mostly used by government agencies and the military for national security and defense purposes. In the 1960s and 1970s, advances in computer technology led to the development of more sophisticated digital mapping tools. In 1963, the first computer-assisted mapping system, called Synagraphic Mapping System (SYMAP), was developed by Howard Fisher at Harvard University. This system used digital data to create maps of the earth's surface, including topography and vegetation [9]. In the 1980s and 1990s, digital maps became more widely available to the public as personal computers and the internet became more accessible. Companies like Google and MapQuest began to offer digital mapping services to the public, which allowed users to access and view maps from their own computers [10]. As the advances in technologies such as mechanical, optical, photo-production etc. have changed shape of the cartography and display of maps on traditional paper, the digital mapping technology has become an essential tool in geography and has changed face and fate of geo-visualization and geo-spatial data analysis in the modern time. It is being used for a variety of applications, including urban planning, environmental management, and disaster response. Advances in its sister technology, such as satellite imagery and remote sensing, have made it possible to create highly detailed and accurate digital maps of the earth's surface which in turn have revolutionized our understanding of the world.

Objectives and Approaches

The recent developments in the digital technologies have brought revolution in geographical information processing by integrating approaches in cartography, geospatial data analysis, geo-visualization, expert systems etc. This is like a magical box that produces excellent data analysis results and astonishing images. Such digital process is always influenced by domain experts, a solid human mind with geographical knowledge. It will not be out of place to

mention here argument of Kessler & Slocum that geography as a core discipline of mapping should embrace map design as a vital component of geographic education, and that good practice of mapping needs to be actively promoted and should be easy to perform. Digital technology can be one part of that process that reduces the barriers to create better maps with new and easier to use tools that do not require the advanced skills that are needed to perform more complex geospatial analysis[11][12]. However, advancing digital technologies have been able to produce platforms for data analysis and map making which can enable users with limited knowledge of geography and geographers with non-familiarity with such digital technologies are decidedly going to lose many important things. Nowadays digital mapping technology has made online maps or web maps a reality of online world. Such web maps, a product of digital cartography, have open new avenue for GIS research, geo-visualization and data presentation as they are interactive, self-telling and accessible through a web browser, and can be viewed on desktop computers, laptops, smartphones, and tablets or any other compatible and computable digital display devices. Web maps are typically built using a combination of programming languages and geographic information system (GIS) technology or with tools outside the GIS environment. Web maps allow users to interact with the map in real-time, zooming in and out, panning, and clicking on features to access additional information. They can also be customized to display different types of data, such as points of interest, population density, land use and land cover patterns, rain profile, temperature, wind speed, weather patterns etc. Web maps are shared or provided over internet through Web Map Service (WMS) protocol designed for serving geo-referenced map images.

Software available for web map design and display along with MATLAB are also dealt in [13][14]. Some simple examples for web map display and computations using MATLAB have also been presented with aim to create interests in students in this field. The last section contains some references through which interested readers may go to glean and gain the better depth of the subject.

Software for Web Maps

A web map is a digital map that is accessible via a web browser. It is one of the most important outcomes of mingle of earth science and computers. It can be interactive and may include layers of geographic information such as roads, buildings, and satellite imagery. Web maps can be interactive, allowing users to zoom in and out, pan, and click on features for more information. They can also include various types of data such as points, lines, and polygons, as well as imagery and base maps. Web maps are commonly used for a variety of applications such as real estate, transportation, and environmental monitoring. Some popular web mapping platforms include Google Maps, Leaflet, and Open Layers. Web maps are typically created using mapping software, such as Google Maps or OpenStreetMap, and can be embedded in a website or accessed through a link. They can be used for variety of purposes, such as navigation, real estate development, resource distribution, rural and urban planning etc. The tools for digital mapping are many and can be searched online, however, it is important to know that the web maps can be produced using GIS software or other mapping or geo-visualization software outside the GIS environment. Some of the popular software are listed below in Table-1.

Table-1 : Showing list of some software for web map display

Name of the software	Details
ArcGIS Online :	A cloud-based mapping and analysis platform from ESRI, which allows users to create and share interactive maps, apps, and data.
Carto:	A cloud-based platform for building and analyzing geospatial data, including the ability to create custom maps and location-based application.
Google Maps Platform:	A suite of tools and APIs that enable developers to integrate Google Maps into their websites and applications, including the ability to add custom markers, overlays, and directions.
Leaflet :	An open-source JavaScript library for creating interactive web maps that can be customized with different map tiles, markers, and overlays.
Mapbox:	A mapping platform that provides developers with tools to create custom maps and location-based applications using open-source software and APIs.
Open Layers:	Another open-source JavaScript library for creating interactive web maps that support multiple map layers, vector data, and geolocation.
R	The R leaflet package is an interface to the JavaScript library Leaflet to create interactive web maps IN R. https://digital-geography.com/webmaps-with-r-the-leaflet-package-for-r/
SciLab GEO	A toolbox for freely availabe SciLab software used in geodaesie and astronomie (http://atoms.scilab.org/toolboxes/scilib_geo/0.6) https://ipcv.scilab-academy.com/2017/11/01/plotting-google-static-maps/
MATLAB	Commercial product of Mathworks, numerical and statistical computation software that comes with mapping toolbox.

These are just a few examples of the many software options, both commercial and free, available for creating web maps. They have different capabilities and features suitable to solve different cartographic problems. Hence, the choice of software not only depends on one's needs and requirements but also on his/her level of expertise and familiarity with different tools and programming languages.

Web Map Display in MATLAB

MATLAB (an acronym for **MAT**rix **LAB**ratory) is a numerical computing environment and programming language developed by MathWorks INC. It is widely used for data analysis, visualization, and algorithm development in a wide range of fields, including engineering, physics, finance, biology etc. MATLAB allows users to perform complex mathematical operations and create custom plots and visualizations. It also includes a wide range of built-in mathematical functions, as well as dedicated toolboxes and libraries for specialized tasks such

as signal processing, control systems, and image processing. It has a user-friendly interface that includes a command-line interface, a graphical user interface, and a set of tools for creating and editing scripts, functions, and apps. Additionally, MATLAB allows interfacing with other programming languages such as Java, C++ and Python, which makes it a great tool for integrating it with other software and systems. MATLAB's core functionality is built around its ability to work with the data structure of matrices and arrays, making it particularly well-suited for linear algebra, signal processing, and image processing. It also includes a comprehensive library of mathematical functions and toolboxes for specialized tasks such as control systems, optimization, and statistics. Users can interact with MATLAB through a command-line interface, a graphical user interface, or through scripts and functions. Additionally, MATLAB offers a wide range of tools for data visualization, including 2D and 3D plotting, as well as support for creating interactive apps.

As said earlier web maps can be developed outside the GIS environment, MATLAB provides such feature as it comes with a specialized mapping toolbox to handle geospatial data and special set of inbuilt functions to display and analyze web maps. In addition, an expert user can also write his/her own codes to extend functionality or can develop different toolbox too. However, it is suggested to search well before writing fresh code as it can save your time and energy wastage in reinventing the wheel. Using inbuilt functions of Mapping toolbox one can create web map display from many WMS servers such as Opentstreetmap, ESRIArcGIS, ISRO's Bhuvan etc. Displaying a web map in MATLAB is very easy.

There are a few different ways to create web maps in MATLAB. One option is to use the Web Map Service (WMS) interface, which allows to access and display maps from a variety of online sources, such as OpenStreetMap or NASA's Blue Marble, ISRO's geo-platform BHUWAN. One can use the "wmsread" and "geoshow" functions in MATLAB to read and display WMS maps, respectively. Another option is to use the "webmap" function, which provides an interactive interface for displaying maps and data on a web map. This function allows adding and customizing layers, as well as interacting with the map through panning and zooming. Let us start with very simple example in which wms services of Bhuvan (https://bhuvan.nrsc.gov.in/) is accessed to display metro route of Lucknow, India as shown below

```
serverURL ='https://bhuvan-vec2.nrsc.gov.in/bhuvan/wms'
info = wmsinfo(serverURL);
orthoLayer = info.Layer(7); latlim= orthoLayer.Latlim
lonlim= orthoLayer.Lonlim;
[A, R] = wmsread(orthoLayer, 'Latlim', latlim, 'Lonlim', lonlim);
Figure; geoshow(A,R);
title(orthoLayer.LayerTitle);xlabel('Longitude');ylabel('Latitude')
```

In the above code *wmsinfo* function gives information on wms services of Bhuvan which is given below

info =

WMSCapabilities
Properties:
ServerTitle: 'GeoServer Web Map Service'
ServerURL: 'https://bhuvan-vec2.nrsc.gov.in/bhuvan/wms'
ServiceName: 'WMS'
Version: '1.3.0'
Abstract: 'A compliant implementation of WMS plus most of the SLD
extension (dynamic styling). Can also generate PDF, SVG, KML, GeoRSS'
OnlineResource: 'http://geoserver.org'
ContactInformation: [1x1 struct]
AccessConstraints: 'NONE'
Fees: 'NONE'
KeywordList: {'WFS' 'WMS' 'GEOSERVER'}
ImageFormats: {18x1 cell}
LayerNames: {4356x1 cell}
Layer: [4356x1 WMSLayer]
AccessDate: '17-Apr-2023'

In this layer 7th index contains data of the metro route of Lucknow which can be read using wmsread function and read data can be displayed using geoshow function as is shown in Fig.1.

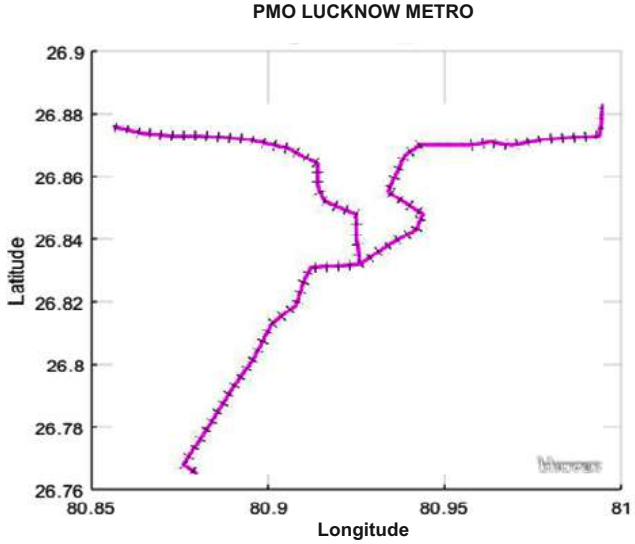

Figure -1 : Metro route of Lucknow as read from ISRO's geo-platform BHUVAN, Govt of India WMS services.

The inbuilt function webmap without any argument is used to display web map in a separate browser which will be centered at [0,0] of longitude and latitude as shown in the Fig.2.This function uses WMS layer in 'Web Mercator' projection system. The default base layer used in display is Worldwide street map provided by ESRI. However, it can be changed using different

layers available in layer manager which comes up by clicking arrow sign on RHS of browser frame as shown in Fig.3 and Fig,4. Also, different input arguments can be used with this webmap function to display web map with different base layer and details of it can be seen in help files of the software or by typing just help webmap in the command window of MATLAB.

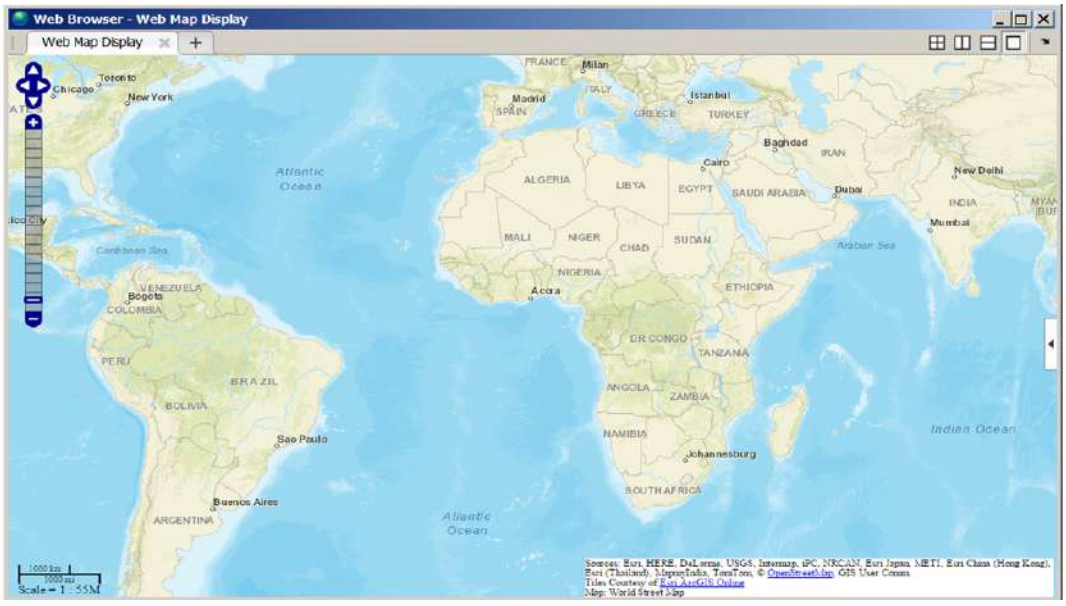

Figure - 2 : Default worldwide street map as produced by inbuilt webmap function in MATLAB.

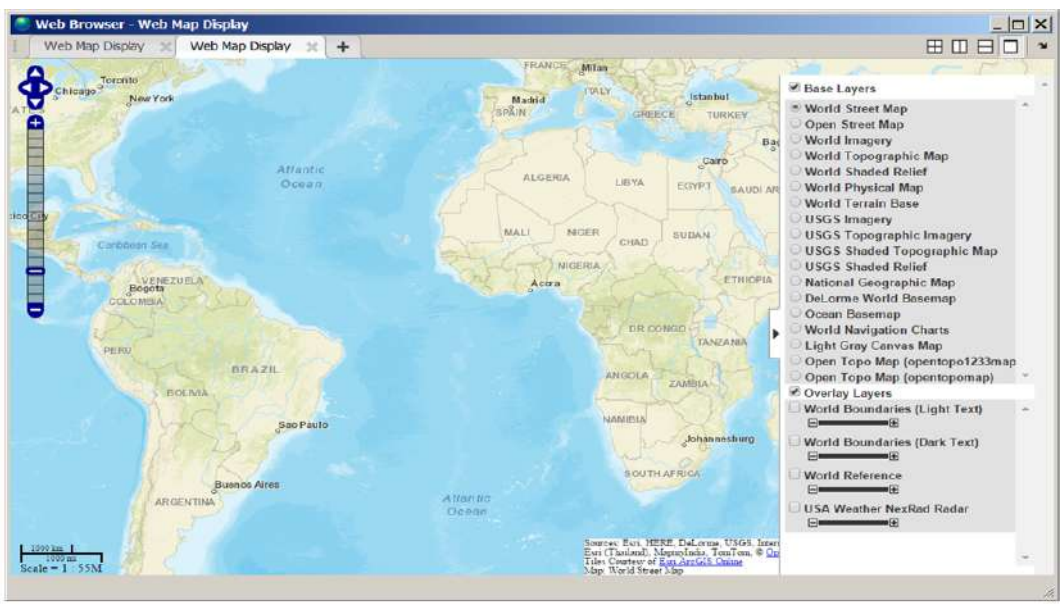

Figure - 3 : List of different base map layers available in the MATLAB.

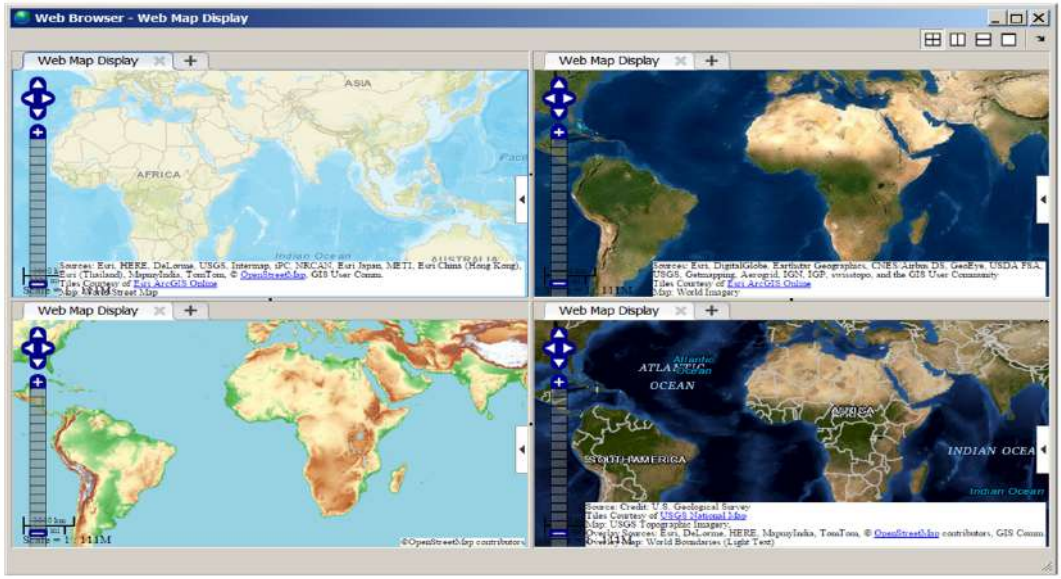

Figure - 4 : Some selected base map layer from list.

The centre of displayed web map can be altered to different coordinates of [Latitude, Longitude] using function wmcenter as illustrated below.

```
wm=webmap
wmcenter(wm,25,75)
wmlimits(wm, [16, 35], [75, 80])
wmcenter(wm,25,75,10)
```

This function centers displayed web map at [25,75] of longitude and latitude values.

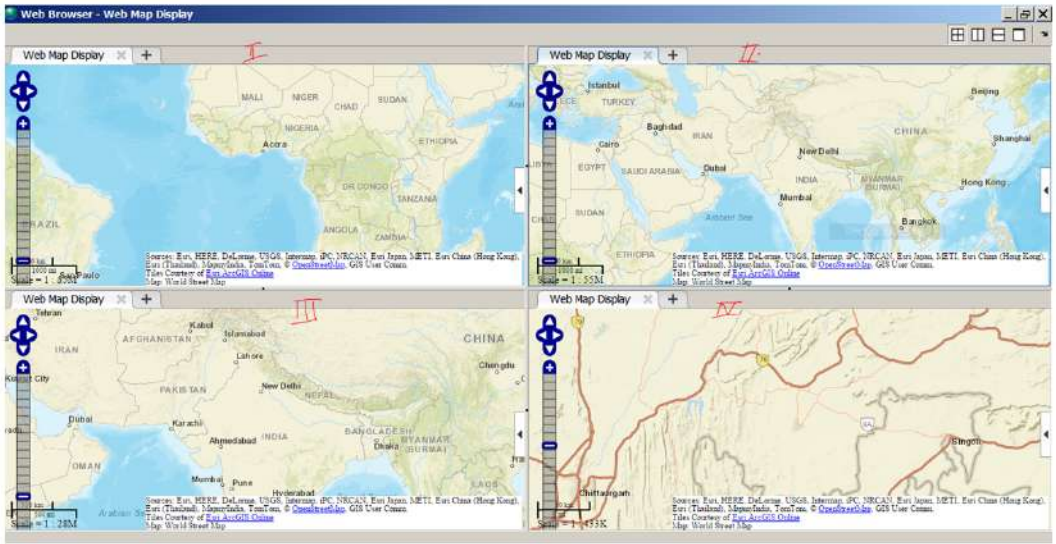

Figure - 5 : Showing screen shots of effects of inbuilt function on displayed web map.

The first frame shows world street map centered at [0, 0], the IInd frame shows the same map centered at [25,75], the IIIrd frame shows web map between limits given in command wmlimit and IVth frame shows action of command wmcenter with zoomlevel 10 and centering at [25,75].

Another inbuilt function can also be used to encircle any location with specified radius. In the following chunk of MATLAB code B.N. College Patna, Bihar has been encircled

```
% Encircle B.N. College Patna
%wm=webmap('OpenStreetMap')
wm=webmap('WorldImagery')
lat_BNC = 25.61966; lon_BNC = 85.15118; zoom_level=16
wmmarker(lat_BNC,lon_BNC,'OverlayName',"B.N. College")
radius =200; az = []; e = wgs84Ellipsoid;
[lat,lon] = scircle1(lat_BNC,lon_BNC,radius,az,e);
wmline(lat,lon,'Color','red','OverlayName','1000 Meters')
wmcenter(wm,lat_BNC,lon_BNC,zoom_level);
```

In the above code function wmmarker inserts geographic marker at latitude (lat) BNC and longitude (lon) BNC. The inbuilt function wgs84Ellipsoid creates **World Geodetic System (WGS84)** as reference coordinate system which is used to calculate circle points by the inbuilt function scircle1. The wmline which creates a circle of specified radius making BN College location as a center. The result is shown in Fig 6.

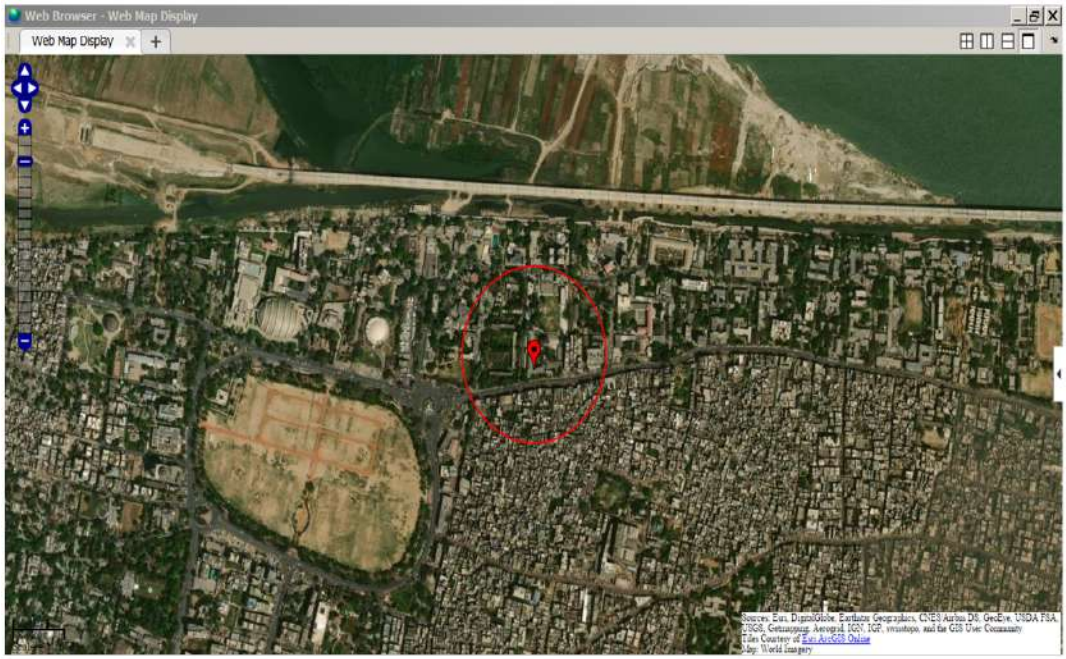

Figure - 6 : Drawing a circle of radius 200 meters around B.N. College, Patna shown by geographic marker.

In the following example code distance between Patna and Tokyo is estimated and both places are connected by an overlaid straight line. Straight lines can be overlaid using function inbuilt function wmline (latitude, longitude) . If latitude and longitude information are not available, they can be read from worldcities.shp file using shaperead function. The distance function estimates distance along arc between two coordinates with reference to parameters of WGS84 coordinate system. Then the line

```
%% Distance between Patna and Tokyo
cities=shaperead('worldcities.shp','UseGeoCoords',true,
...'Selector',{@(v)(ismember(v,{'Patna','Tokyo'})),'Name'});
lat=[cities.Lat];lon=[cities.Lon];
wm=webmap;wmline(lat, lon)
[arc_dist
az1]=distance(lat(1),lon(1),lat(2),lon(2),wgs84Ellipsoid)
s = geoshape(lat,lon);s.distance=round(arc_dist)/1000;s.Units = 'Km';
wmline(s,'Color','red','LineWidth',3,'FeatureName','Distance
between Patna-Tokyo','Overlayname','Distance');
```

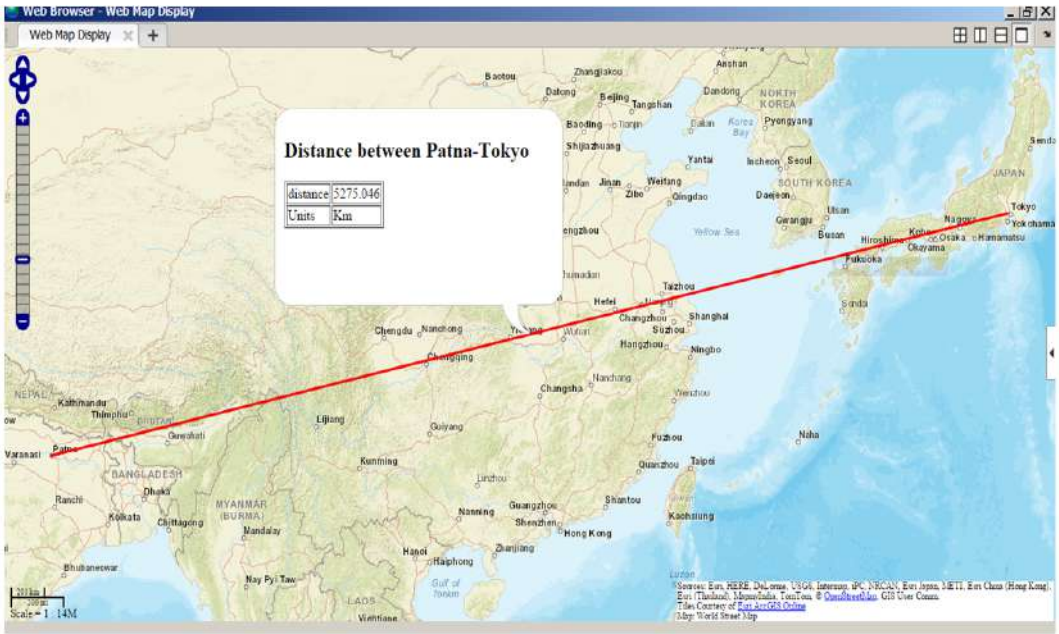

Figure - 7 : Distance display between two cities. Here distance between Patna and Tokyo has been displayed on the webmap.

In MATLAB there are many other inbuilt functions that can be used to handle web map display and for WMS services details of which can be seen in help files and reference documents of the software. Some of them are listed below

webmap	Open web map
wmclose	Close web map
wmprint	Print web map
wmmarker	Display geographic marker on web map
wmline	Display geographic line on web map
wmpolygon	Display geographic polygon on web map
wmremove	Remove overlay on web map
wmcenter	Set or obtain web map center point
wmzoom	Set or obtain zoom level of web map
wmlimits	Set or obtain web map limits
addCustomBasemap	Add custom basemap
removeCustomBasemap	Remove custom basemap

Conclusions

In this paper the power of digital technologies that have drastically changed the ways and style of taking subject of geography was discussed in details with special emphasis on digital cartography where in one of its major components digital map and its publication and sharing through internet was also presented. The handling of web maps was also presented in popular software MATLAB which is also versatile software for the numerical and statistical computations. In the modern era the teaching of geography remains incomplete if students are earning degrees in this subject without exposure to such technologies. Unfortunately, most of the colleges and universities in Bihar lack in computational facilities for the students of geography.

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ASSESSMENT OF WASTELAND IN JAMUI DISTRICT USING ISRO'S LISS–III SATELLITE DATA (2008–2016)

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ABSTRACT

The term wasteland means low-quality land from an agricultural point of view, often referred to as degraded land. According to National Wastelands Development Board, waste land is defined as 'degraded land that can be brought under vegetative cover' with reasonable effort and which is currently under-utilized and land which is deteriorating due to lack of appropriate water and soil management or on account of natural causes". Jamui is one of the badly affected districts by land degradation in Bihar. The wasteland or degraded land area of this district has been classified into five classes using ISRO's RESOURCESAT – 1, LISS – III Satellite Data selecting two base years for comparison (2008 – 2016). Gullied and Ravinous land, Degraded Forest, Barren Rocky Area, Scrub land and Sandy Area are the five major classes of wasteland acquired through remote sensing data processing. The finding suggests that the scrub land is the largest wasteland area which has shown largest change detection in eight years duration.

Keywords : Wasteland, Soil Management, RESOURCESAT – 1, LISS – III, Bhuvan Platform

Introduction

Every living thing including plants, animals and humans obtain a great majority of their energy (calories) from the land, yet much land throughout the world is suffering degradation from one of the biggest threats to soil-soil erosion. Anthropogenic activities have caused increased soil erosion in many places, but we can limit much of this by employing conservation practices that are known to be successful. India is home for over 17 percent of world's population in an area, which is just under 2.5 percent of global spread. Per capita arable land in India, which is around 1500 sq. meter at present, is expected to decrease to a meager 900 sq. meters by 2075. The lands are highly vulnerable to degradation and it takes hundreds of years for the formation of a centimeter of the top soil. Because of lack of adequate information on soil resources coupled with improper land use planning have resulted in many of the present day land degradation problems in our country such as salinity / alkalinity and water logging in river basin areas, severe erosion in catchments leading to siltation of dams and reservoirs, decrease in productivity of crops etc.

Raindrop impact tends to promote depletion of soil covering, so rainfall runs off at the surface, carrying soil in a thin layer of unchanneled water called sheet erosion. If sheet erosion becomes channelized, the water begins to concentrate in small and shallow (2-4 cm deep) channels, called rills. Rills can coalesce to form deeper channels called gullies. If enough gullies coalesce, they can form a streambed.

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This sequence of three photographs [fig - 1(a), 1(b), and 1(c)] illustrates how the flow of water can become more concentrated. In the first photograph [fig - 1(a)], unconfined sheet wash draining an agricultural field begins to run together, forming rills, similar to those pictured in the next photograph [fig - 1(b)]. As rills merge, the water has more power and can cut deeper, forming a gully, as in the last photograph (fig - 1c).

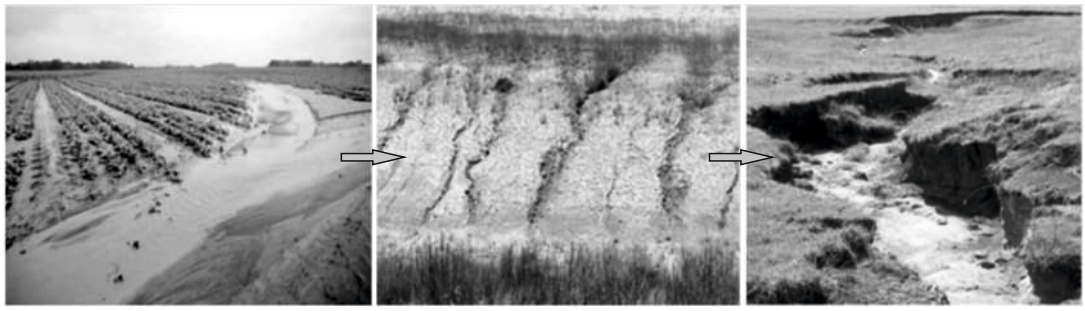

Figure - 1 (a) **Figure - 1 (b)** **Figure - 1(c)**

Jamui District has been badly affected by the problem of land degradation. The lack of adequate information on soil resources associated with unsuitable land use design have caused many of the present day land degradational problems in the present study area such as Gullied and Ravinous land, degraded forest area and increase in sandy areas, resulting negatively in productivity of crops etc.

There are several common causes of land degradation in Jamui district like climate variation (drought), anthropogenic activities i.e. conversion of native vegetation into crop and grazing land or deforestation, thus making soil cover vulnerable for land degradation. These unsustainable land management practices have an impact in increase of gullied/ravinous and badland topography.

Study Area

Jamui was formed as a District on 21st February, 1991 as a result of its separation from Munger district. It lies between Latitude: 25°08'36"- 24°22'10" North and Longitude: 85°49'38"-86°37'04" East. The area of the district is approximately 3122.80 sq.km, while the perimeter is nearly about 360 km. Munger district is situated in the North, Giridih and Deoghar districts of Jharkhand are in the south of Jamui district. It is bounded in East by Banka and Deoghar and in the west by Nawada and Giridih districts.

Most of the part of the district has hilly topography. Western portion of Jamui like Sikandra, Jamui & a little part of Khaira has plain area. Sikandra block is situated in alluvial zone. A sizeable part of the district comprises plains which are paddy-growing lands. Southern part of the district is covered with hills and forest characteristically reminiscent of the Chhotanagpur plateau in physical features. Hills of the district are considered to be the out -laying extension of Vindhya Range. Southwest part of the district has another block of hills known as Gidheswar Pahar.

Hills of the district are considered to be the out -laying extension of Vindhya Range. Southwest part of the district has another block of hills known as Gidheswar Pahar. Kiul and Ulai rivers

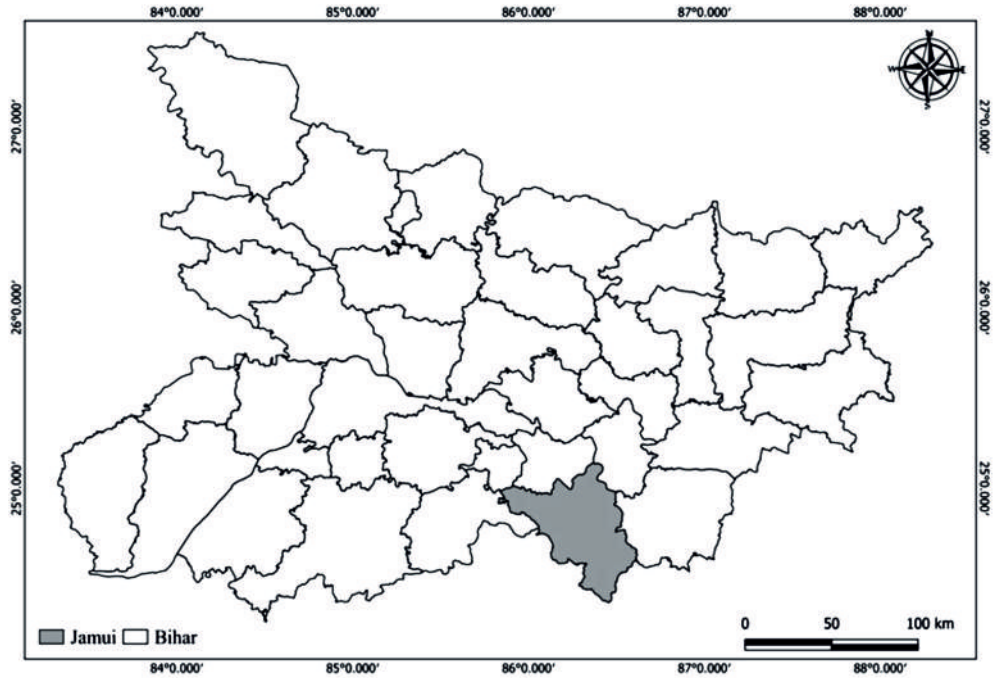

Figure 2 : Study Area

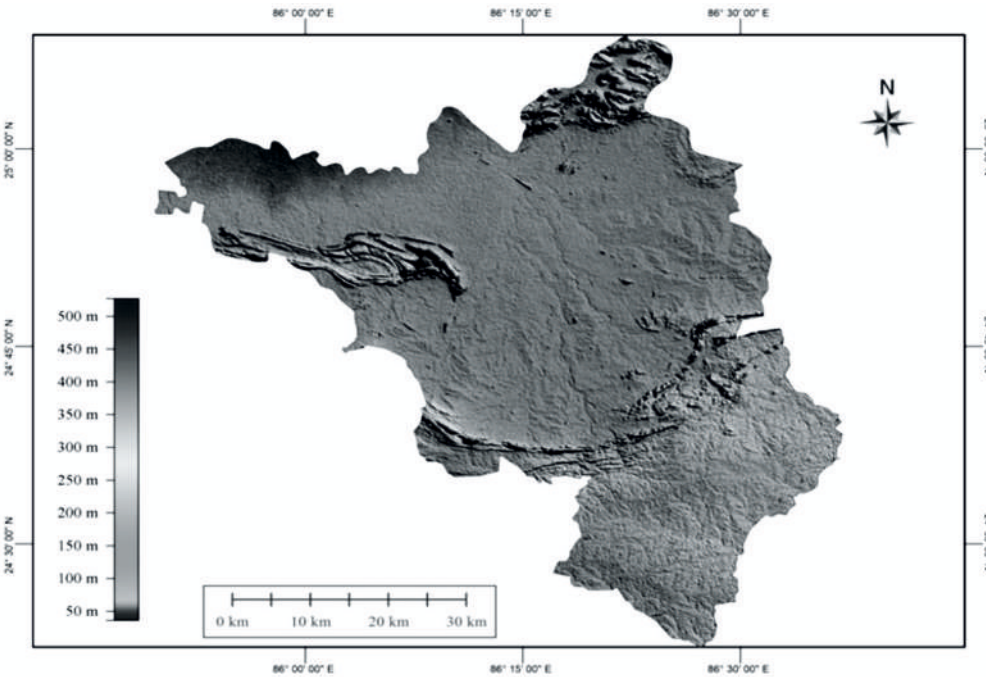

Figure 3 : Topography of Jamui District

are the chief rivers of the district. Beside these rivers, tributaries and sub tributaries, rainy rivers flow in scattered way. There are three major irrigation dams Garhi, Nagi and Nakti Dam situated in the southern hilly terrain of the district. Nagi and Nakti Dams are declared as Bird Sanctuary.

The present study has incorporated data from Natural Census Program of ISRO to analyze the temporal land degradation in Jamui District. For this purpose LISS - III satellite data of two base years 2008-09 and 2015-16 supported by SRTM and CARTODEM, soil and precipitation along with Land Use Land Cover data have been used. Suitable and adequate ground truthing were also done.

Research Question

The purpose of this paper is to examine the causes and consequences of alarming trend of land degradation in Jamui district where the tools of investigation, examination and interpretation shall be satellite image processing.

Objectives of the Study

The basic objective of these ISRO derived data was to generate the first ever comparative temporal and spatial map of land degradation in Jamui District and also extract numerical values for each land degradation class.

Database and Methodology

The land degradation and soil erosion raster data for each state of India can be found at ISRO's Bhuvan Platform. The raster data of Jamui District for two base years (2005 - 06 and 2015 - 16) were downloaded using web services via Qgis software. With the help of Jamui District Vector data (shape file) the raster for the study area was masked out. Then after each land degradation class was color coded according to the legends applied in ISRO - NNRMS (Natural Resources Census Program). Each legend was assigned with a unique pixel value. The numbers of unique pixel value for each legend were calculated using raster processing toolbox. By getting these numbers, each legend area was calculated for each land degradation class. Spatio - temporal analysis for each class was tabulated and compared.

The present study is primarily based upon multi-temporal satellite data acquired from ISRO's Resourcesat - 1, LISS - III sensors. To facilitate this, uniform mapping procedures and digital database standards have been adopted in this study. The three-season (Kharif, Rabi and Zaid seasons of 2008-09 and 2015 - 16) satellite data were geo-rectified with that of 2005-06 and 2015 - 16. The wasteland vector layer of 2005-06 and 2015 - 16 were overlaid with the geo-rectified satellite data of 2008-09 and 2015 - 16 respectively. The wasteland polygons of 2005-06 and 2015 - 16 were updated using satellite data of 2008-09 and 2015 - 16, thus the change areas / categories / polygons were identified. These changes were later confirmed using limited ground checks and the wasteland change vector layer of 2008-09 and 2015 - 16 were generated.

Five threshold wasteland classes were regrouped based on the satellite data processing i.e. Gullied and Ravinous land, Degraded Forest, Barren Rocky Area, Scrub land and Sandy Area.

I. **Gullied and Ravinous land :** Gullies are formed as a result of localized surface run-off

affecting the unconsolidated material resulting in the formation of perceptible channels causing undulating terrain. Gullies develop from rills which are tiny water channels with a few centimeters deep, formed as a resultant impact of heavy rainfall and wearing action of run-off generated there from. These are the first stage of excessive land dissection followed by their networking. Ravines are basically an extensive system of gullies developed along river courses.

II. **Degraded Forest :** Lands within Notified Forest boundaries, with various types of forest cover, in which vegetative cover is less than 20 percent are classified as degraded/underutilized. These lands are generally confined to the fringe areas. Such lands appear in dark gray to light red tone during the maximum green period. The tonal variations are subject to change with the foliage cover and the season of data acquisition.

III. **Barren Rocky Area :** These are rock exposures of varying lithology often barren and devoid of soil and vegetation cover. They occur amidst hill-forests as openings or as isolated exposures on plateau and plains. Such lands can be easily discriminated from other categories of wastelands because of their characteristic spectral response. They appear in greenish blue to yellow to brownish in color depending on the rock type. They vary in size with irregular to discontinuous shape with a linear to contiguous or dispersed pattern. They are located in steep isolated hillocks/hill slopes, crests, plateau and eroded plains associated with barren and exposed rocky/stony wastes, lateritic out-crops, mining and quarrying sites. These areas appear in light gray to black tone due to hill shadow on one side and light red on the other side due to vegetation, the tonal variation is subject to degree of soil erosion.

IV. **Scrub Area :** These areas possess shallow and skeletal soils, at times degraded, extremes of slopes, severely eroded and lands subjected to excessive aridity with scrubs dominating the landscape. They have a tendency for intermixing with cropped areas. They appear in light yellow to brown to greenish blue depending on the surface moisture cover and vary in size from small to large having either contiguous or dispersed pattern. The vegetal cover on scrub lands may be dense or sparse.

V. **Sandy Area :** These are the areas that have stabilized accumulation of sand in coastal or inland areas that can be either desertic or riverine. They appear as white to light yellow/bluish depending on moisture content and at times light red when vegetation is associated with the class, vary in size; with regular to irregular shape with contiguous to linear pattern. Mostly they are located in deserts, riverbeds and along the shores.

Results And Findings

The main objective of this study was to acquire wasteland or degraded land areas falling under Jamui district on a temporal basis. Two base years (2008 - 09) and (2015 - 16) were selected taking three-season (Kharif, Rabi and Zaid seasons of 2008-09 and 2015 - 16). The results showed that in 2005-06 total wasteland area was approximately 599 km2 which was reduced by 9 sq. km in 2015 - 16 seasons to nearly 590 km2 in 2015 - 16.

Table : 1

Wasteland Class	2008 - 09		2015 - 16	
	Area (in sq.km)	Area (in per cent)	Area (in sq.km)	Area (in per cent)
Gullied and Ravinous land	27.59	4.6	28.28	4.79
Degraded Forest	39.49	6.6	40.9	6.99
Barren Rocky Area	7.41	1.24	7.82	1.32
Scrub Land	524.18	87.5	512.64	86.83
Sandy Area	0.35	0.06	0.36	0.07
	599.02	100	590	100

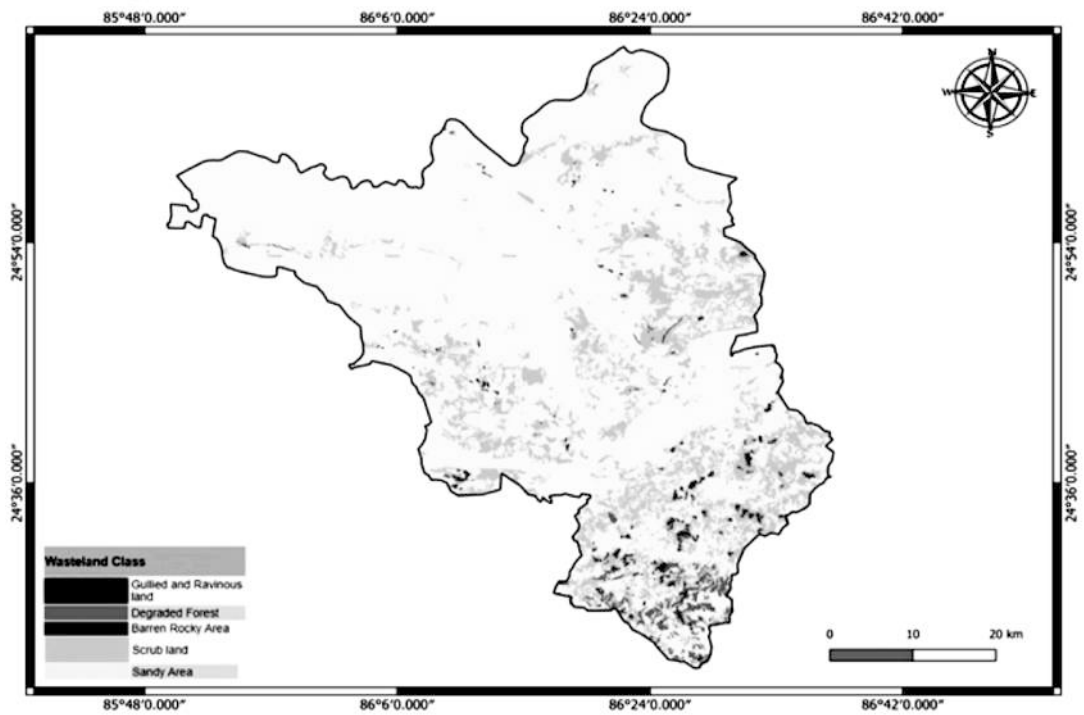

Figure 4 : Spatial Distribution of Wastelands of Jamui District (2008-2009)

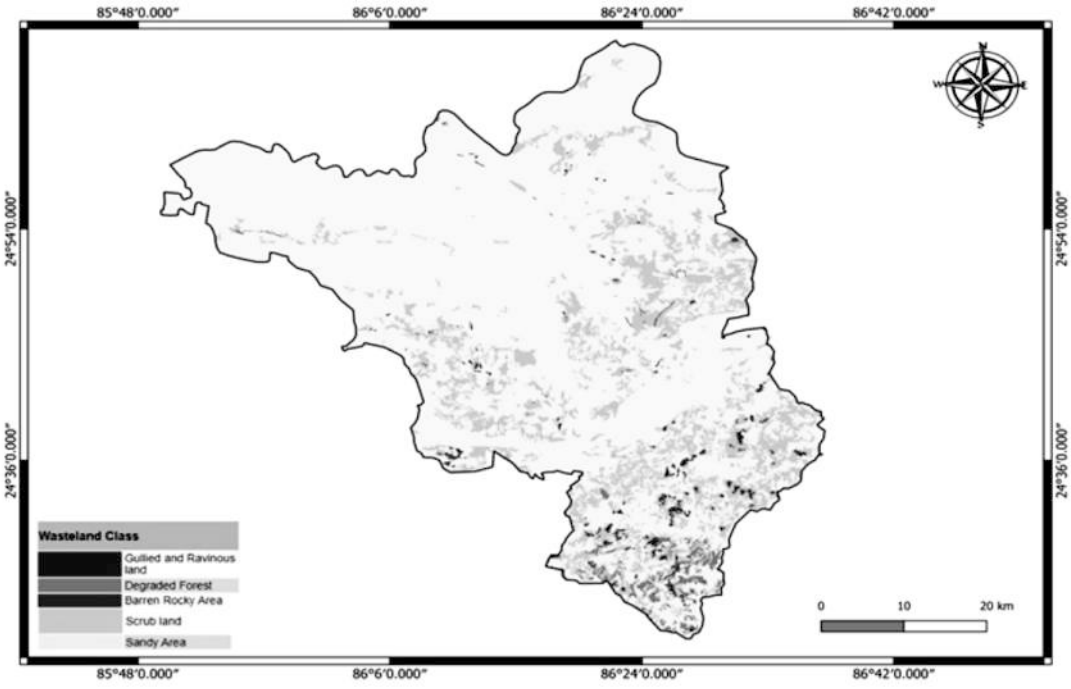

Figure 5 : Spatial Distribution of Wastelands of Jamui District (2015-2016)

The scrub land remains the largest wasteland area in Jamui district. In 2008 - 09 approximately 16.78 percent of total area of Jamui district was covered by Scrub, it reduced slightly by 0.37 percent in 2015 - 16. The Gullied and Ravinous land was 4.6 percent of the total wasteland in 2008 - 09 which increased by merely 0.19 percent to 4.79 percent of the total wasteland area in 2015 - 16. The Degraded Forest area was 6.6 percent of the total wasteland in 2008 - 09 which increased slightly by 0.39 percent to 6.99 percent of the total wasteland area in 2015 - 16. The increase in Barren Rocky and Sandy areas were negligible comparing the other larger wasteland/degraded land area (table - 1).

Suggested Use

These satellite data processed wasteland maps and data can be used at broad level for the following purposes:

- Watershed Management
- Agricultural Productivity Improvement
- Soil Conservation Strategy and Erosion Controlling Strategies
- Land Use Planning and Management

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UN RESOLUTIONS AND JAMMU AND KASHMIR

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ABSTRACT

The dispute between India and Pakistan over Jammu and Kashmir continues to be a complex, explosive and rigid issue which has beleaguered both the nations ever since they acquired independence from the British rule. Kashmir issue has throughout attracted international attention. Being strategically located, it has a unique geographical personality which makes it a complex territorial issue between India, Pakistan and China who are putting claims on some or all parts of the state. United Nations (UN) intervention regarding Jammu and Kashmir started way back in 1948 when Ladhak of the India lodged complaint to UN Security Council regarding the tribal invasion in Kashmir which according to India was assisted by the Pakistani armed forces. This paper emphasises on all important UN resolutions regarding the state of Jammu and Kashmir and also the views of international community as well as view of both countries that is, India and Pakistan. It also addresses the plebiscite issue and discusses the efforts made by Pakistanis in all these years by projecting itself as the sole champion of UN resolutions specially the right to self-determination or plebiscite.

Keywords: Geographical personality, UN Resolutions, India, Pakistan, China, Kashmir, Plebiscite, Jihadi

Objectives and Approach

This research paper is prepared on the basis of the study of various documents, resolutions and empirical assessment. The author intends to present a systematic account of the conflict of Jammu and Kashmir in the light of various resolutions of UNO. In order to make the findings holistic and logistic, the author has also taken the help of reference books. Personal observation of the author has also got due accommodation in this research paper. The most of information are based on secondary and tertiary sources. Emperical observation and assessment constitute the basis of deriving concluding remarks in this paper.

Introduction

UN resolutions on Jammu and Kashmir have been the most debatable part of the study of Indo-Pak conflict. UN intervention in Kashmir dispute started when India lodged a complaint to the UN Security Council on January 1, 1948 under Article 35 of the Charter, which permits any member state to bring any situation, whose continuance is likely to endanger international peace and security, to the attention of the Security Council. the intention behind this reference was to prevent a war between the two newly independent countries (India and Pakistan) which was becoming increasingly possible due to tribal invasion assisted first indirectly and then actively by the Pakistani armed forces. The Government of India requested the Security Council "to put an end immediately to the giving of such assistance which was an act of aggression against India" (mea.gov. in). **On Jaunary 6, 1948** the Security Council, at its 226th

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meeting, decided to invite the representatives of India and Pakistan to participate, in the discussion on Kashmir issue without voting right. Indian representative explained how the Government of India was compelled to bring the question before the Security Council. The Indian representative also pointed out that after the Indian Independence Act coming into force on August 15, 1947, Kashmir had started negotiations with both India and Pakistan concerning accession to one of them. Pakistan applied coercive pressure on Kashmir. It withheld essential supplies to Kashmir. It also aided the armed insurgency in the state of Jammu and Kashmir. To counteract the mass raid of tribesmen, the Maharaja decided to accede to the Dominion of India on October 26, 1947. The Government of India had accepted the accession on the understanding that the will of the people regarding it should be made clear in a plebiscite or referendum when law and order had been restored. The meeting was however postponed till Pakistani Foreign Minister, Sir Muhammad Zafrulla Khan reached New York and submitted three documents replying to India's charges. Pakistan denied the charges of aid and assistance to the 'invaders' or any act of aggression against India. It requested the Security Council, inter alia, to arrange for the cessation of fighting in the State of Jammu and Kashmir; the withdrawal of all outsiders, whether belonging to Pakistan or India, including their armed forces; restoration and rehabilitation of all Muslim residents of the Jammu and Kashmir State who have been compelled to leave the State as a result of disturbances and to take steps for impartial and independent administration in Kashmir. It also advocated for a free and fair plebiscite to ascertain the will of the people of the States as to whether they want to accede to Pakistan or India (mea.gov.in).

On January 17, 1948, the Security Council adopted a resolution (S/651) which called. upon both the Government of India and the Government of Pakistan to take immediately all measures within their powers (including public appeals to their people) to improve the situation, and to refrain from making any statements and from doing or causing to be done or permitting any acts which might aggravate the situation. Further requests were made to both. the governments to inform the council immediately of any material change in the situation which occurs or appears to either of them to be about to occur while the matter was under consideration by the council and consult the council thereon. At its 229th meeting, on January 17, 1948 the council decided that the President should invite the representatives of India and Pakistan to take part in direct talks under his guidance in an effort to find some common ground on which the structure of the settlement might be built (Official Records of Security Council, S/636).

On January 20, 1948 the Security Council adopted another resolution in which a commission of the Security Council for India and Pakistan was established which came to be known as United Nations Commission on India and Pakistan (UNCIP). The commission was composed of three representatives of United Nations, one from India, one from Pakistan and the third was to be designated by the two (the representatives of India and Pakistan) so selected. The commission was invested with the dual function: (i) to investigate the facts pursuant to Article 34 of the Charter of United Nations and (ii) to exercise, without interrupting the work of Security Council, any mediatory influence likely to smooth away difficulties and to carry out

the directions given to it by the Security Council; and to report how far the advice and directions, if any, of the Security Council have been carried out. The commission was supposed to take decision by majority vote and determine its own procedure. It was supposed to allocate among its members, alternate members, their assistants and its personnel such duties as may have to be fulfilled for the realisation of its mission and the reaching of its conclusions. The Secretary General was supposed to furnish the commission with such personnel and assistance as it may consider necessary (Official Records of Security Council, S/639 and S/640).

On 21, April, 1948, the Council adopted yet another resolution which emphasised the cessation of fighting by India and Pakistan for an early restoration of peace and order in the state of Jammu and Kashmir (Official Records of Security Council, S/639 and S/640). It was also decided to increase the membership of the UNCIP to five. For the restoration of peace and order the government of Pakistan was supposed to secure the withdrawal of tribesmen and Pakistani nationals from the state of Jammu and Kashmir who were not normally resident therein and had entered the state for the purpose of fighting. Pakistan was strongly instructed to prevent any intrusion into the state of such elements and not to furnish any material aid to those fighting in the state. Pakistan was also asked to maintain peace and order in the state and provide full freedom to all subjects of the state, regardless of creed, caste, or party, to express their views and vote on the question of accession of the state. **India was also asked to withdraw its forces from Jammu and Kashmir and reduce them to a minimum strength required for the support of civil power in the maintenance of law and order ONLY when it would be established to the satisfaction of UNCIP that the tribesmen are withdrawing.** Apart from various steps regarding the withdrawal of Indian troops, India was also asked to agree that a nominee of the Secretary General of United Nations would be appointed to be a **Plebiscite Administrator**. Besides this the government of India was supposed to undertake that the government of Jammu and Kashmir would appoint fully qualified persons nominated by Plebiscite Administrator to act as **special magistrates** within the state judicial system to hear cases which in the opinion of plebiscite administrator have a serious bearing on the preparation for and the conduct of free and impartial plebiscite. The government of India was also asked to ensure that minorities in all parts of the state are accorded adequate protection and all subjects of the state of Jammu and Kashmir regardless of caste, creed, or party would be safe and free in expressing their views and in voting on the question of accession of the state and that there will be freedom of the press, speech, and assembly and freedom of travel in the state, including freedom of lawful entry and exit. All citizens of the states who had left on account of disturbances would also be invited to return to their homes and exercise their right to vote as citizens. India was also to seek withdrawal of all Indian nationals other than those who were normally resident therein or who on or since 15 August 1947 had entered the state for unlawful purpose. At its 287th meeting, the Security Council appointed Belgium and Colombia as the additional members of UNCIP whose other members were Czechoslovakia (nominated by India), Argentina (nominated by Pakistan) and United States of America (designated by the President of the Council in the absence of agreement between Argentina and Czechoslovakia on the member to be designated by them).

From January 20, 1948 to November 5, 1965 the UN Security Council adopted as many as 16 resolutions on Kashmir issue. All but one, were under chapter VI of UN Charter on the "Pacific Settlement of Disputes". The ceasefire resolution of 20 September 1965, during the war was adopted under chapter VII on "Action with respect to threats to the peace, breaches of peace, and acts of aggression". In between both sides accepted two resolutions of UNCIP, that of August 13, 1948 and January 5, 1949. These UNCIP resolutions (Appendix- V) are the most frequently referred resolutions because they form the foundation for the subsequent resolutions and provide the broader guidelines for the settlement of the dispute (Noorani, 1997a).

The UNCIP Resolution of August 13, 1948

The resolution had three parts: (i) The first part dealt with ceasefire. (ii) The second part or the most relevant part dealt with a truce agreement under which Pakistan was supposed to accept unconditional withdrawal of its troops, tribesmen, and all unlawful Pakistani nationals from Jammu and Kashmir. Further, this part recognized the necessity of India to maintain an army in Jammu and Kashmir to maintain law and order in the state. (iii) The third part was related to reaffirmation of both the countries to determine the wish of the people.

India sought a series of clarifications from the UNCIP on the implementation aspects. After the UNCIP received final communication from the Governments of India and Pakistan, the UNCIP passed another resolution on January 5, 1949, declaring certain provisions supplementary to the UNCIP resolution of August 13, 1948 (Deshmukh, 2002).

The UNCIP Resolution of January 5, 1949

This resolution required that all persons who on or since August 15, 1947, have entered the state of Jammu and Kashmir for other than lawful purposes, will have to leave the state. Besides it also provided for a **Plebiscite Administrator** to be nominated by the UN Secretary General in consultation with the UNCIP. More important but unambiguous was the fact that the consideration of the plebiscite would come into effect ONLY AFTER the UNCIP would find that the ceasefire and truce arrangements set forth in Parts I and II of the Commission's resolution of August 13, 1948, have been carried out. The UN resolution further required that all persons who on or since August 15, 1947, have entered the state of Jammu and Kashmir for other than lawful purposes, shall be required to leave the state (Deshmukh, 2002).

Furthermore, it should be noted that the UNCIP resolution of August 13, 1948 provided that the future status of the State of Jammu and Kashmir shall be determined in accordance with the will of the people, and thereby included the possibility of Jammu and Kashmir becoming independent of both India and Pakistan. Pakistan had this provision reduced, in the UNCIP resolution of January 5, 1949, to the question of the accession of the State of Jammu and Kashmir to India or Pakistan, thereby excluding the possibility of an independent Jammu and Kashmir. Yet, Pakistan has carried out the propaganda that it champions the cause of freedom of the people of Jammu and Kashmir (Deshmukh, 2002).

Pakistan, knowing well the fate of such plebiscite, did not take any step to fulfill its obligations under the agreement and continued to hold the territory of the State illegally and forcefully

even today. The issue plebiscite was linked with the condition of withdrawal of Pakistani forces and tribesmen from the occupied territory of the state which it never fulfilled, making the resolution absolutely irrelevant. Instead, Pakistan consolidated its aggression by dishonestly raising the strength of forces in the occupied territory. On the other hand India, instead of evicting the intruders on the spot, kept protesting to the Security Council, that Pakistan should vacate its aggression.

All the truce proposals, the UNCIP's of 28 April 1949, those of General A.G.L. Naughton of Canada of 22 December 1949, Sir Owen Dixon's report of 15 September 1950 and Dr Graham's (1951 to 53), treated the Northern Areas as an integral part of Kashmir. Besides UNCIP's resolution also recognised India's sovereignty over the entire state as its chairman Josef Korbel gave assurance to Nehru in a letter. Regarding the Plebiscite Administrator, he said that he was to be formally appointed to the office by the government of Jammu and Kashmir and was to report to it, besides the UNCIP, the result of the plebiscite. Thirdly, the POK could only be administered by local authorities under the surveillance of the commission, once the Pakistani troops withdrew. But Pakistan was unlikely to expect any of the three fundamentals underlying the UNCIP's resolutions mentioned above (Noorani, 1997b).

Pakistan separated northern areas from the rest of POK and annexed them directly. Its minister, M.A. Gurmani concluded an agreement with POK leaders bringing the northern areas within the purview of Pakistani government. Five days later on third May, 1949, he wrote to the UNCIP claiming that the territory has been firmly under the control of government of Azad Kashmir. The POK has been annexed indirectly through its constitution of 24 August, 1974. It forbids the cry of plebiscite there (Article 7) and makes Islam a state religion (Article 3) and has set up a council with Pakistan's Prime Minister as its chairman, thus reducing the POK to its province (Noorani, 1997b).

The UNCIP having reported failure at the end of 1949, the Council's President General **A.G.L.McNaughton,** at the request of Security Council met the representatives of India and Pakistan to find a mutual solution to the problem. On February 3, 1950, he submitted a final report presenting a demilitarisation programme to be executed prior to the plebiscite. He reported that both the parties (India and Pakistan) suggested amendments to the proposal which were not acceptable to either of them. On March 14, 1950 began the second phase with Council's fifth resolution appointing a UN "Representative" in the place of UNCIP. **Owen Dixon,** who rose to be in Chief Justice of Australia, was appointed by the Council as United Nations Representative for India and Pakistan. He submitted his report on September 15, 1950. His efforts were also unsuccessful. The Council adopted a resolution on 31st March, 1951 (its sixth) accepting his resignation and appointing a replacement charged with securing the implementation of UNCIP's resolutions. Next in the row was **Frank Graham** who submitted five reports that of October 15 and 18 December 1951, 22 April and 19 September 1952, and 27 March 1953. During this period, the Council passed its seventh and eighth resolutions respectively on November 10, 1951 and December 23, 1952. They extended his mandate and urged the parties (India and Pakistan) to cooperate with him. However, no settlement could be reached (Noorani, 1997b).

After a gap of 4 years, the Council adopted a resolution (the ninth) on 24 January 1957, after the State's Constituent Assembly had enacted a constitution on 26th November 1956, reaffirming its view of 30th March, 1951. On 21 February, 1957 (the 10th resolution), it further requested its President Gunnar Jarring of Sweden to mediate. He also reported failure on April 29, 1957. Then the council again sent its mediator Frank Graham (the 11th resolution) in hope of some triumph. Graham also reported failure on 28th March, 1958 and this brought an end to the second phase of Council's proceedings (Noorani, 19976).

The third and last phase of the Council's proceedings were triggered off by a report by the Chief Military Observer of UN Military Observers Group for India and Pakistan (UNMOGIP), General R H Nimmo, following Pakistan's "Operation Gibraltar". The Secretary General, U Thant, reported to the Council on September 3, 1965: "the series of violations that began on August 5, 1965 were to a considerable extent in subsequent days in the form of armed men, generally not in uniform, crossing the ceasefire line from the Pakistan side for the purpose of armed action on the Indian side". The Council adopted five resolutions in its wake (12th to 16th) - calling for a ceasefire on 4th September, 1965. Again it repeated on 6th September, 1965 with the plea for return to status quo as it was on August 5, 1965. The vital ceasefire resolution of September 20, 1965, the first under Chapter VII of UN Charter (on action with respect to threats to peace, breaches of the peace, and acts of aggregation) demanded ceasefire by September 22, 1965. Two other resolutions, that of 27th September and 5th November 1965, sought consolidation of the ceasefire. The debates in September 1965 in the wake of Operation Gibraltar resulted in the burial of UNCIP's resolutions. None of the council's members urged their enforcement. As a sop to Pakistan, resolution adopted on 20 September recorded that, after the ceasefire and restoration of the status quo before 5 August 1965 the council decided "to consider..... what steps could be taken to assist towards a settlement of the political problem underlying the present conflict" and in the meantime called on them to use peaceful means to resolve it directly. The Security Council reaffirmed this resolution in all its parts on November 5, 1965, its last resolution on the subject. Nothing survived of the UNCIP's resolutions or the Council's own from 1948 to 1957(Noorani, 1997c).

The record shows that to resolve the political deadlock, Pakistan launched a war in 1965. It is thus obvious that Pakistan can not attain its goal by plebiscite or at a conference table and even in the battlefield. Pakistan imposed yet another war on India in 1971. After this war, bilateral talks were held and the truce agreement on plebiscite was superseded by the **Shimla Agreement** between India and Pakistan signed on July 2, 1972, in which the two countries undertook to resolve all differences bilaterally and peacefully. Pakistan, through its commitments enshrined in this Agreement, accepted the need to once and for all shift the Kashmir question from the **UN plane to the bilateral plane** (Noorani, 1997c).

However the two propositions of UN resolutions survives till today. One is reiteration, twice on 30 March 1951 and 24 January 1957, of the principle that the people of Kashmir would decide their future, not the Constituent Assembly. The other is the plea on 20 September 1965 for a settlement of political problem underlying the present conflict.

India's View before the World Community

India considers the state of Jammu and Kashmir as its integral and inalienable part. The foundations of India's claim to the state of Jammu and Kashmir are solidly entrenched in hard facts from the history of the region going back to over five thousand years. In the modern context, democratic principles and international tenets of contemporary world order dictate it.

The **Accession of the state of Jammu and Kashmir,** signed by Maharaja Hari Singh, on 26th of October 1947, was completely valid in terms of Government of India Act (1935), Indian Independence Act (1947) and various international laws and was thus complete and irrevocable. The accession was also supported by the largest political party in the State, the National Conference. In the Indian Independence Act, there was no provision for any conditional accession. The Instrument of Accession executed by the Maharaja was the same as executed by over 560 princely states in India. There has been no confusion in any of the other cases (mea.gov.in). The case of Jammu and Kashmir would have gone without any complication if Pakistan would not have sent tribal invaders first (October 1947) and its own regular army later (May 1948). The pre-accession confusion was fuelled more by the Maharaja's hopes of retaining post-independence control as he did under the British, than by anything else. It is clear that if the Hindu Maharaja wanted to betray his majority Muslim subjects and accede to India, he would have done so when he had an opportunity in August 1947 itself.

Lord Mountbatten's acceptance of the Instrument of Accession was unconditional. He said: "I do hereby accept this Instrument of Accession". So the Instrument of Accession was complete with offer and acceptance. So, there can be no question regarding the authenticity of the accession of Jammu and Kashmir to India.

The origin of the question of Plebiscite can be traced to a letter of October 27, 1947 which Lord Mountbatten wrote to Maharaja Hari Singh of Kashmir after the latter had signed his acceptance on the Instrument of Accession on October 26, 1947. According to Justice Anand, that letter of Mountbatten was a personal letter, and it was in reply to the Maharaja's letter of October 26 stating that "a grave emergency" had arisen in his state and acknowledging that the Indian Dominion "cannot send the help asked for" without his state acceding to India. Accordingly, to that letter of October 26, the Maharaja attached the Instrument of Accession for acceptance. Mountbatten, in his letter wrote, " my government has decided to accept the accession of Kashmir state to the dominion of India. In consistence with their policy that in the case of any state where the issue of accession has been the subject of dispute, the question of accession should be decided in accordance with the wishes of the people of the state, it is my government's wish, that, as soon as law and order have been restored in Kashmir and its soil cleared of the invader, the question of the state's accession should be settled by a reference to the people." Apart from the legal point above, Justice Anand has considered the effect of the "wish", expressed in Mountbattan's letter. "In expressing the wish," says Justice Anand, "Lord Mountbatten was probably expressing a pious hope of declaration without legal effect. Moreover, Lord Mountbatten's letter spoke of the policy of a reference to the people "

(Lavakare, 1999). There was absolutely no dispute about the state's accession to India. Neither India nor Pakistan was disputing the Maharaja's sovereign right to take the decision he wanted.

As the accession of the state of Jammu and Kashmir to India was similar to other princely states which acceded to India, the question of plebiscite was not needed. Even then India had accepted the proposal for plebiscite for determining the final status of Jammu and Kashmir, on the floor of UN Security Council when the matter for resolving the problem of Pakistani backed tribal invasion in the state was sent to it by the Jawaharlal Nehru government of India. It had, however, been made clear by the Indian leaders that holding of such a plebiscite would be conditional upon Pakistan fulfilling **Parts (I) & (II) of the UNCIP resolutions of 13 August, 1948,** which inter alia, required that all forces regular and irregular under the control of both sides shall cease fire. Pakistan would withdraw its troops. Besides it would also endeavour to secure withdrawal of tribesmen and its nationals while India would withdraw bulk of its forces once the UNCIP confirmed that the tribesmen and Pakistani nationals have withdrawn and its troops are being withdrawn. India was also to ensure that the state government takes various measures to preserve peace, law and order. Indian acceptance of these UNCIP resolutions was also subject to several conditions and assurances given by UNCIP including that Pakistan would be excluded from all affairs of Jammu & Kashmir and "Azad Jammu and Kashmir Government" would not be recognized. It was also assured that sovereignty of Jammu and Kashmir government over the entire territory of the state shall not be brought into question and territory occupied by Pakistan shall not be consolidated as Pakistani troops would be withdrawn completely. **Pakistan never fulfilled those assurances.** The Government of Pakistan wrecked any possibility of plebiscite being conducted by not implementing part II of the resolution, perhaps because it was fully aware of what the result of such an exercise would be. The Pakistani troops, which were to withdraw from the state, did not do so. As a result normal conditions under which a plebiscite could be held were never created. So the **preconditions for plebiscite (Part I and II of the UNCIP resolution of August 13, 1948) were never fulfilled by Pakistan.**

The UN resolutions have become obsolete in time perspective. Almost 6 decades have passed since the question of plebiscite was laid by the UN Security Council. Since then time and circumstances have changed the entire ground situation. Pakistan unilaterally ceded a part of the state to China in 1963. Pakistan has also induced demographic changes in the state by allowing generations of Non-Kashmiris to settle in the part occupied by it. Further it has also terrorised the native Hindus of the state to flee to other parts of India. Besides since 1957 there has been no UN resolution on substantive aspects of Jammu and Kashmir State.

Under the UN Charter, the principles of **self-determination are meant to apply to colonial territories and not to integral parts of countries** (meaindia.nic.in) and the state of Jammu and Kashmir is an integral part of India. India waited for several years, for Pakistan to fulfil the preconditions. When that did not happen, the people of Jammu and Kashmir then convened a Constituent Assembly in 1951, which once again reaffirmed the Accession of the State to India in 1956 and finalised the Constitution for the State. The Jammu and Kashmir Constitution reaffirms that "the State is and shall be an integral part of the Union of India." Any plebiscite

today would question the integrity of India and can raise the issue of secession which can also be dangerous to several multi-ethnic and multi-religious countries of the world.

India also refutes the Two Nations Theory' of Pakistan due to which it puts its claim on the state of Jammu and Kashmir which is having a majority of Muslim population. No place in the world having the majority Hindu or Muslim population can become a part of India or Pakistan respectively. It is the historical and cultural heritage and the Constitutional base of the place in accordance with international law, which determines to which nation, a place belongs. However, in the war of 1947, it was the Muslim community in the state of Jammu and Kashmir that suffered the most at the hands of Pakistani backed tribal intruders, as the majority population in the state was that of Muslims. The shameful atrocities of loot, murder and rape committed on the Muslim masses of the state had demoralised them, yet Pakistan boasts that it champions the cause of liberation of Muslims from the tyrannical Indian rule. Pakistan has thus ignored the interests of a larger population of Muslims in India, and had abused the Muslims in erstwhile East Pakistan (Bangladesh), which eventually led to its secession from Pakistan despite religious affiliation to it. So the 'Two Nations theory' of Pakistan holds nowhere in the present world context.

It is also worthwhile to discuss the **case of Junagarh** here. Pakistan also encouraged and wangled the accession of the State of Junagadh which was surrounded by Indian territory, and was not at all contiguous to Pakistan. This was done on the ground that the ruler of Junagarh, in this case a Muslim, had shown his desire to accede to the state of Pakistan despite the wishes of his subjects (who favoured accession to India) and despite geographical contiguity and other favourable factors like accessibility with the surrounding Indian territory. However, India was the first to suggest plebiscite as a peaceful method for resolving the Junagadh dispute with Pakistan. India held a plebiscite in Junagadh in which the number of voters who polled was 190,870 out of a total of 200,569. Of these 190,779 voted for India and only 91 for Pakistan (Sharma, 1967). India had also made a similar offer for settling the Kashmir situation in 1947 and this was reaffirmed when the matter was taken to the UN Security Council for resolving the dispute. The Pakistan was never in favour of a plebiscite in the state of Jammu and Kashmir as every time the UN came very close to organising a plebiscite, Pakistan created difficulties and actually avoided it. In fact Pakistan had resorted to barbaric tactics of forcibly occupying the state of Jammu and Kashmir by tribal invasion which was supported largely by its army. So Pakistan knew that Kashmiris had suffered so much at the hands of Pakistani intruders that a plebiscite at that time would have definitely gone in favour of India. However when a large Princely State, **Kalat in Baluchistan,** now in Pakistan, which had obvious geographical compulsions to accede to Pakistan, approached the Government of India for political relationship, it was refused. Certain unofficial overtures were also made from another Princely State, **Bahawalpur** (Sharma, 1967), and they were similarly discouraged, although in this case the State was also contiguous to Indian Union territory. But India had refused its proposal too as they were not fully in accordance with the principle of accession. If India had hinged on the question of plebiscite in Bahawalpur and Kalat than those places would have either seceded from Pakistan or would have remained disputed till today. But Pakistan was not pious enough

and knowing that the accession of the state of Jammu and Kashmir to India was also supported by the largest Democratic party in the state it raised the question of plebiscite in that state. Even when India was ready for a plebiscite at that time, it created problems regarding demilitarisation which was an essential precondition for the plebiscite. Thus Pakistan's strategy was to avoid plebiscite till it manipulated the demography of the state which could take a period of 20, 30 or even 60 years till the Indians in the state would have been replaced by illegal infiltration.

Pakistan's Interventions

Pakistan's views regarding the state of Jammu and Kashmir are quite contradictory to those of India's. India considers the state of Jammu and Kashmir to be an integral part of the country while Pakistan calls it a 'disputed territory' and 'an unfinished agenda of partition'. Pakistan advocates for the **'Two Nation Theory'**. According to Pakistan partition of the country in 1947, was done on communal lines and the state of Jammu and Kashmir being a Muslim majority state should have gone to Pakistan which had declared itself as a Muslim state.

Pakistan projects that the people of the state of Jammu and Kashmir, around 80 per cent of whom were Muslims, were groaning under the tyrannical rule of Maharaja Hari Singh. So the Muslim masses of the state wanted to accede to Pakistan and so they revolted against the oppressive rule of Maharaja. They also projected that the tribal intrusion in the state of Jammu and Kashmir which India claims was backed by Pakistan, was in fact the **popular uprising** against the Hindu Maharaja.

Pakistan also does not recognise the **Instrument of Accession** signed by Maharaja Hari Singh which led to the accession of the state of Jammu and Kashmir to India. Pakistan calls the Instrument of Accession of the state of Jammu and Kashmir as controversial as the Maharaja had signed it in utter confusion and haste and also under intense pressure from the Indians to get the military help from India in order to counter the popular uprising in the state.

When the matter of armed aggression in the state of Jammu and Kashmir was taken by India to **UN Security Council** on 1 January, 1948, the dispute over the state entered United Nations. Pakistan refuted all charges made by India of any aid to tribal intruders and any sort of aggression against India. After the UN resolution of 20th January, 1948, the President of Security Council in consultation with the representatives of India and Pakistan reported that the parties have agreed to principle on the desirability of a plebiscite to determine the accession of the State of Jammu and Kashmir. Thereafter the representatives of both India and Pakistan submitted their proposals. The Indian government, among other things suggested that the interim Government of Sheikh Abdullah would be converted into Interim Council of Ministers. The ministry would function as responsible ministry. Government of Sheikh Abdullah would convene a National Assembly, which would then assemble to constitute a National Government. The National Government would then have the plebiscite taken on the question of accession. The plebiscite would be taken under the advice and observation of the United Nations. Indian proposal also mentioned that although its troops would be withdrawn from the state of Jammu and Kashmir but it would keep adequate number of troops in the state

to maintain law and order and also to counter any external aggression. The aforesaid **Indian proposals of partial demilitarisation and plebiscite under the government of Sheikh Abdullah were not acceptable to Pakistan.**

The Pakistani proposal was submitted in the form of a draft resolution. It asked for the following things:

1. The establishment of impartial interim Government in the State of Jammu and Kashmir:
2. Withdrawal of foreign armed forces including tribesmen and Indian troops;
3. Return of all citizens of Kashmir who left the State because of the disturbances;
4. Holding of a free and fair plebiscite to ascertain the will of the people as to whether they want to accede to Pakistan or India.

Pakistan did not regard Sheikh Abdullah's Government as an impartial one as he was a member of Indian delegation to the Security Council. He had also said in front of the Security Council that Pakistani request for an outside administrator would mean that the people of Kashmir would have no hand in running the country. He further mentioned that at the helm of affairs in accordance with the wishes of his people and any one replacing him would not be impartial, and that there was no reason to fear that the Indian army would interfere with the exercise of a free vote. The Pakistani representative pointed out that Sheikh Abdullah's statement in the Security Council showed how much impartiality could be expected from an administration under him (Sharma, 1967).

Pakistan thought that the Indian Prime Minister Jawaharlal Nehru had betrayed to them on the plebiscite issue by violating the UN resolutions as soon as they were passed. The insertion of Article 370 in the Indian Constitution (which gave special status to the state of Jammu and Kashmir), the creation of Jammu and Kashmir Constituent Assembly on 5 November 1951, the signing of 'Delhi Agreement' between Nehru and Sheikh Abdullah which incorporated Article 370 and the incorporation of the state of Jammu and Kashmir into the Indian Union under a new constitution in 1957 were all done in direct contravention of UN Security Council and UNCIP resolutions. Pakistan claims that the people of the state of Jammu and Kashmir were not consulted in all these matters by the Indian government (Peerzada,).

Since then Pakistan has consistently called for the implementation of UN resolutions to determine the status of the state according to the will of the people. Pakistan and India have major differences on the issue of demilitarisation in order to accomplish the objective of plebiscite in the state of Jammu and Kashmir. Pakistan also criticises the heavy deployment of Indian troops around 700,000 (www.pak.gov.pk) in the Indian administered Kashmir which includes Regular Army, Paramilitary Forces, Border Security Force and Police. Pakistan accuses the Indian troops of committing human rights violations like custodial killings, illegal detentions, fake encounters, rape, torture etc. According to Pakistan all these have brought a lot of tension and suffering in the life of innocent people of Jammu and Kashmir. So Pakistan has always tried to attract the attention of international community or internationalise the Kashmir dispute.

In the Indo-Pak war of 1965, though the war began with the clashes between India and Pakistan in the Rann of Kutch but it also engulfed the state of Jammu and Kashmir. Pakistan hoped to support an uprising by Kashmiris against India. Due to UN intervention the war came to an end on 23 September 1965 and a Soviet-brokered Tashkent declaration was signed on January 10, 1966. Within the hours of the agreement, Shastri, the then Prime Minister of India, died of a heart attack. While Tashkent agreement noted the existence of Kashmir dispute, it put it effectively in cold storage. The Shimla Agreement signed on July 2, 1972 brought an end to the 1971 Indo-Pak war in which both India and Pakistan decided to solve the Kashmir dispute through bilateral talks. Pakistan claims that before 1997 India was not even bothered to discuss Kashmir with Pakistan not even bilaterally. According to Pakistan, the Indo-Pak talks of early 1990s failed because India was not ready even to accept Kashmir a dispute as such, contrary to what the Tashkent Declaration and the Shimla Accord had recommended and what the UNSC and UNCIP in their resolutions had stated (Nicholeson's Report, www.jammu-kashmir.com). Pakistan thinks that if the international community would have intervened in the matter then the Indo- Pak talks at Lahore or Agra or at other places would not have failed.

Views of Permanent Security Council Members

The Charter of the United Nations was signed on June 26, 1945, thereby concluding the United Nations Conference on International Organization. It went into effect a few months later on October 24, 1945. This gave birth to the Security Council as well as the other main bodies of the United Nations.

The Security Council is the UN organ primarily responsible for maintaining international peace and security. **Articles 23-32** of the U.N. Charter deal specifically with the Security Council. Security Council has a total of 15 members, five of which are permanent while the other 10 are non-permanent. The permanent members include United States of America, the Russian Federation, France, the People's Republic of China, and the United Kingdom. The non-permanent members are elected by the General assembly. They are elected for a two-year term, with only five of the ten retiring after every two years. Each Council member has one vote. If a permanent member does not agree with a decision, it can cast a negative vote, and this act has power of Veto. The Security Council has, arguably, the greatest power of any of the bodies present in the United Nations. Its overall objective is maintaining international peace and security (Nicholeson's Report, www.jammu- kashmir.com).

The question of Jammu and Kashmir has been on the UN agenda since 1948, when the Indian government lodged a complaint to the UN Security Council regarding Pakistani aggression along with tribal intruders in the state of Jammu and Kashmir which could have disturbed international peace and security. Almost 7 decades have passed but the dispute over the state of Jammu and Kashmir remains unresolved. The UN Security Council resolutions of 1947, 1965, 1971 and 1972 established a framework for resolving the dispute of Kashmir. Sadly, the superpowers of the time did not encourage the UN to follow up with a full resolution of the Kashmir dispute (www.un.org).

However, all the permanent members of Security Council endorsed the idea of a plebiscite in

the state of Jammu and Kashmir as soon as both the parties had withdrawn their forces from the state. The option given to the people of Jammu and Kashmir was to join either India or Pakistan. The members of the Security Council did not note that there could have been a third option as well, that is the option of an independent state of Jammu and Kashmir. According to the UN resolutions, Pakistan was to withdraw all tribesmen and its army men from the state of Jammu and Kashmir after which India was to withdraw the bulk of its forces and keep a minimum number to maintain law and order in the state. Pakistan did not withdraw its forces back and the status continues till today. None of the permanent members of the Security Council did ever force Pakistan to withdraw its forces so that a plebiscite would be held under international auspices and the dispute over to the state of Jammu and Kashmir could have been resolved forever. Finally, the UN Security Council debate ended, with the President of the Security Council stating, on May 18, 1964, that the negotiations between India and Pakistan might be complicated by any outside intervention. Thus USA, Great Britain and the Soviet Union asked for a bilateral settlement instead of UN involvement (www.un.org).

However, all the permanent members of Security Council still reiterate the idea of a plebiscite to resolve the dispute over the state of Jammu and Kashmir. During the Cold War era Pakistan happened to be an important ally of United States. So the US policies during that time happened to be Pakistan-centric. Even during the Afghan -Soviet war Pakistan received huge amount of funds from the Western countries including United States to counter the Soviet advance into the region and it was during this time that Afghani mujahidin fighters were encouraged to drive off the Soviets from their country in the name of Jihad. At that time the Jihadi freedom fighters were encouraged by the Americans. After the Soviets were defeated, the Americans left the region for Jihadis to prosper in the region and they created turmoil in the state of Jammu and Kashmir. They had turned a deaf ear to the incidents of terrorism that took place in the state of Jammu and Kashmir by the Jihadis imported from Pakistan and Afghanistan. But the incident of 9/11 (World Trade Centre demolition) shook the entire world and the Americans opened their eyes to the harmful consequences of Jihadi terrorism. Now the Americans along with other permanent members of Security Council have realised the threat caused by Al Qaeda, a powerful terrorist organisation that has a well organised network in 60 countries of the world (Glass, 2002). Now United States have declared the global war on terrorism in which they have engaged Pakistan in spite of the fact that Pakistan continues to host the deadly Al Qaeda and Taliban along its border with Afghanistan. Other permanent members of the Security Council like China, United States, France and UK have also expressed concerns over this and have repeatedly asked Pakistan to end cross-border terrorism and infiltration in the state of Jammu and Kashmir. Thus US has adopted a mid- way path of engaging both India and Pakistan in the coalition to fight Al Qaeda and its likes and, therefore, wants a peaceful solution of the Kashmir dispute through bilateral means as specified in the Shimla agreement of 1972.

The US and French views against the internationalisation of the Kashmir issue is shared by China and Russia as well. The Russians are facing the problem of terrorism in Chechnya and so they have accorded full support to India regarding Kashmir issue. Although China continued to

be a close ally of Pakistan but there has been a paradigm shift in the foreign policies of China since late 1990s. The Chinese have shown a neutral attitude towards Pakistan during Kargil war between India and Pakistan. Today the China also emphasises that the solution of Kashmir dispute should be through bilateral means and have accused Pakistan on not being able to reduce cross-border terrorism to the Indian administered Kashmir and other parts of India. China has also been facing the problem of Muslim separatists in its state of Xinjiang. China considers that these Muslim separatists have alleged links with Jihadi groups of Afghanistan and Pakistan. Thus China considers India as an important neighbour and has increased its efforts to resolve the Kashmir dispute bilaterally with Pakistan.

Although all the permanent members of Security Council have reiterated their call for a plebiscite in the state of Jammu and Kashmir, but none has acknowledged the fact that in the last seven decades the state has undergone tremendous demographic changes. Cross-border terrorism has led to the exodus of a vast majority of Kashmiri pundits from the valley. On the other hand many non-Kashmiris have entered the valley from across the LOC and have settled there. So the plebiscite held at this stage would not be a fair one as the large number of real Kashmiris have migrated from the state and so the validity of UN resolutions is questioned by India now.

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PUTTING 'GENDER' FIRST IN RESETTLEMENT PLANNING: LESSONS FROM SARDAR SAROVAR PROJECT RESETTLEMENT AND REHABILITATION

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ABSTRACT

Development projects have become synonymous with land acquisition leading to dispossession and forced migration of a large number of people and their involuntary resettlement in an alien environment. Traditionally, the focus of resettlement planning by planners is at the household level. This neglects the understanding of the dynamics of intra-household relations between women and men and fails to take into consideration any gender needs. Involving both men and women at all levels of development planning, implementation and evaluation will make a world of difference in the entire society by carrying out social change through development interventions. Such planning processes ensure women to be a social resource and treat them as partners in development. The research article asserts that gender mainstreaming is required to integrate gender concerns in all aspects of planning of resettlement and rehabilitation. The insights in the work are based upon the fieldwork in select resettlement sites of Sardar Sarovar Project in Gujarat. The author adopted participant observation, focus group discussions and key informant interviews as a means for data collection and better comprehension of the study area. Certain strategies are suggested in engendering the planning of resettlement sites, which are also a practical instrument in fulfilling the agenda of putting 'gender' first in the resettlement planning. The paper highlights the urgent need to transform the current planning stereotypes and involve a gender-aware perspective in planning of resettlement locations.

Keywords: Resettlement; Planning; Gender; Displacement; Development

Introduction

Involving both men and women at all levels of development planning, implementation and evaluation will make a world of difference in the entire society by carrying out social change through development interventions. Such planning processes ensure women to be a social resource and treat them as partners in development. This argument presents a robust underpinning for the Gender and Development (GAD) approach. GAD focuses not on women per se but on gender relations i.e. the relations between men and women in diverse settings (Kabeer,1994). GAD approach considers women as active agents and not passive recipients of development (Razvi and Miller, 1995). It is highly relevant for a fair and proper resettlement

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planning. Resettlement refers to physical, pre-planned relocation, combined with appropriate support mechanisms, including social support, in the new location. Resettlement is a combination of physical relocation (displacement) with subsequent attempts to restore the displaced people's livelihood in the new place. It considers resettlement a holistic exercise, encompassing several aspects of life (Terminski, 2013).

Traditionally, the focus of resettlement planning by planners is at the household level. This neglects the understanding of the dynamics of intra-household relations between women and men. This resettlement planning is so mechanical in nature that it fails to take into consideration any gender needs(Sikka, 2016). The ingrained notion of masculine hegemony (Connell, 1987) and the maintenance of patriarchal ideology create ripples in the production of spaces, particularly in spaces created through resettlement of affected people. The inherent societal bias reflected in the policy may preclude women from benefiting from opportunities provided through the project. Adding further, when gender differences and gender needs are overlooked in the planning phase of the projects, then the projects are unlikely to respond to women's need and may even have negative consequences for women (Thukral, 1996).

Planners must have the significant task of listening to both men and women and then to build their vision into planning strategies. A sense need to be prevailed that planning is more than just a technical and mechanical exercise. The policymakers set the planning agenda but it is the planners' perspective which influences the levels of ardour to fulfil the policymakers' wish. In fact, the planners are front-line agents of the state's development intervention. Therefore, they are not merely technical experts but also political actors in the development process.

The present research article highlights the need of reorienting the resettlement planning in context of development projects involving displacement of persons. Certain strategies are suggested in the paper for engendering the planning of resettlement sites, which are also a practical instrument in fulfilling the agenda of putting 'gender' first in the resettlement planning. There is an urgent need to transform the current planning stereotypes and involve a gender-aware perspective in planning of resettlement locations. Since women are affectively attached to the welfare of the household, they are more aware than men about the needs for infrastructure and services for their household. They are also more committed to the success of the projects that improves living conditions, therefore, women's participation is a means to improve project results (Young, 1997).

Objectives of the Study

- To understand the impacts of resettlement planning on gender relations in study area.
- To suggest strategies for engendering the planning of resettlement sites

Study Area

Sardar Sarovar Dam, a large multipurpose river project on river Narmada is located in the Gujarat state of India. Sardar Sarovar Dam has been planned for generating 1,450 MW of electricity and to quench the water needs of the people of Kachchh, Kathiawar, North Gujarat and the southern part of Rajasthan (Figure 1).The construction of the dam began in 1960s which came to its end in 2017 when the dam reached its full height. According to the official estimates, Sardar Sarovar has displaced 46507 families, primarily tribals from the 245 villages

spread over three states of Gujarat, Madhya Pradesh and Maharashtra (Figure 3). The civil society group like Narmada Bachao Andolan contests the official figures and claim that about 1,00,000 families have been displaced by this project. The majority of the resettlers are tribals belonging to tribal communities like the Tadvi, Vasava, Raathwa and Bhilala etc. These resettled persons have been taken as the subject of the present study. To resettle these affected people, around 200 resettlement sites were developed by the Sardar Sarovar Punarvasvat Agency (SSPA) in Gujarat. The maximum number of these sites is located in the Vadodara district. Therefore, Vadodara in Gujarat was selected as the study area for this research.

Figure 1 : Sardar Sarovar Project at its full height of 138 metres on 17 Sept. 2017

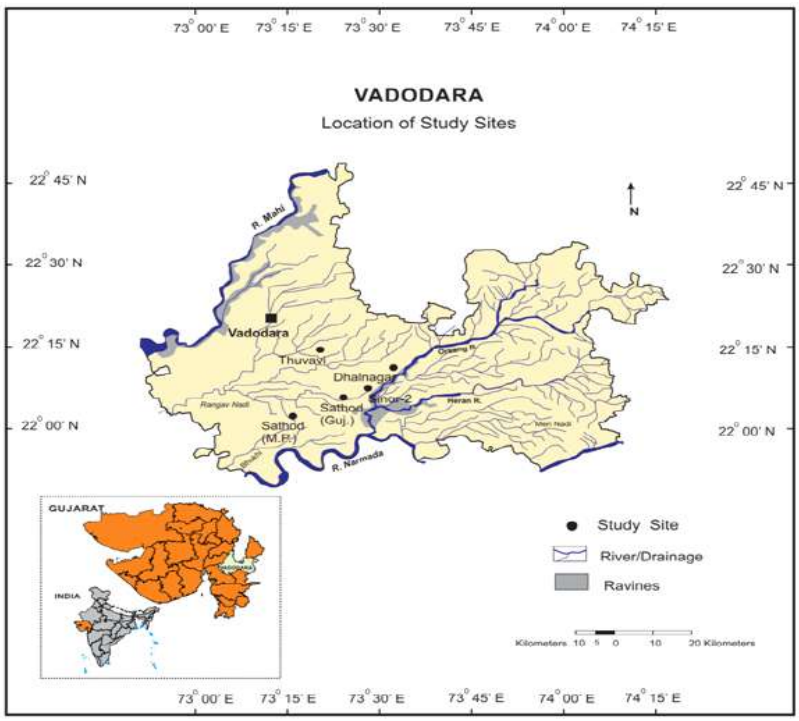

Figure 2: Location of Study Sites in Vadodara, Gujarat

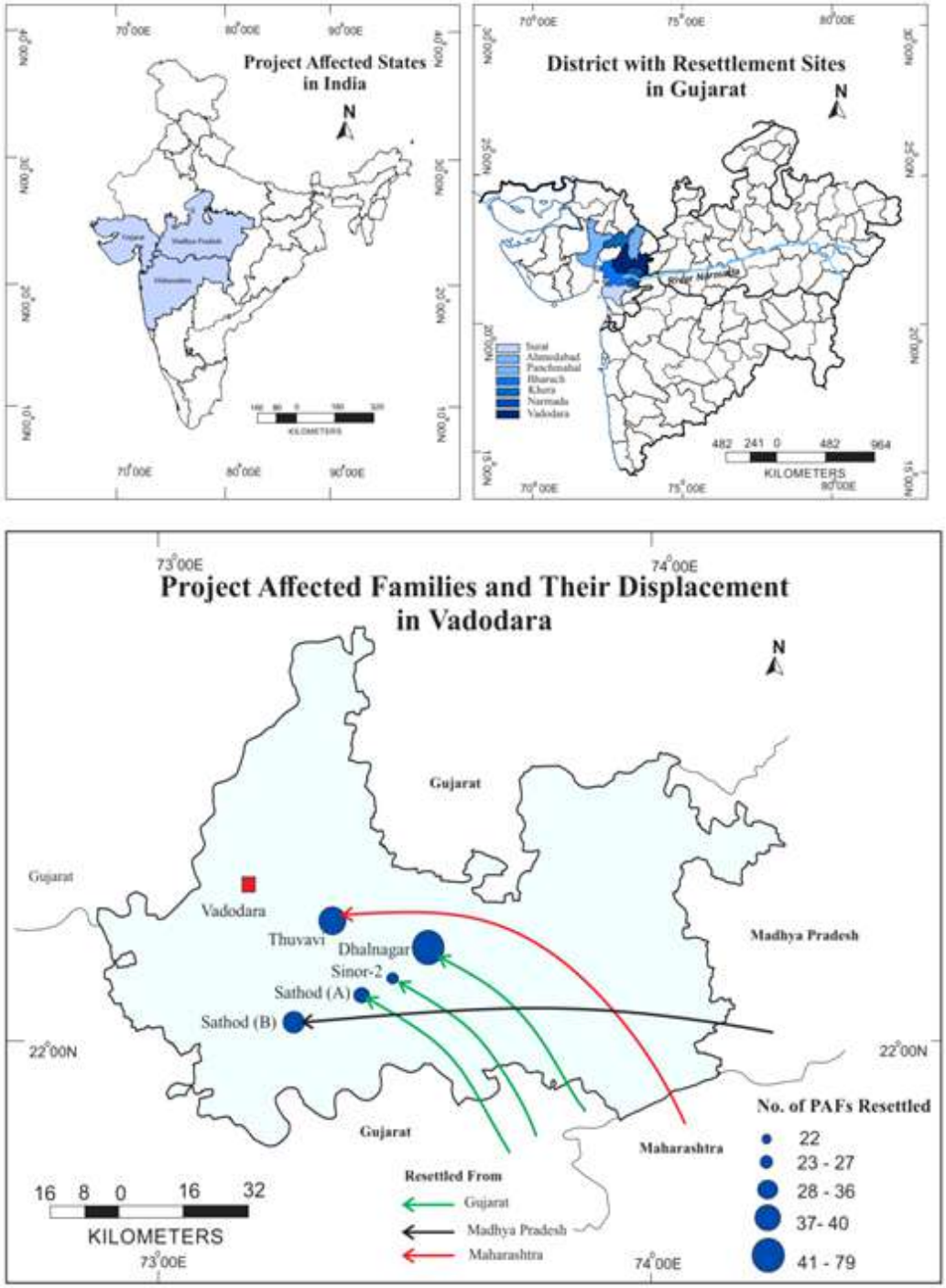

Figure 3: Origin of project affected families and displacement of people due to Sardar Sarovar Project

Methodology

The paper is based on the recently updated research and a conceptual understanding while the initial field surveys of the selected sites were carried out in early 2016.Key-informant interviews, focus group discussions and participant observations were utilised for data collection in the study area. Men and women resettlers from tribal communities residing in the resettlement sites of Sardar Sarovar dam were taken as the respondents of the study. This paper is based on the fieldwork undertaken in the selected resettlement sites of Vadodara, Gujarat. Thuvavi, Sathod (A), Sinor-2, Sathod (B) and Dhalnagar as shown in Figure 2 were the selected resettlement sites for this study. The selected sites were diverse in terms of community and their place of origin and the method of site selection is a combination of random stratified sampling and snowball sampling. Sathod (B) and Thuvavi sites were selected to understand the conditions of resettlers who came from Madhya Pradesh and Maharashtra respectively. Sathod (A), Dhalnagar and Sinor-2 sites were selected to understand the resettlement and rehabilitation of various tribal resettlers from the Project affected parts of Gujarat.

Focus group discussions (FGDs) and interviews of both male and female members of the households were conducted. The FGDs and in-depth interviews were the important qualitative methods from the point of view of this research paper and gave an insight into the transforming gender relations after displacement and resettlement. At least two sessions of FGDs at each selected site were done with small groups of men and women separately. These sessions with focus groups extended to around thirty minutes and the discussion revolved around their participation in pre-project consultation, compensation, and problems faced after resettlement and any suggestions for the same. As a follow up to the group discussions, personal interviews were held. In total, 37 respondents were part of these interviews and these interactions were in-depth in nature which helped in understanding the socio-cultural implications of the resettlement including spatial mobility of men and women. The in-depth interview sample for the study was a 'purposive sample'. Narratives of the resettlers have been incorporated to understand the post- resettlement transformations in the gender relations and implications of resettlement planning. In simple terms, narrative research is used to answer the question – 'what happened' (Zeller, 1995), and to make known or convey information (Lacey, 2000).

Result And Discussion

Impacts of Resettlement Planning on Gender Relations

The changes in production processes caused by irrigation, relocation, changes in occupational structures due to the downstream impacts of dams, all cause profound changes in social and gender relations in a community. In some cases, the social impacts of dams resettlement planning might lead to more egalitarian gender relations. For example, in a resettlement scheme in Zimbabwe, women tended to be less constrained by past kinship patterns and had better relations with their husbands (Koenig, 1995). Displacement and resettlement have changed gender roles in the context of displaced Muslims in Sri Lanka which were displaced by the ongoing civil strife with Liberation Tigers of Tamil Elam (LTTE) from the Northern Province. The displaced women after resettlement worked as wage workers on onion and chilli farms and earned a sufficient income to become economically independent and managed to establish new social networks. On the other hand, the men became used to doing household

chores that only women had done in the past. This included taking children to school and collecting food rations from cooperative stores. During the initial phase of resettlement, many men did not engage in any productive activity to contribute to the household income as they were experiencing the trauma and shame of being displaced as landless refugees. During this time, they depended on their women to earn a living. This reversal of gender roles brought in social, cultural, and economic changes among these displaced communities (Ghani, 2014).

However, a different scenario was observed among the tribal resettlers at the Sardar Sarovar Project resettlement sites in Gujarat, India. New gender roles after the resettlement dictate that women no longer remain productive and equal partners in the community and are meant to remain at home taking little part in income-generating activities (Sikka, 2019). Overall, there has been a devaluation of the roles and tasks that women traditionally performed, and also a relegation of women to a lower status, as gendered roles and functions have taken on different meanings. This devaluation has directly to do with the way gender roles have been created during the process of compensation and rehabilitation established by the Project authorities (Sikka, 2019).The state of Gujarat devised a policy on resettlement and rehabilitation in late 1980. Men resettlers recalled that the compensation benefits they were given were the same as those mentioned in the Gujarat policy. Almost all the men resettlers in various resettlement locations reported being 'happy' because all the assumed head of households and the major sons as well, received land-for-land compensation with legal titles. It was also notable that adult unmarried women and widows were excluded from land compensation. Besides, there was no mechanism to ensure women's participation in pre-project consultation and participation, site selection, design and suitability of house and provision of basic amenities. Women spend her maximum time in the house - nevertheless their spatial needs were ignored.

In the original villages, women were largely engaged in informal work like gathering minor forest products and selling them. Women's supplementary income from minor forest produce gave them a sense of pride and a voice in the household's decision-making. Displacement has completely diminished women's access to the forests and their income from forest produce. In the absence of this supplementary income even the men feel financially tight and insecure. As a result of this, at the new resettlement sites the gender roles have changed and women have become completely dependent on their men for their all needs.

Moreover, there was loss of social networks as a result of relocation as mentioned by the women resettlers of Sardar Sarovar Project, which affected women more than men. For women, much of the support provisions flow from close networks: child care, assistance during sickness, access to information, economic assistance and a variety of other support. Resettlement has taken women far away from their natal home. This has seriously affected their welfare, as support in times of crisis from parents and brothers is not available due to a loss of frequent contact. If socially cohesive units, from the point of view of women were not resettled together, it would seriously affect the welfare of women and children (Parasuraman,1993). However, young men at resettlement sites were able to develop new social networks for seeking employment opportunties. There were also incidences of increase in social evils like alcoholism, gambling and adultery because of displacement and resettlment at the new sites. Women at times faced new forms of violence like sexual abuse, molestation, eve teasing and domestic violence to an increased degree and frequency.

Engendering the Resettlement Planning: Suggested Strategies

Against this backdrop, there should be efforts to mainstream gender – i.e. to integrate gender concerns in all aspects of planning of resettlement and rehabilitation. We assert here the need for gender mainstreaming. Gender mainstreaming is the "process of assessing the implications for women and men, of any planned action, including legislation, policies or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality" (UN Economic and Social Council,1997). Buckingham (2004) stated that gender mainstreaming is an issue of developmental effectiveness and cannot merely be considered as political correctness or kindness to women.

Kumar (2005) quoted by Ahmad & Lahiri-Dutt (2006) puts forth that the time has come for the resettlement planners and policy makers to incorporate recent feminist arguments and approaches arising out of empirical research and social activism. Despite good policies, implementation and adherence to gender equality laws, policy frameworks remain weak. This is particularly evident in more remote areas, where the dynamics of gender relations intersect with traditional culture, beliefs, and practices, and gender inequality is exacerbated by prevailing high incidence of poverty.

Moreover, in 1997 the gender mainstreaming adopted by UN as a global strategy which was based upon the Beijing Platform for Action, have also incorporated many gender planning concepts (Moser, 2014). Gender planning attempts to bridge the gap between theory and practice and gender planning, its principles and practices are still relevant today. Furthermore, gender planning contributes to the continuous demand for practitioner-focused gender frameworks to create awareness among new generations, as well as providing associated tools for policy, planning and project formulation and implementation.

Certain strategies can be suggested in engendering the planning of resettlement sites that can be useful for project authorities. These strategies are developed based on an empirical research on gender dynamics of displacement and resettlement of Sardar Sarovar Project, India (Sikka & Mathur, 2018; Mathur & Sikka, 2021). The strategies for engendering the resettlement planning are as follows:

1. The gender perspective should be recognised in resettlement planning, as women are the primary users of their household space. This should begin by recognition of the fact that bias exists and steps should be taken to rectify it by the authorities. This could be achieved by seeking consultation with project affected men and women about house design to meet their physical and spatial needs like location of kitchen and storage spaces in the household.
2. Project planners and state officials can ensure proportionate or at least 50% of women representation of women during meetings on resettlement planning and discussion on resettlement plan. This could ensure adequate representation and presence of women in all project related meetings. The policy should not be a formality to gender representation at meetings, it should have mechanisms to ensure women's participation. Therefore, it

should be ensured that the consultations should be organised at a time when women find it convenient to attend so that maximum participation is achieved in these meetings. The venue for meetings should be chosen bearing in mind easy access to women. Besides, the discussion in the meetings should take place in local dialects of that community. Moreover, separate meetings with women could also be a progressive method of soliciting women's views on sensitive issues like sanitation, house plan etc.

3. Gender concerns should be addressed in data collection by collecting gender disaggregated data. It is necessary to generate gender-specific data of affected communities in the project impact area. Gender disaggregated data forms an integral part in framing a gender inclusive resettlement plan. The collection of gender disaggregated data can include ownership, access and benefits of resources, household decision making, income earning activities of women and their reliance on common property resources, skills and requirements.

> *"Generate and Disseminate gender disaggregated data and information for planning and evaluation."*
> *"Take measures to integrate a gender perspective in the design and implementation of, among other things, environmentally sound and sustainable resource management, production, techniques and infrastructure development in rural and urban areas."*
>
> - Platform of Action and Beijing Declaration,
> Fourth World Conference on Women, Beijing, 1995

4. The definition of oustee or project affected person should be gender inclusive. Both men and women should be co-beneficiaries in the compensation package awarded to the household. There should be explicit provisions for the individual compensation to single and widowed women.

5. Tenure rights in the form of joint titling can be another step in the right direction as it gives the women power of decision making in households and sense of security, thus affirming the value of the house in their lives as something that not only fulfills their practical gender needs but also their strategic gender needs. Besides giving women 'attachment to the house', the property rights also make them assertive of their needs if their preferences are being overlooked (Datta 2006). This is a bold step in making married women visible in the gender analysis.

6. Gender needs should be fulfilled in site selection, site and housing design and suitability of physical area. This has direct bearing on the women's welfare as she derives much of the support from kin living in the vicinity. It should be ensured by the project authorities that at least 50% of the representatives or resettlers themselves who are shown resettlement sites are women. The details about the sites - location, safety issues and appropriateness should be shared with both men and women. Women's concerns should be taken into account before the site is finalized. Jena rightly remarks, when the Constitution of India under 73rd Amendment Act, 1992 already mandates 1/3rd of the seats of local governments for women, "the inclusion of women in R&R committees is un-negotiable" (Jena, 2006).

7. Project planners should develop an arrangement wherein the affected men and women can participate in the housing design and structure, and location of amenities at resettlement sites. This could ensure that the resettlers particularly women will have an easy access to basic civic amenities like water, sanitation etc. This also fulfils the spatial needs of women, as they spend their maximum time at home. Special efforts should be made to develop sites in a safe and habitable environment. Women's opinion on safety can also be sought.
8. Efforts should be made by the project authorities for income restoration of women to make them financially independent from the men and give them a say in the decision making of the household. Skills training for both men and women, keeping in mind their specific needs and spatial requirements, should be organised. Establishment of self-help groups will also prove beneficial in this context. These self-help groups can also renew the redundant skills of the resettlers. For example, a mechanical flour mill can be set up at the resettlement sites that can be owned as a collective enterprise by women through a women's group, where all members learn to run, maintain and service the mill. Apart from reducing the resettler women's burden of flour grinding, this could increase the feeling of self-worth and also bring collective social recognition to women. The income from these projects can be used for community projects or for providing micro credit and could give women a greater decision making power within the community.
9. In order to make the grievance redressal mechanism gender friendly, the personnel involved should be trained in handling gender sensitive issues. Steps should be taken to ensure the presence of women/gender experts in grievance redressal units at a formal or informal level.
10. There is an urgent need for a gender sensitive institutional framework for resettlement. Female staff or a gender specialist should be hired by the resettlement agency to work with and assist women in various stages of resettlement and rehabilitation. Women's groups should be involved in resettlement planning, management, income generation and grievance redressal.

Lastly, the current planning stereotype needs to be transformed by the incorporation of gender aware organizations and planners into the planning process of resettlement as well as into their monitoring and evaluation.

Good Practice on Engendering Resettlement Planning

A case study of Song Bong 4 Hydropower project in Vietnam can be mentioned as a good practice of planning from a gender perspective. The resettlement plan of the project has ensured the equal participation of women at all stages. Women's voices were heard and agreement was reached in resettlement consultations, women's role in site selection, women's contribution in design and management of infrastructure at sites were some of the pioneering features of gender inclusive approach adopted by these authorities. The intrinsic value of women's participation for women themselves and communities is reflected in the fact that women are continuing to meet on a regular basis even after their villages have been fully

relocated (ADB, 2014). These meetings are avenues to discuss issues ranging from private to community matters at the resettlement sites. Gender related benefits in resettlement have also emerged in this project. Women have equal entitlement to compensation like joint titles in the name of both husband and wife, same individual rights have been guaranteed for households headed by a single man or a single woman, practice of paying cash compensation to both husbands and wives equally, transparently and publicly. Besides, women have direct channels of grievance redressal, women enjoy improved mobility, access to services like healthcare and maximum opportunities to develop skills and capacity of affected women.

Conclusion

In this intervention, it is sought to bring both affected men and women as equal partners in the processes of resettlement planning. Beginning with a broad discussion entailing gender and resettlement planning, the narrative has been situated in GAD approach and laid an agenda for the project planners. In fact, the resettlement shall be treated as a development opportunity, and for meeting the aims and objective of the project benefits, the affected women's participation should be a means to improve project results. The resettlement of Sardar Sarovar project entailed direct impacts on gender relations and gender roles in the project affected communities. The authors assert for gender mainstreaming to integrate gender concerns in all aspects of planning of resettlement and rehabilitation. Certain strategies are suggested in engendering the planning of resettlement sites that can be useful for Project authorities. These strategies are a practical instrument in fulfilling the agenda of putting 'gender' first in the resettlement planning. The pragmatic steps highlighted in the discourse above would assist in transforming the current planning stereotypes and involve a gender-aware perspective in planning of resettlement locations. The Song Bong 4 project, Vietnam presents a good practice where the project planners has involved women as equal partners in all stages of project- pre project consultations, site-selection, infrastructure development, compensation entitlement, access to services, capacity development, grievance redressal and post-resettlement monitoring. With this in mind, the resettlement planers and project authorities are required to critically engage with gender dynamics of the resettlement. The development projects should ensure that the resettlement policies are sensitive with the provisions of sustainable livelihood opportunities for affected, consultation with both men and women in all the phases of the project, sharing project benefits with the affected and an inclusive compensation entitlement.

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STUDY OF VARIABLES OF CLIMATE CHANGE USING STATISTICAL TECHNIQUE : A CASE STUDY OF PATNA DISTRICT

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ABSTRACT

Climate Change refers to increase in the global average temperature due to consistent rise in the concentration of atmospheric greenhouse gases, resulting in climatic shifts and impact across the world. Although climate change has occurred on a global scale, its impact often varies from region to region and even from location to location. Bihar is one of the most climate-sensitive states in India due to its geographical setting, hydro-meteorological uncertainties, dense rural population and high level of poverty and Patna is not exception to this. The city has witnessed constant rise in the temperature and variability in rainfall pattern in last few decades and increase in the occurrence of floods and drought conditions in this region suffice the evidence of climate change impact. In recent years the potential impacts of climatic change and variability have received a lot of attention from researchers. Climatic variability is implied to understand mean state and climatic statistics on all temporal and spatial scale beyond individual weather events. Understanding of climatic variability(such as precipitation, temperature, humidity, etc,) trends and prediction will help policy makers and planners for better management of vulnerable resources. The present study aims to identify trends in temperature and humidity time series of Patna District covering a period of 39 years from 1981-2019 and to predict variation in the variables of climate of Patna District.

Keywords : Precipitation, Temperature, Climate Change, Trend Analysis, Linear regression method.

Introduction

Climate change is a long-term change in the average weather patterns that have come to define earth's local, regional and global climates. It poses a major threat to all dimensions of sustainable development and has widespread impacts across various sectors and ecosystems as well as on the occurrence and intensity of climate related hazards such as floods and drought (Khan et al, 2016). Human activities have increased the atmospheric concentration of greenhouse gases, changing the Earth's climate on both global and regional scales. In recent years the potential impacts of climatic change and variability have received a lot of attention from researchers. According to IPCC (2001), increase in greenhouse gas concentrations increased the annual mean global temperature by $0.6 \pm 0.2°C$ since the late 19th century. Over the past 100 years, the global average temperature has increased by approximately $0.74 \pm 0.18°C$ (Mean $\pm$ s.e.) and is projected to continue to rise at a rapid rate (IPCC 2007). The Fourth

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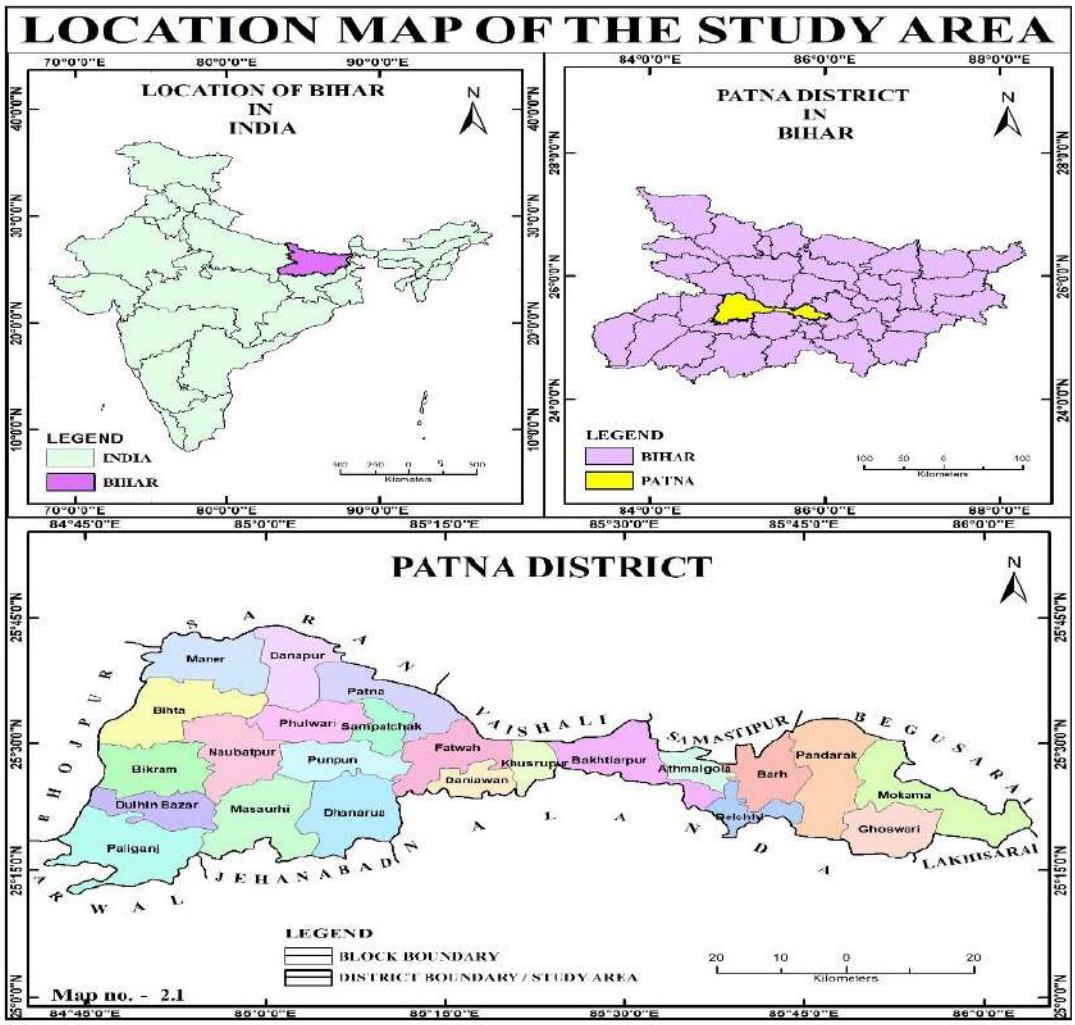
Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) has played a major role in framing the current understanding of likely impacts (IPCC, 2007a, 2007b, (Gosling et al. 2011)). The global mean surface air temperature has risen about 0.5°C during the 20th century(Al-Muhyi, Jabbar, and Kwyes 2016).Although climate change has occurred on a global scale, its impact often varies from region to region and even from location to location. Bihar is one of the most climate-sensitive states in India due to its geographical setting, hydro-meteorological uncertainties, dense rural population and high level of poverty and Patna is not exception to this. The city has witnessed constant rise in the temperature and variability in rainfall pattern in last few decades and increase in the occurrence of floods and drought conditions in this region suffice the evidence of climate change impact.

In current scenario, Policy-makers need up-to-date information on the likely future impacts of



Source : District Census Handbook, Patna, 2011

Figure 1 : The location of study area

climate change on human society and natural systems.(Gosling et al. 2011). Precipitation and air temperature are two of the most important variables in the fields of climate sciences (Chattopadhyay and Edwards 2016). It also impacts the water demand and supply. As cropping season is directly proportional to the rainfall pattern, a better scientific understanding of trends in climatic variables would help policy makers to prepare better plans for sustainable development in agriculture. According to fifth report of IPCC, there exists a direct unambiguous relationship between the concentration of carbon dioxide and rise in temperature universally. Also, climatic variable alters the process of hydrological cycle and climatic impacts are also seen on the health of people and consequently results in noticeable altercation in water present in lakes, ponds, rivers, oceans, etc.

Study Area

The study area of the present research work, being the Patna District, which is located on the natural levee, lies in the central part of the state of Bihar, to the south of River Ganga. It covers an area of 3202 km2. The extent of Patna district is within 25°28?45? N to 25°40? N latitudes and 84°68? E to 85°20? E longitudes. Geographically, most of the area falling under Patna District, exhibits a typical example of natural levee with fine alluvial sediments.

Climate of Patna : An overview

The summer season marks its beginning from the month of March with the blowing of westerly wind accompanied by dust storms locally known as 'loo' and continues up to the end of May. The scorching weather is felt in the month of April, but the mercury shoots up to 46?C in the month of May. The summer is followed by the rainy season, with the onset of south-west monsoon. Precipitation is received from the Bay of Bengal branch, although the temperature falls but it remains Muggy during the months of July- September. The mean normal annual rainfall of the region is 1131mm. The winter season starts from November and continues up to February with pleasant weather and little rain due to retreating monsoon. January remains the coldest month with several chilling cold phases/segments. Figure no. 2 shows that relative humidity falls up to 33 percent in the month of April whereas it rises up to 77 percent during the South-west monsoon in the month of September. Wet Bulb Temperature is highest in the month of August whereas it is lowest in the month of April.

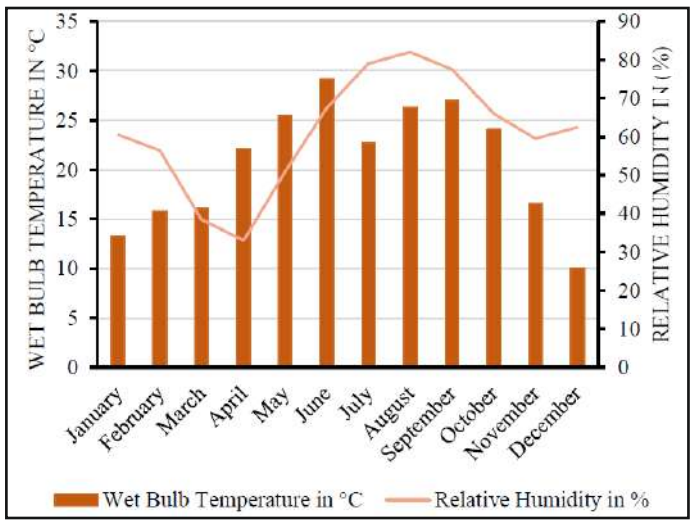


Figure 2 : Weather conditions of Patna District Source: Directorate, Statistics and Evaluation, Government of Bihar

Objectives of the Study

The objective of the study is

- To identify trends in temperature and humidity time series of Patna District covering a period of 39 years from 1981-2019.
- To assess vulnerability to climate in present and future of the region.
- To predict variation in the variables of climate of Patna District.

Methodology and Data Used

Data Sources

The data is procured from NASA POWER - Prediction Of Worldwide Energy Resources (https://power.larc.nasa.gov/ data-access-viewer/). Time series of monthly mean temperature, annual mean (Maximum and Minimum) temperature, annual mean humidity and Annual mean precipitation of Patna district covering a period of 39 years (1981-2019) were analyzed in MS Excel for this study. The temperature data is in degrees Celsius, precipitation in mm and humidity as a percentage.

For better understanding of the observed trends, the temperature and humidity anomalies were computed by Pearson's correlation coefficient:

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

r = correlation coefficient

x_i = values of the x-variable in a sample

$\bar{x}$ = mean of the values of the x-variable

y_i = values of the y-variable in a sample

$\bar{y}$ = mean of the values of the y-variable

In statistics, the coefficient of determination, denoted R2 , indicates how well data points fit a line or curve. Linear regression method is used to find relationship between a set of variables and to understand the future prediction in the variables. The following equation has been used for the present research:

$$Y=a+bx \text{ ----------(1)}$$

Where, Y is the dependent variable

X is the independent variable

a is constant

b is the shape of the slope

Pearson's moment coefficient correlation

In order to measure the strength of association between annual mean temperature and annual mean humidity, Pearson's product-moment correlation coefficient has been computed and its value 0.5164 as shown in figure 3 shows moderate positive relationship between the variables which means as temperature rises, humidity also follows the same trend.

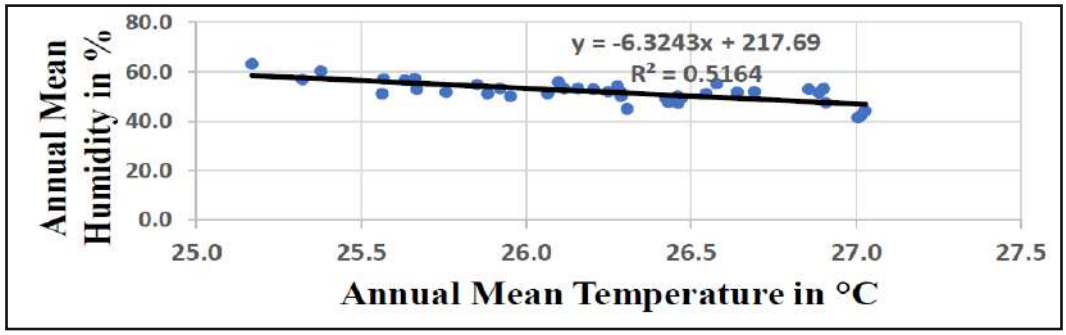


Figure 3 : Pearson's moment coefficient correlation between annual mean temperature and annual mean humidity

Temperature, humidity, atmospheric pressure, wind, and precipitation are some of the important climatic variables which are significant for understanding change in climatic pattern and resultant mitigation and adaptation measures to cope with climate change. Because knowledge of climate variability and trends is important for many aspects, the accurate forecast/prediction of climate variables is also equally important for the policymakers, planners, and other people working on water resource management and on mitigation and adaptation measures to cope with climate change. (Mahmood, Jia, and Zhu 2019).

Prediction of Variation in Climatic Variables using Regression Analysis.

An understanding of climate variability, trends, and prediction for better water resource management and planning in a basin is very important. All data records show peaks and valleys in sync with each other. Regression equations in table 1 has been applied to project yearly annual maximum mean temperature(fig.4), annual mean minimum temperature (fig.5), annual mean relative humidity and annual mean precipitation (fig.6).

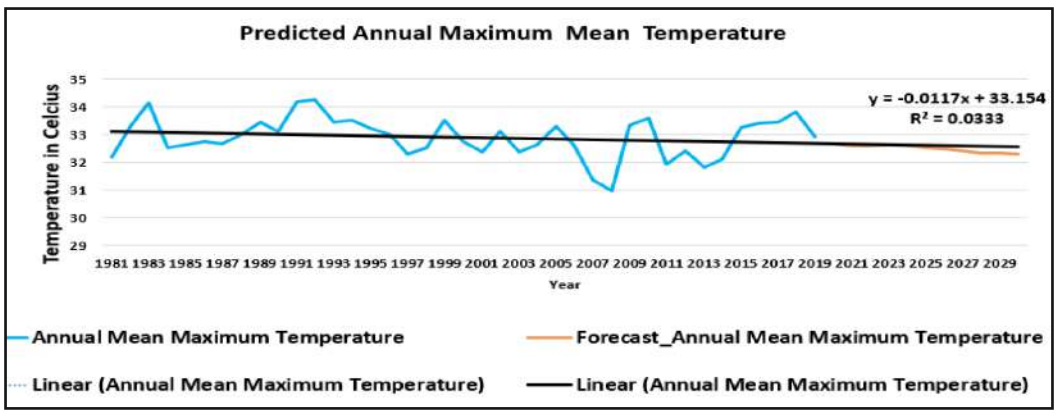


Figure 4 : Showing anomalies and forecast in annual maximum mean temperature

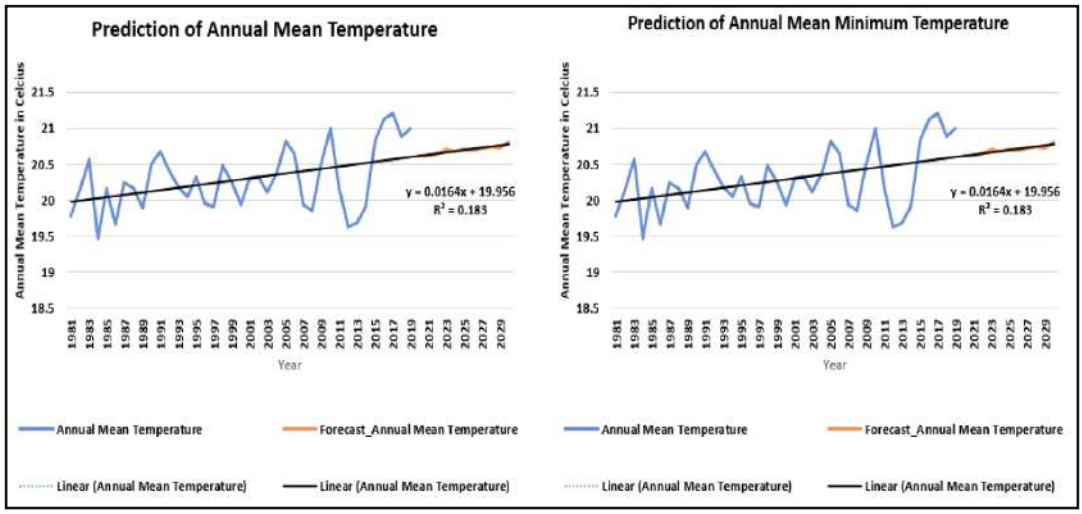


Figure 5 : Showing anomalies and forecast in annual mean minimum temperature

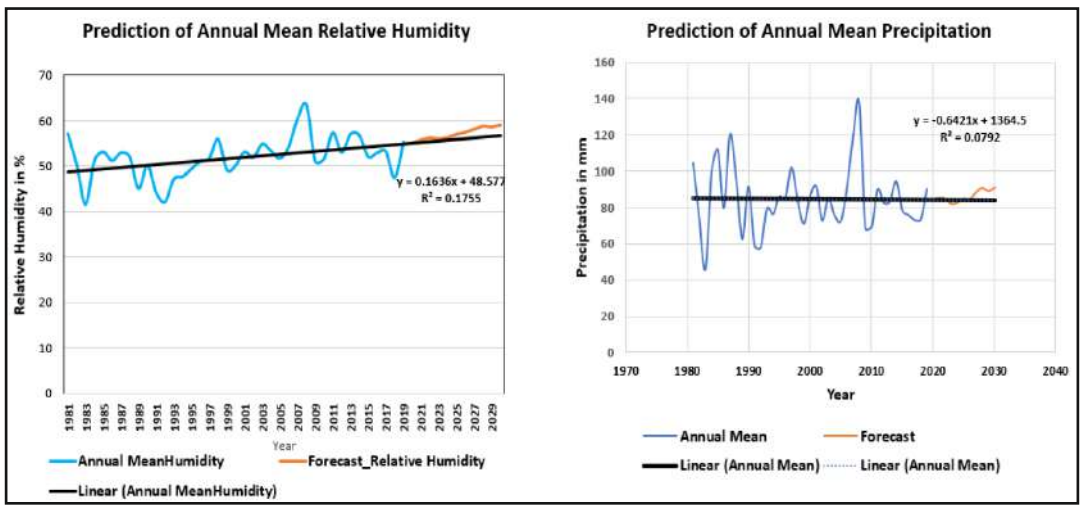


Figure 6 : Showing anomalies and forecast in annual mean relative humidity and annual mean precipitation

All data on temperature show rapid warming in the past few decades, with the last decade being the warmest. The resultant analysis indicates how strong the trend in temperature or humidity is, and whether it is increasing or decreasing. Fig(4) represents anomalies and forecast in annual maximum mean temperature. It is clear that the trend has increased from year to year, and the magnitude of temperature increase is 0.32 °C for the period (1981 to 2019), this value is less than that presented by the IPCC, 2007 (Over the past 100 years, the global average temperature has increased by approximately 0.74 ± 0.18°C (Mean ± s.e.)). of the most important results that we draw from given figure 4, 5, 6 is that the linear regression line divided the temperature and humidity time series into two parts, the first part begins from.

Table - 1 : Showing forecast of the change in the climatic variables- temperature in ° C, relative humidity in percentage and precipitation in mm.

Year	Annual Mean Maximum Temperature	Annual Mean Minimum Temperature	Annual Mean Temperature	Annual Mean Relative Humidity	Annual Mean Precipitation
2020	32.686	20.612	19.713	55.122	67.450
2021	32.617	20.616	19.679	55.790	67.544
2022	32.604	20.642	19.663	56.133	65.854
2023	32.659	20.701	19.697	55.858	61.780
2024	32.603	20.680	19.662	56.223	61.144
2025	32.546	20.708	19.662	56.800	61.811
2026	32.487	20.688	19.617	57.275	59.803
2027	32.409	20.720	19.617	57.996	61.976
2028	32.358	20.744	19.602	58.724	62.241
2029	32.361	20.731	19.570	58.622	58.314
2030	32.326	20.799	19.592	59.118	57.803

The first year of the series is 1981 and upto 2000 if is with a negative value, while the second part takes positive value from 2000 until the end of the series in 2019. This means that the first part is comparatively cold and the second is warm relative to the mean value. Also the situation is similar when trend analysis of relative humidity is observed, the first part of the humidity time series is negative and second part is positive. This means that humidity begins to increase from 2000 its value decreased below the average.

The trends of temperature (annual maximum and annual minimum) have been obtained using a linear regression line. Unlike precipitation and humidity, an increasing trend for temperature has been noticed from fig 5. The rate of change for minimum and maximum annual mean temperature is 0.0063 and 0.0029 ° C. The rise in temperature can be attributed to various regional factors like growth of industries which do not abide the GHGs emission norms in the peripheral areas of the city. The relative humidity and precipitation trend depicts the r^2 value of 0.175 and 0.079 depicts very poor corelation over the years. The highest relative humidity value for the year 2030 has been predicted as 59.11 % which is approximately 4 percent greater than the year 2020.The rainfall anomaly can also be seen due to the presence of interannual variability where the rainfall trend decreases below the long-term average during the years 1982 and 1993 and increases in the year 2009 and especially year 2019 experienced maximum annual rainfall in last two decades which has led to conditions of drought and floods alternatively.

To summarise variations in the climatic conditions in Patna district, climograph for five decades i.e, 1980, 1990, 2000, 2010 and 2020 has been prepared. To construct climograph temperature in ºC and Relative humidity for aforementioned five consecutive decades were procured from NASA POWER - Prediction of Worldwide Energy Resources (https://power.larc.nasa.gov/data-access-viewer/. Further, wet bulb temperature in F was calculated using the given formula(Roland Stull, 2011):

Tw = T * arctan[0.151977 * (rh% + 8.313659)^(1/2)] + arctan (T + rh%) - arctan(rh% - 1.676331) + 0.00391838 *(rh%)^(3/2) * arctan(0.023101 * rh%) - 4.686035----------(ii)

Where T = Temp in F

rh = Relative humidity

Table-2 : Showing month-wise wet bulb temp in F and relative humidity(%) for year 1980, 1990, 2000, 2010, 2020

Month / Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Wet bulb Temp (F) 1980	44.71	50.1	51.34	53.31	68.83	77.47	80.51	80.36	78.76	68.75	58.05	49.18
Relative Humidity 1980	29.73	33.64	25.11	16.94	30.08	48.26	83.38	87.62	85.54	70.42	48.26	42.04
Wet bulb Temp (F) 1990	44.55	48.26	52.07	50.99	63.24	77.02	80.12	80.33	77.82	70.01	57.86	50.7
Relative Humidity 1990	38.24	32.55	24.15	13.51	21.95	44.13	75.29	85.31	84.92	68.77	53.9	49.48
Wet bulb Temp (F) 2000	43.71	45.18	46.08	56.47	72.34	78.95	80.25	79.91	77.86	69.76	57.43	46.4
Relative Humidity 2000	30.92	28.42	16.48	19.45	38.02	65.57	78.74	80.61	86.65	66.67	49.04	41.25
Wet bulb Temp (F) 2010	46.12	50.13	51.79	55.92	70.83	75.27	79.75	80.22	78.39	72.4	64.16	50.64
Relative Humidity 2010	45.28	36.7	20.02	16.86	35.75	42.21	69.27	78.64	83.76	74.15	63.67	52.4
Wet bulb Temp (F) 2020	46.63	52.01	53.95	62.64	64.03	75.76	81.12	80.88	78.74	72.02	64.43	52.69
Relative Humidity 2020	39.64	38.48	28.22	27.71	23.13	39.43	75.4	80.41	82.18	82.07	75.47	71.09

In the given figure 7 the climograph shows high wet bulb temperature and relative humidity is high as compared to other months. In the year 1980 it can be noticed that there is an increase in wet bulb temperature, it goes up to 80ºF in the month of July and August. Simultaneously relative humidity is also high for the aforementioned months. This makes the climate muggy. The same trend has been noticed in the decades 1990, 2000, 2010 and 2020 with slight variation. Climograph of Patna in all decades witnessed diagonally elongated shape which is typical example of monsoon type of climate.

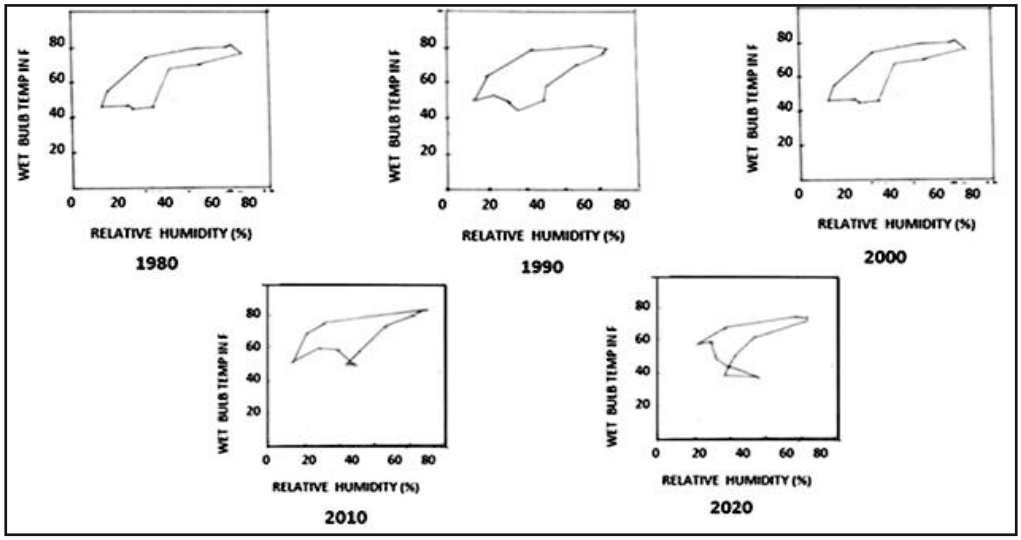


Figure 7 : Showing Climograph of Patna in 1980,1990, 2000, 2010, 2020

The city has witnessed impact of climatic variability in

- agricultural productivity,
- on ecological system
- Health hazard.
- According to health experts, such change in climate is taking a toll on human health and leading to an increase in the number of cancer and diarrhoea cases(Report-Times of India, Feb2022).

Conclusion

Rainfall and temperature trend analysis play a predominant role in understanding the climatic variability of a region (Kumari et al, 2021). Due to its physiographic location Patna is prone to disasters such as flood and drought and vulnerable to changing variability in climate. The linear increase in minimum temperature is higher than that of mean and maximum temperature. Increasing temperature will hit the agricultural production along with associated livelihoods of the people and ecosystem at the large. The results from this study also indicates an increase in rainfall in the future climate, which would increase the chance of flash floods at most of the sites studied. An increase in rainfall intensity in the future climate may lead to flood conditions and lesser groundwater recharge(Tesfaye, et al, 2017). Therefore, it is high time that the concerned authorities should address the critical issue of climate change more comprehensively and holistically.

In order to mitigate the adverse impact of climate change. There is a need of these suggestions:

- People should be made aware of the effects of climate change through different media such as radio, TV, newspapers, banners, face to face contacts and through NGOs.
- There should be change in the cropping pattern seeing the variability of monsoon
- Farmers should be made aware of the long-term and short-term prediction, and
- Awareness about the resultant health hazards should also be made.

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STRATEGIES FOR SUSTAINABLE INDUSTRIAL DEVELOPMENT : A CASE STUDY OF ARWAL DISTRICT IN BIHAR

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ABSTRACT

India, the second most populous country in the world having large rural population, which makes evolution of non-agricultural pursuits essential for the development of the country. The development is a comprehensive and multidimensional concept and rotates around three I's, "Intention, Incentive, and Investment", and is unfortunately missing in the context of rural development. Agriculture being the only source of employment in the Arwal district is the key to its backwardness in the country. There is an urgent need to formulate strategies to augment employment opportunities in non-farm sector in rural areas. The formulation and adherence to sustainable rural development goals may go a long way in achieving desired industrial development in the study area.

Keywords : Sustainable Development, Infrastructure, land reforms, Budgetary Allocation, Horticulture

Introduction

Development is a comprehensive and multidimensional concept and rotates around three I's, Intention, Incentive, and Investment. The intention of development leads to incentive for development and which in turn mobilize investment for the same and is unfortunately missing in the context of rural development. India, the second most populous country in the world with large rural population makes country's development synonymous with rural development. But the rural areas in the country are confronting with various social, economic, environmental and political issues and reeling under poverty and unemployment. Agriculture being the only source of employment in the rural area is the key factor of rural backwardness in the country. Hence it is important to address the problem at the earliest to bring about overall development of the country.

The Arwal district is also passing through the same phase. In the absence of non-farm activities and industries, people are largely dependent on agriculture for their livelihood in the district. The green revolution induced agricultural advancement has greatly helped the big farmers in the one hand and further widened the gap between privileged and under-privileged farmers on the other, and was the main cause of Maoist insurgency in the district in the past. At present, the district requires appropriate strategy, extensive grass root planning, stakeholder participation and conducive policies to initiate sustainable industrial development process. This can prove

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to be a powerful tool to realise four critical goals of poverty reduction, wider shared growth, food security and sustainable resource management (World Bank, 1997).

There seems to be a fallacy in the conceptualization of rural development initiatives, and is largely linked with improvement in various infrastructure facilities and rise in agricultural production. But agriculture is just a component of the rural development. In fact, the process of economic development is a means to enable human beings to realise their full potential, nurturing of human values and attainment of human dignity by all (Rao, 1997). In fact, rural industrial development is a process of judicious utilization of natural and human resources and existing infrastructure facilities to enhance the quality of life of the rural folk in economic, physical and intellectual terms. Thus, the rural industrial development initiatives need to incorporate micro- industrial pursuits like bee rearing, food processing, horticulture, floriculture, sericulture, dairy products and eco-tourism and many more.

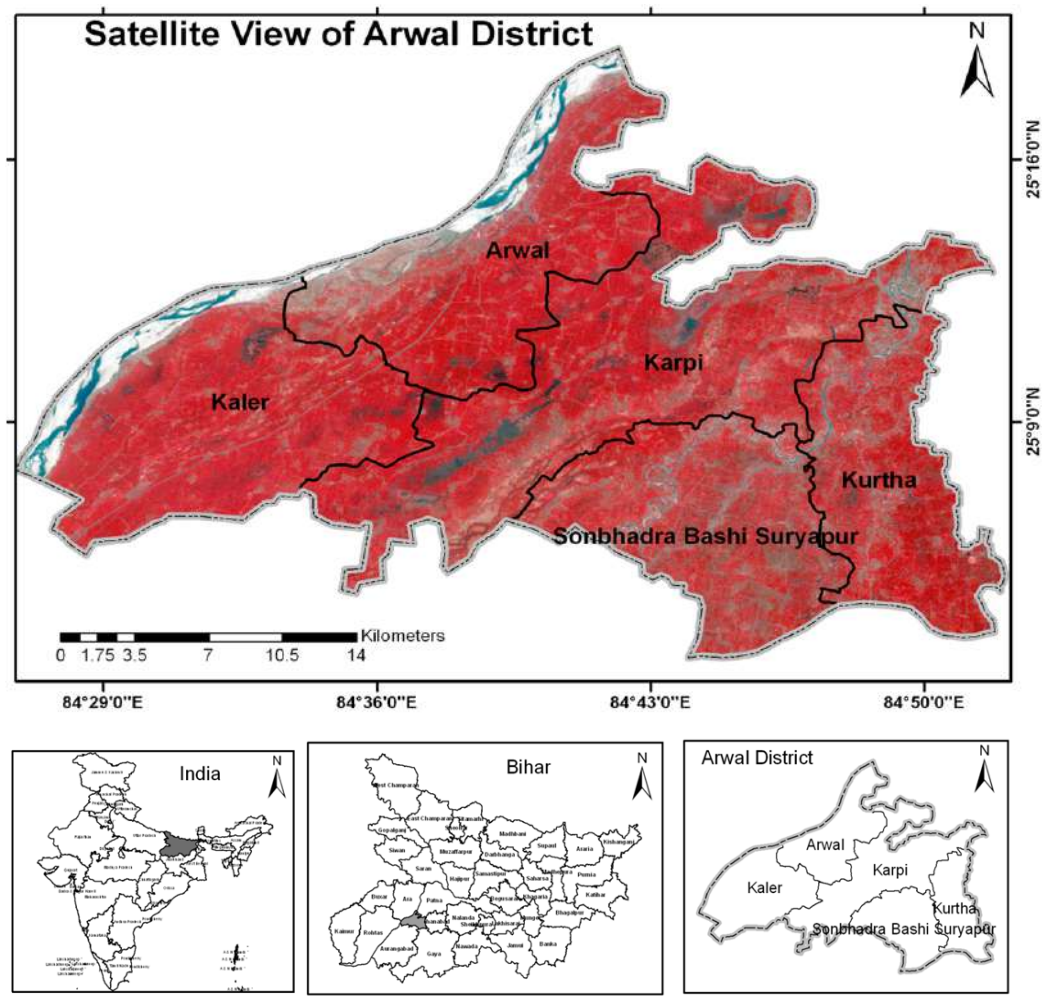

Figure 1 : Map of Arwal District

Objectives of the Study

The present study proceeds with the following aims and objectives:

- To evaluate resources potential and infrastructure facilities present in the district,
- To analyse means and ways to improve infrastructure facilities,
- To explore opportunities and avenues for sustainable industrial development of the Arwal and at the same time to see how viable strategies could be prepared .

Research Design

The present research paper is based on secondary data and extensive literature survey. The secondary data has been obtained from various authentic government and non-government sources. Appropriate cartographic and statistical technologies have been used to represent the obtained facts and figures.

Study area

Arwal district of Bihar is located between 25°00°N to 25°15°N latitudes and 84°70°E to 85°15°E longitudes(Asmarika, 2011). Initially Arwal district was a sub-division of Jehanabad district and in 2001 it was separated from Jehanabad to form a district. Arwal district comprises a sub- division, 5 blocks, 68 panchayats and 317 villages. Arwal, Kaler, Karpi, Kurtha and Sonebhadra Bansi are the five blocks, Arwal being the headquarters of the district. The district occupies an area of 637 square kilometers having a population of 7.09 lakhs (Census, 2011).

Result and Discussion

Appraisal of Resources Potential and Infrastructure Facilities in the District

Alwar district situated in south Bihar and is composed of fertile alluvial soil and is endowed with abundant water resource. The district has meager vegetation cover of just 6.87 percent (ADH, 2011) of the land. Agriculture is the main occupation in Arwal. The agricultural

Table 1 : Occupational Structure in Arwal District

S.N.	Categories	Percentage
1	Cultivators	20.79
2	Agricultural labourers	61.22
3	Household industry workers	2.86
4	Other workers	15.13

Source : NABARD, 2021-22

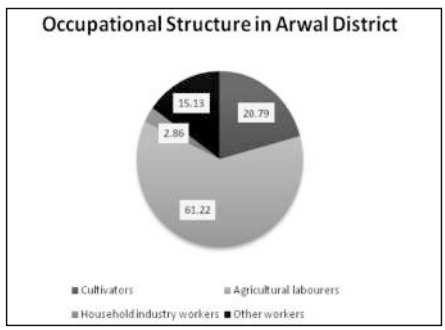

Figure 2

produce includes cereals, sugarcane, vegetables, fruits, and fodder. Table 1 shows occupational structure of Arwal district and it is clear that 82.1 percent (Cultivators-20.79% and Agricultural labourers-61.22%) working population is engaged in agricultural activities, 2.86 percent of work force is engaged in household industry and 15.13 percent of remaining workforce falls under other workers.

The table 2 gives the details of various enterprises in the Arwal district. The agro-based industries include rice, flour, pulses and oil crushing mills. The metal work units incorporate goldsmith, blacksmith, iron-lathe, and other enterprises include cane and dried leaf work, earthen pottery and shoe making. Above types are mostly run by family members as family business to cater the local needs. Altogether, there are 68 furniture manufacturings, 31 agro-based and 18 metal processing units, collectively employing 921 people (DIC, 2016). The basic infrastructure facilities and amenities are pre-requisite for upliftment and development of any region which is in a dilapidated state in the study area as the table 3 clearly reflects.

Table 2 : Details of Existing Micro & Small Enterprises & Artisan Units in the District

S.N.	Enterprises	No. of Units
1.	Agro-based	31
2.	Tailoring & embroidery	15
3.	Wooden furniture manufacturing units	68
4.	Paper and Paper products	04
5.	Chemical/Chemical based	02
6.	Metal based	18
7.	Repairing & servicing	17
8.	Others	14
	TOTAL	168

Source: DIC Arwal, 2016

Table 3 : Social Infrastructure Facilities in Arwal District

SL. No.	Amenities & Infrastructure	Total Number	Population Being Catered
1	Primary Schools	282	2,503
2	Middle Schools	187	3,747
3	High Schools	39	17,970
4	College	04	1,75,211
5	Primary Health Centers	05	1,40,168
6	Health Sub-Center	65	10782
7	Bank	14	50,060

Source: Self Computed with the help of District Handbook 2011.

The above table makes it clear that the educational facilities are not up to the mark and district has a literacy rate of 69.54 percent. It has 4 colleges, 39 high schools, 187 middle schools and 282 primary schools (arwalpolice.bih.nic.in), each catering a population 2,503, 3,747, 17,970 and 1,75,211 respectively. Poor infrastructure, paucity of educational institutions, incompetent and untrained teachers, and people's ignorance are collectively responsible for poor state of education here. The health service too is in a shabby condition, having just one Sadar hospital. This apart it has 5 Primary Health Centers and 65 Health Sub-Centers (dhsarwal. bih.nic.in), each serving a population of 1,40,168 and 10,782 persons respectively.

Banking facility is too in a shabby condition, having just14 banks (Website, Arwal), each bank serving a population of 50,060. It is obvious that Arwal district has poor infrastructure, unable to utilize its resources sustainably and is reeling under poverty and unemployment.

Means And Ways to Improve Infrastructure Facilities

There is an urgent need to strengthen the infrastructure to initiate the process of sustainable development in the district. There is a need to work on education, health and sanitation status of the district. Education enhances one's ability to comprehend ideas, technology, and policies and empowers the community as a whole. It is important to renovate educational infrastructure, and the appointment of adequate competent teachers. The self-employment vocational training, such as mushroom cultivation, bee rearing, silk worm rearing, water harvesting, composting need to be imparted to rural youth to evolve efficient and skilled human resource and accelerate resources mobilization. The Kaushal Vikas Yojna and Hunar scheme are governments initiatives in this direction (https://state.bihar.gov.in). The health and sanitation infrastructure too need to be restored as a healthy body shelters a healthy mind which in turn, empowers the human resource. The financial institutions too required to be re-organized to facilitating transparency in transactions. Measures such as micro-credit and viable crop insurance policy need to be incorporated.

The development of other infrastructural facilities such as access to electricity, sanitation, safe drinking water, housing, irrigation and transportation facility are equally important. Power resource and electricity are key input for economic development, however electricity supply in the district is largely insufficient and mere 8.41 percent (DCH, 2011) of it's electricity demand. There is an urgent need to work in power sector. The geographical location favours the development of solar energy, and installation solar panel grids throughout the district can transform the electricity deficient district into self-sufficient one. Likewise, biogas is a perfect solution for decentralized off-grid electricity situations in rural areas where abundance of biowaste is available as feedstock (www.biowaste-to-biogas.com/). On the lines of Chhotkei village in Angul, Odisha which has installed first smart micro electricity grid based on solar power, generating a 30kWp daily (https://sunmoksha.com), creation and management of mini, micro, and nano grids based on solar and bio-gas energy can make Arwal self-sustainable in energy resource. In the present digital era, internet connectivity and broadband are essential for better use of resources. The intelligent logistics networks would allow villages to provide their products and services more efficiently on urban and global markets.

It is evident that the district's economy is largely dependent on agriculture and allied services, hence it is essential to consolidate the present agricultural system on which foundation of industrial development can be laid. The land reforms measures are imperative to enhance agricultural efficiency. The need of the hour is the sustainable use of land resources and re-orientation of long-term growth policies in the favour of small farmers to maintain food security and social equity in the district (Boron. Et.al., 2016). Strengthening of the present agricultural and land utilization system is essential to facilitate economic diversification.

Opportunities, Avenues and Strategies for Sustainable Industrial Development

The Arwal district requires extensive resource appraisal and formulation of realistic sustainable development goals to break the inertia and accelerates pace of industrial development. The district holds tremendous potential to cater on-farm and off-farm small industrial activities, such as poultry farming, dairy farming, fishing, mushroom cultivation, honeybee rearing, sericulture, composting, basket making, pottery, horticulture, processing of agricultural products, eco-sustainable tourism and many more. However, most of the above-mentioned pursuits are being practices in the district in a subdued manner and need to be planned and amplified to transform them into profitable venture.

The development of livestock rearing, dairy farming, fishing and poultry farming can prove to be take off point for sustainable industrial development in the area. The Arwal district is situated close to Patna, Gaya, Jehanabad and Ara urban areas and have high demand for animal products. At present there are 94 dairy co-operative society and 1 milk collection unit in the district (NABARD, 2020-21). There is also rising demand for organic milk derived from native breeds (Neelgai). The small and marginal farmers can be organized under cooperatives and brought into this tread with little help and support from government or non-government organizations. At the same time the cattle dung can be utilized to form biogas, a clean source of energy, and the left-over slurry can be used as manure.

The Poultry farming too is not much developed here, as per 2010-11 estimates there are a few commercial poultry farms having a total of 2916.4 poultry birds (46.0 birds per hectare) and addition to that there are 2989.14 poultry birds (47.1 birds per hectare) being reared on individual courtyards(PLCP,ARWAL, 2010-11) for self-consumption. The farmers in the district being financially weak and hardly have any access to financial institutions are not capable of establishing commercial poultry farm, but those who are keeping poultry birds on individual basis can organize themselves in a group to form cooperative and can collectively sold their products in nearby markets. They can concentrate on rearing native breeds, on locally available feed which will enhance the nutritional and test quotient of the product and will be able to create their own demand base. It will be both profitable as well as cost effective. At the same time the broilers and layer-based poultry farms also need to be expanded greatly to meet rapidly growing demand. To promote poultry farming the government of Bihar has come up with Samekit Murgi Vikas Yojana, which has training, credit and marketing provisions (https:// vijaysolution.com/).

Red meat is also in great demand and pork, buffalo beef and goat meat are important source of red meat in Arwal. Goat and pig rearing is a low-input and high-return activity and does not require a lot of skill (ILRI FDGs 2018) and is largely reared by poor and scheduled caste communities on a small scale in backyards on household waste and agricultural crop residues as feed. They need to be provided with infrastructural, technical and financial assistant to make it a profitable venture.

The Arwal district is dotted with water bodies which can be utilized for fishing, and

aquaculture on cooperative basis. People may be trained to rear ornamental fishes which has high demand in urban areas. The National Fisheries Development Board (MOA&FW), Hyderabad has formulated many schemes to support ornamental fisheries in the country under Blue Revolution (https:// www.oftri.org), which need to be utilized. It can be done as a backyard venture as well as on extensive commercial basis both the options are needs to be explored by the district authorities. The fresh water pearl culture too can be developed using base technology for cultivating pearl in freshwater habitat created by the Indian Council of Agricultural Research (ICAR) and Central Institute of Fresh Water Aquaculture (CIFA) Bhubaneswar (https://www.intechopen.com). The interested people can be trained for the same.

The lotus cultivation too has potential to augment farmers income. as it is in good demand. Lotus flowers contain medicinal properties and its seeds, young leaves and rhizomes are all edible and are used in various cuisine and for making pickles. It is used for decoration purpose, the large leaves are used as a wrap for food. A unique fabric from the lotus plant known as lotus silk is derived from the lotus stemsand. it is one of the most costly expensive fabrics in the world (https://en.wikipedia.org). It is an important venture in rural areas of Manipur and the dissemination of this technology in Arwal can be of great help.

In order to achieve above objectives it is important to revamp animal husbandry and livestock related infrastructure in the district and requires consolidated effort of all the stakeholders. The skewed veterinary health services, non-availability of animal feed for all species (Rahman 2017), absence of cold storage facility, negligible budgetary allocation for livestock research and development (1 percent) is a major challenge at present. The district has only 08 veterinary hospitals, 08 artificial insinuation centres, and 04 animal markets and they need to be extended(NABARD, 2020-21). The women folks are intrinsically involved in livestock management but does not have access to technology, credit and, services as their men counterpart, it is essential to eliminate this gender gap to accelerate development in the livestock sector. It is important to bring the scheduled castes population (20.16%) to the fore front as they largely depend on livestock rearing for their livelihood but unfortunately their voice is unheard due to limited bargaining power (Nathan and Xaxa 2012). The strategies for smooth marketing of the products without intervention of middle man is equally important.

The horticulture and related food processing activities too have tremendous potential in the district. Horticulture mainly comprises of fruits, vegetables, ornamentals, medicinal and aromatic plants, mushroom cultivation, apiculture (bee keeping) and sericulture practices. The Table 4. reflects the composition of horticulture crops in Arwal districts. It is clear that area under horticulture crop is quite meager. However, among fruits, mango occupies larger area and production both. Whereas among vegetables potato has largest area and production both. There is need to expand area under horticulture crops. The community land and premises of government buildings can be utilized for the purpose. People are needed to be encouraged to plant fruit trees in their premises as well.

Table 4 : Area Under Horticulture Crops in Arwal District

Horticulture Crops			
I.	**Fruits**	**Area (in hectare)**	**Production in Metric Tons**
Sl. No.			
1.	Mango	500	4500
2.	Guava	200	1800
3.	Banana	150	9150
4.	Citrus fruits	150	1500
5.	Muskmelon	NA	300
6.	Watermelon	NA	600
7.	Anole (gooseberry)	NA	200
II.	**Vegetables**	**Area (in hectare)**	**Production in Metric Tons**
1.	Bitter gourd	110	880
2.	Bottle gourd	500	870
3.	Green chilli	310	3926.68
4.	Potato	4561	111744.5
5.	Cauliflower	400	8100
6.	Tomato	400	8500
7.	Brinjal	410	9737.53
8.	Onion	400	9900
9.	Cabbage	400	6800
10.	Okra	200	2400
11.	Carrot	150	1050
12.	Pea	100	500
13.	Radish	100	2100
14.	Parwal	100	600
III.	**Medicinal and Aromatic crops**	**Area (in hectare)**	**Production in Metric Tons**
1.	Lemon grass, Tulsi, Mentha, Aloe vera etc	**.03**	**NA**

Source: Horticulture Department, Government of Bihar, 2018-19

The people need to take advantage of government scheme "Mukheya Mantri Bagwani Mission", aimed at promoting cultivation of horticulture plants. The scheme has the provision of subsidy on establishment cost of orchards and gardens, on refrigerated Transport vehicles. Honey extractor Machine, etc. It also aims at creation of direct rural market, Solar Micro Cool Chamber and functional infrastructure for collection, sorting, grading, and packing units (http://horticulture.bihar.gov.in).Under the scheme training is also imparted to farmers and has provision of exposure visit for the farmers.

This apart, the food processing industry holds tremendous potential to accelerate industrial development in the district. Numerous agricultural, horticulture and livestock products can be processed to enhance their utility and value. Maize is an important crop in the district and is mainly used as animal feed and is consumed in various forms. It can be processed to make

frozen corn, corn starch, corn flakes, corn chips, corn cob jelly. Baby corn is also an important maize product.

Corn cob, a waste product of corn contains large amount of sugars that can be further utilized to produce various compounds (Cao et al., 1996). This natural and organic material may be used as a raw material to process thermal insulating products, light partition walls, ceiling coating, indoor doors and furniture (https://www.sciencedirect. com), liquid fertilizer (https:// www.philstar.com), animal feed (https://uma.ac.id) and being a bio-absorbent material can be effectively used to filter contaminations present in water (https:// www.efilters.ca).

Banana offers significant opportunities for both fresh and processed food market. The processed item of banana includes banana chips, pulp, baby food, ready to eat, canned banana flower and stem curry vegetables, and pickles. This apart the banana leaf and trunk can process to obtain fiber which has a good market demand. The Naugachia, near Bhagalpur district has set up a banana fibre extraction and yarning units. The banana leaf can be used to make organic disposable plates and bowls (http://swc.bihar.gov.in). Besides fruit and vegetable processings, such units also include manufacturing of dehydrated and frozen fruit and vegetable. Dehydrated and powdered vegetables such as garlic, ginger onions, coriander, mint and fenugreek leaves have great demand. The processing of mangoes into pulp, juice, pulp slabs, jam, jelly, beverage, nectar, candies, powder, is also a lucrative option (http://www. udyogmitrabihar.in). Similarly, many other horticulture products produced in the district may also be processed to add value and create job options. The establishment of small processing units to prepare squash and pickles from citrus fruits, pickles from Anole, chilli sauce from green chillies, potato chips from potato, tomato sauce from tomato, frozen peas will definitely add to industrial development and prosperity of the district. It is also required to lay hand on newer avenues such as honey bee rearing, mushroom cultivation, compost manufacturing units, manufacturing of tiles made of cereal husks, Aloe-vera processing units, development of nursery to produce decorative and feng-sui plants, hydroponic and vertical farming will further push district towards development.

In this regard, the government has launched various programmes like Pradhan Mantri Kisan Sampada Yojana (PMKSY) and Micro Food Processing Enterprises Scheme (PMFME), the vision 2015 and Bihar Start up policy to encourage establishment of horticulture related enterprises. The vision 2015 was designed to 'tap the untapped potential' of Bihar's agriculture sector through accelerated development of the food processing industry. Likewise, Bihar Start up policy 2022 has also incorporated development of food processing industry under High Priority Sector.

The traditional artisans involved in the manufacturing of pottery, cane and palm leaves products too need to be updated, trained and financed to adopt newer technology to join present market for their products. The potters need to train to manufacture pottery utensils and crockery which is nowadays in high demand. Similarly, cane and palm leaf workers to need to be updated regarding current demand of their products and should be trained accordingly.

The fashion industry is in big boom and requires trained and competent manpower. The government need to utilize this opportunity and provide tailoring and embroidery to female folks and link them with the people involved in fashion tread.

Rural tourism and agritourism are complementary economic activities that could further stimulate rural entrepreneurship in the district. Rural tourism refers to the movement of people from their normal place of residence to rural areas for a minimum period of twenty-four hours to the maximum of six months for the sole purpose of leisure and pleasure (https://tourismnotes. com/rural-tourism/). Whereas, agritourism presents a unique opportunity to combine aspects of the tourism and agriculture industries to provide a number of financial, educational, and social benefits to tourists, producers, and communities (https://nationalaglawcenter.org/).

The rural based tourism encourages local communities to revive and preserve their traditions, crafts, traditional festivals, architecture and other unique practices (https://pscnotes.in/rural-tourism-india-pdf/). The tourist points in Arwal includes Makhdum Shah ka Mazaar (Arwal), Fakharpur Temple (Fakharpur Panchayat), Madhushravatemple and Ashram (Mehendia), Gautam Budha Mandir (Akronja) and Aganoorjal VidhutPariyojna plant (Kaler Block), Belsaarsurya mandir (Kaler) along sone. The rural tourism need to be developed in Arwal district, and requires renovation of above tourist places and water bodies, provision for stay, good and hygienic restaurants, good roads and communication. Organizing programmes such as folk dance, folk song and light and sound will also be of great help. However, it requires meticulous planning and implementation.

Conclusion

It is evident that district holds tremendous potential and avenues for development of small industrial units. It requires vision, transparency, political will and commitment on the part of all stakeholders. The realization of above discussed activities depends on extensive research, collaboration, import of unconventional and innovative techniques, meticulous training, and, bottom-up approach. Access to financial provisions will play pivot role in the industrial development of the region. To ease up financial stress industrial houses can be approached for adopting village. This apart, financial institutions need to provide micro loans. Formation of cooperative too will help and enable small and marginal farmers. The rural development needs to be based on inclusive policy incorporating every section of society. It is important to bring women folk and backward community in the fore front as they greatly contribute in all sorts of economic pursuits, but are often denied the fruits of development. Access to market is also essential and it also needs to create local market where the entrepreneurs can sold their products. Online access to market will be of great help in connecting producer and buyers.

Last but not least, transition from linear to circular economy is also recommended to strike a balance between nature and anthropogenic activities. The present linear economy is based on the "take-make-use-dispose" plan, and involves transformation of raw materials into products. That are used and are finally discarded as waste (www.igi-global.com), which puts tremendous

pressure on finite resources and causes environmental degradation. Whereas, circular economy represents a restorative or regenerative industrial design, promoting use of renewable energy, discarding use of toxic and harmful chemicals, and aims for the elimination of waste through the superior design of materials, products, systems, and business models.

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CHALLENGES OF RURAL HANDICRAFTS INDUSTRY IN BIHAR : A CASE STUDY OF BRASS INDUSTRY OF PAREV (BIHTA, PATNA DISTRICT)

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ABSTRACT

Indian Handicraft Industry has offered several exquisite art and craft to the whole world for several centuries. Parev, a hub of traditional brass utensil manufacturing units is about 42 kilometers from Bihar's capital Patna. Dozens of big, medium and small units in the village supply brass utensils across Bihar, besides neighboring Jharkhand, and eastern Uttar Pradesh. In the absence of govt. support, the work in Parev; flourished, with the determination of the local manufacturers and entrepreneurs, and hardworking craftsman. Thus, this paper attempts to identify major factors affecting the brass industry in Parev, in terms of managerial factors like poor working conditions, increased prices of raw materials, preference of buyers, the low motivation level of artisans, and the threat of substitutes which are the main challenges faced by the artisans of Parev. The findings include the socio-economic conditions; educational level; health facilities and financial problems of brass workers in Parev village.

Keywords : handicrafts, brass, working conditions, innovations.

Introduction

Handicraft is one of the most important sectors in the Indian economy employing more than seven million people. The country produces wood ware, art metal wares, hand printed textiles, embroidered goods, jewellery, etc. Most of the manufacturing units are in rural and small towns, and there is enormous market potential in all Indian cities and abroad.(ibef.org/exports) The unique features of art and crafts in Bihar are intrinsic beauty and great creativeness. Pottery, wooden articles, metal wares, stoneware, jewellery, lacquer works, kashida, sikki and moonj wares, wooden and clay toys, zari, artistic textile fabrics, and printing on cloth are some of the contemporary crafts of Bihar which are known in Indian as well as international markets for their artistic beauties and innovations (Ranjan, 2009). Another chief feature of Bihar's handicrafts is their practicality and usefulness in everyday life like bangle making, khatwa works, and stonework. However, reasonable prices are the most important feature of the art and crafts in Bihar because of which there are great demands in India as well as in foreign markets. (Reddy, 2011)

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Brass Industry of Parev

Notwithstanding changing lifestyles and habits, brass utensils, considered auspicious, are still in demand, particularly in rural and semi-urban areas. Brass utensils are used for performing religious rituals at home and in temples, ensuring a steady demand for manufacturers in Parev. Parev is a hub of traditional brass utensil manufacturing units, situated about 42 km from Bihar's capital Patna. Dozens of big, medium, and small units of the village supply brass utensils across Bihar, besides neighboring Jharkhand, and eastern Uttar Pradesh (Khan, 2018).

Work in Parev thrives not with the government's support, but with the determination of the local manufacturers and entrepreneurs, and hardworking craftsmen. They have not only kept their traditional craft alive but ensured its growth. This is a rarity in rural Bihar, which is mainly agrarian.

Objective of the Study

Based on the above discussion, the objective of this paper is to find out:

- The socio-economic conditions of the people in the brass industry of Parev
- Level of education and health facilities of the people in the brass industry of Parev
- The financial and managerial problems faced by the people of the brass industry in Parev

Methodology

The Methodology includes a detailed literature survey, analysis of the various primary and secondary data collected from the sample survey (30 households) and at the Parev Panchayat office; through a structured questionnaire, and presentation of results and findings in the form of tables and suitable diagrams.

Study area

Parev is a village of Bihta Block in Patna District of Bihar State, India. It belongs to Patna Division. It is located 30 km. towards the west of District headquarters in Patna. 31 km from the State capital Patna. Parev is surrounded by Naubatpur Block towards the east, Koilwar Block towards the west, Maner Block towards the east, and Bikram Block towards the south. Maner, Dighwara, Masaurhi, and Patna are the nearby Cities of Parev. This place is on the border of Patna and Bhojpur Districts. (District Census Handbook, Patna; 2011).

Figure 1 : Location of Parev village in the District of Patna.

Case Study: Results and Discussion

The Village Profile

Parev is home to around 1,500 families, mostly belonging to the Thathera caste, designated among the Other Backward Classes. More than a fourth of the families are engaged in manufacturing brass utensils, from melting raw materials to giving shape and polishing, brass utensils. Manufacturers in Parev have generated hundreds of jobs for skilled and unskilled workers. Some youths have come forward to become entrepreneurs. The industry has allowed hundreds of villagers to work and prosper without having to leave their homes. Now they have worked all around the year except for two months of the rainy season. The demand peaks during the traditional marriage seasons, locally known as lagan, which fall in March, April-May, and November-December (Khan, 2018).

There are 25 big and medium brass utensil manufacturing units and 35 small units in Parev. There are not less than 50 retail and wholesale shops selling brass utensils. There is also plenty of work for everyone, unlike in the past when the demand had slumped and Parev's villagers had started to migrate to Nepal, Moradabad, and Gujarat for work. It is a culture in rural areas where people gift brass utensils to their daughters in their marriage and gift brass for religious rituals. Thus, with increasing demand of brass utensils in recent years, the manufacturers have seen their profits progressively increasing.

The Traditional Craft

The villagers still follow the traditional technique where the lengthy process of making brass utensils start with melting the raw material, molding it into nuggets, and flattening and shaping them. 90% of the work is done manually (Tyagi,2008). Now that the power supply has improved, they use some machines also. The villagers also use earthen stoves buried in the ground to melt plates before shaping them. Master craftsmen make the designs, which have been passed down the generations orally. The people are engaged in doing some of the other related work to brass utensils; like flattening plates with a hammer, giving shape to pots or bowls with chisels, and polishing utensils.

Social and economic conditions of respondents

Table 1 : Age group of respondents

The age group of the respondents	Percentage
20-30	42.5
31-40	27.5
41-50	20.84
51-60	9.16
Total	100

Table 2 : Average family size

family size of the respondents	Percentage
2-4	44.1
5-7	37.5
8-10	10.0
Total	100

Source **:** Primary Data, 2021

The above table 1 shows the age group of the respondents in Parev. Most of the 42.5% are in the age group of 20-30 years followed by 27.5% falling under the age of 31-40 years. Only 9.16% of respondents were in the age group of 51-60. Table 2 shows the average family size.

Figure 2 shows the monthly income of the respondents of Parev which indicates that a maximum of 30% of respondents have income between 10001-15000 followed by 25% of respondents having income up to 5000. Only 10% of respondents have a monthly income above 20000 as they are big wholesalers of the market and send their articles to all the districts of Bihar.

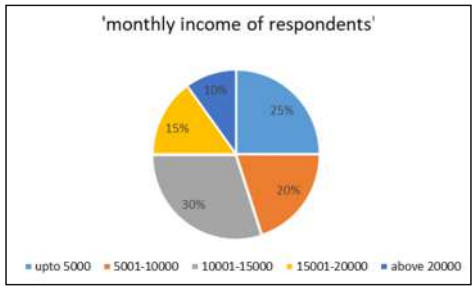

Figure 2 : Monthly income of the respondents.

Figure 3 shows the level of education of the respondents which indicates that 26% have studied up to metric level, followed by 25% of respondents who have studied up to primary level. About 15% of them were illiterate. However, education is not a compulsory requirement here for passing over the skill to next generation. It is this phenomenon due to which the industry is alive.

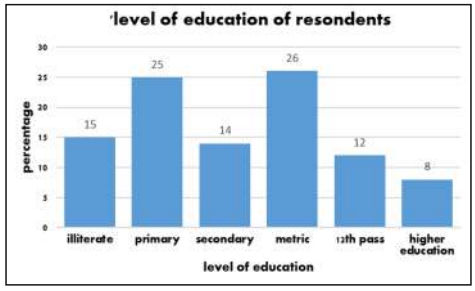

Figure 3 : Level of education of respondents.

Financial Problems faced by Brass Manufacturer

The brass manufacturer at Parev is self-dependent and faces many financial and managerial problems as shown in figure 4. The government policies are not very supportive of these rural handicraftsmen, and they are forced to solve their problems on their own. The biggest problem they face is e-commerce facilities where about 87% of respondents said that they are not computer friendly and do not know how to sell their products online.

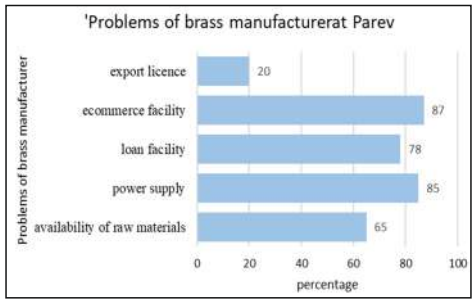

Figure 4 : Problems faced by the brass manufacturer at Parev

Another challenge they face is the continuous power supply which hampers their work daily. The power cuts are unpredictable, and they can take place from 2 hours to 6 hours on average. The situation worsened in the summer season when hot climatic conditions without power supply become erratic, causing delay in meeting the supply order intive.

Another problem they face is the loan facility. As most brass utensil manufacturers work from home and do not possess any assets which can be mortgaged against a loan; therefore, small shops do not have the facility of loan from the bank. In the absence of loan money, the respondents are not able to expand their business or improve their living conditions which is a matter of concern.

Another challenge is the availability of raw materials, particularly zinc and copper. The price of these two raw materials is increased every year, and this results in the increased price of brass utensils. Thus, making them costlier as gift items. Therefore, the manufacturers are now also keeping utensils made from steel and aluminum for low-income customers.

Only 20% of respondents said that they like to export their utensils abroad, but they do not have any idea about it and some of them tried but said that a huge amount and lots of paperwork discouraged them from obtaining the license for export.

Managerial problems faced by the brass manufacturers of Parev

Figure 5 shows the managerial problems faced by the respondents of Brass utensil manufacturers at Parev. The biggest problem which is 21% is no incentives from the government towards the brass manufacturer of Parev. The government does not give them any subsidy or tax rebate and does not take interest in their social welfare aspects. Another problem (19%) they face is the threat of substitutes from other cheap metals. In other words, the manufacturers said that the demand for brass utensils is going down and utensils of other metals like aluminium and steel are more in demand nowadays as they are cheaper and lighter to carry from one place to another. This is followed by another big problem of the high cost of labour as most of the work is done by hand and young generations are not very much interested in doing brass work.

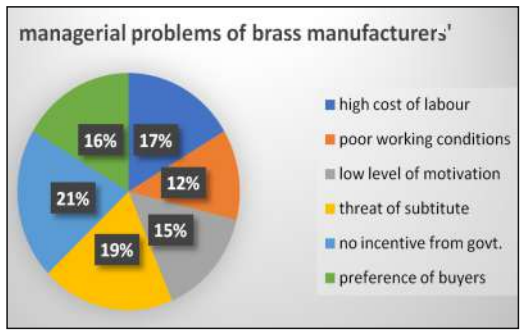

Figure 5 : Managerial problems of the brass manufacturers at Parev

As discussed earlier brass utensils are now considered expensive gifting items, therefore, the preference of buyers has also been changed or has become limited as said by the 16% of the respondents at Parev. Another 15% of respondents said that the level of motivation is low among the workers due to tough competition and decreasing demand for brass utensils in the market. This problem is supported by the other problem (12%) of poor working conditions where utensil workers have to work inside their small houses and face difficulties during summer and humid conditions.

The way forward

Rural handicrafts are traditional but unique in their own way. It gives employment opportunities to many landless people in villages as well as those residing in small towns (Kumar, 2010; Sinha, 1988). Parev is one such village that is famous for its brass utensils all over Bihar and even in neigh bouring states. The people here are thriving and running their businesses successfully, without any government support and aid. But they are also facing several financial and managerial problems which should be a matter of concern for the state government and the ministry of the Rural Industries so that the beautiful and unique art of brass can not only survive but also flourish worldwide.

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STATUS, DRIVERS, CHALLENGES AND PROSPECTS OF SMALL-SCALE RURAL INDUSTRIES IN RURAL-URBAN FRINGE OF PATNA

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Abstract

Rural industries play an important role in fostering growth of the national economy. The central and the state government have taken several active steps to promote small scale rural industries in Bihar, but these industries are facing several challenges. Being a capital city, Patna has experienced a huge influx of population in the city centre, which has further led to a shift in population and industrial activities towards the rural-urban fringe. Being closely linked with both rural and urban areas, it provides immense scope as a geographical space for growth and development of small-scale rural industries. The present study is based on primary data collected through a field survey conducted in Mahuli and Simra village located in the fringe of the city. The objective of the study is to understand the working status, drivers fostering the growth of industries in the fringe. The strengths, weaknesses, opportunities and challenges have been analysed in order to crystallize the opportunities coming in the way of developing small-scale rural industries in the rural-urban fringe of Patna. The finding of the study suggests that industrial policy needs to be more flexible and difficulties in accessing government benefits needs to be catered for development of small-scale industries of the fringe, also future growth of rural industries particularly agro-based, food-processing, corrugation industries would check out-migration of workers from Bihar.

Keywords: Small-scale industry, Rural industry, Rural-urban Fringe, Peri-urban, Industrial Development

Introduction

The growth of suburbs and the rural-urban fringe has been associated with a general redistribution of the population outward from the cities and movement inward from the open country (Reeder,1955). Industries also shift from the congested city into areas that surround the city or at the periphery of a city (Reeder,1955; Myles,1947; Vincent,1948) due to recent rapid urbanization. The main small-scale industries located in the rural-urban fringe of Patna include agro-processing units involved in production of rice, wheat flour, fine wheat flour *(Maida)*, *Besan* and food-processing units involved in production of varied snacks items. One of the most interesting industries located here is corrugation industries involved in production of corrugated packaging boxes. "Rapid industrialization of the rural areas is a vital necessity for developing the country and making the people economically independent" (Kumar,2019).

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The minerals form base as raw materials for a variety of basic industries, but it is also a fact that Bihar has numerous major minerals such as granite, bauxite, quartzite, pyrite, mica and limestone confined to West Champaran, Rohtas, Kaimur, Nawada, Jamui and Banka (Bihar State Profile,2016-17:15). The minor minerals available in Bihar are mainly stone, morum and soil. Patna has minor minerals such as sand and brick earth. So, industrial advancement could be achieved only by growth and development of industries associated mainly with agricultural produce as raw material, corrugation industry and handicraft and artifact industry. Agro-processing industries have immense potential for growth and development and thus, are regarded as the sunrise sector of Indian economy which is progressing up to contribute more to the economy of Patna and Bihar as a whole. The food processing sector and small machine manufacturing sector has been given priority in the State Industrial Policy of Bihar, 2016 (Bihar State Profile, 2015-16:54).

Objectives of the Study

1. To assess the present status of selected small-scale rural industries of the study area.
2. To identify the key drivers leading to growth and development of small-scale industries in the rural-urban fringe.
3. To analyse the strengths, weaknesses, opportunities and challenges (SWOC) of the industries.

Study Area

Mahuli village and Simra Village located in Phulwari block of Patna district (Figure:1) have a population of 2,353 and 4,582 persons respectively while 34.48% and 53.21% of the total working population of village Simra and Mahuli are engaged in non-agricultural activity, respectively (Census of India, 2011).The location has good linkage with the city centre via roadways and nearest railway station at Parsa. The study area lies in the periphery of central city Patna as per 'Improved draft of Master Plan 2031'. It encompasses both rural as well as urban characters, because of its location and connectivity. However, the areas located near to the main road and rail route show dominant urban traits and diminishing rural character as moving away. In recent years, a wide spectrum of rural industries have sprung up and taken a shift from the main urban centre towards its periphery.

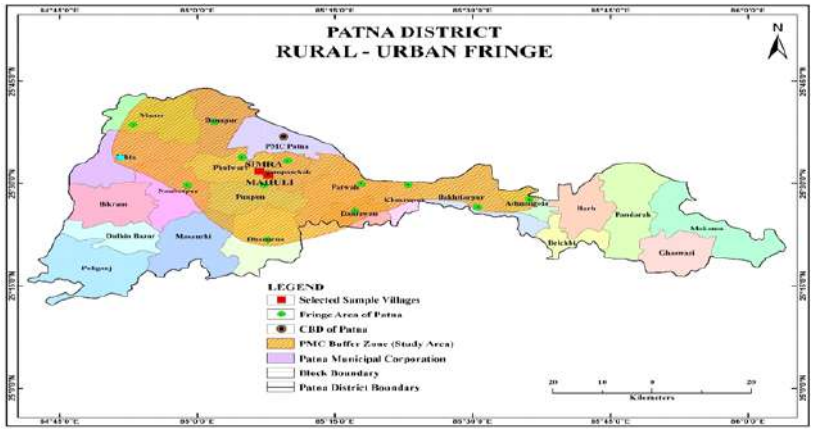


Figure - 1

Methodology and Sample Design

The paper is based on purposive random sample. The industries have been selected purposively considering the convenience of carrying out field work while the respondents are taken randomly. Primary data has been collected via interview method. A schedule was prepared in order to collect required information from purposely selected six industrial units from both Mahuli and Simra villages (Figure:1 and Table:1). The Fringe area has been taken up to 21 kilometres from the Municipal boundary as per available literature. A set of three point scale has been developed based on the five point scale of Rensis Likert (1932) for the purpose measuring the opinion of 100 selected respondents for SWOC analysis.

Table: 1

S. No.	Category of Units	Number of units selected for the study	Male	Female	Total samples drawn
1.	Food Processing Industry	4	56	8	64
2.	Corrugation Industry	2	24	12	36
	Total	6	80	20	100

Source: Primary Survey, 2021

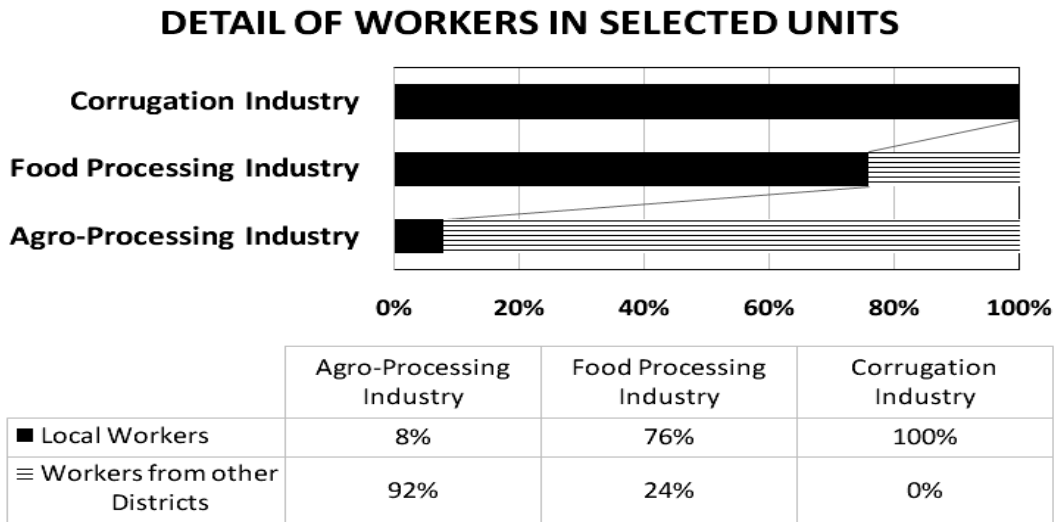
The findings show that development of the agro-processing sector often has stronger backward and forward linkages with the agricultural sector than other sectors and thus, plays an important role for rural transformation. It has been visualised that cluster of agro-processing and corrugation industries have developed in the study area, involved in production of varied commodities. An unit of food processing industry involved in production of rice, wheat flour including (*Aata, Maida, Besan*), produces 120-150 tons of finished goods while units producing snacks item produce about 1 ton a day. The corrugation units of the study area produce about 2 tons of corrugated boxes of varied sizes depending upon demands from the city centre primarily. Raw materials are mainly procured from local village market (*haat)* and from the market of Patna City. The main market of finished products are Patna, Muzaffarpur , Ranchi and Kanpur urban and the immediate surrounding area. Table:2 shows manufacturing units existing in the fringe area of Patna.

These industries depend on seasonal, perishable agro-produce as raw materials which varies in quality and quantity depending upon season and space**.** Container manufacturing and cardboard box manufacturing from what is locally called *pluff* is one of the most common industries located in the study area of Patna. These industries have witnessed increasing demand at Patna city centre as well as in other districts of Bihar recently. During COVID-19 crisis, this industry provided cardboard boxes for packaging of food products, Surgical Masks, Gloves, and other medical supplies. For a mineral-lackingdistrict, this industry shows signs of big hope for further advancement and expansion of such industries in Patna and other districts of Bihar.

Table: 2

Production Unit	Type of commodity produced	Local raw materials used	Materials from City Patna	materials from other district/state
1. **Food processing Units**	Wheat Flour(*Aata, Maida*),Rice, *Besan* &,variety of snacks	Wheat, Pulses, Rice,Gram	Packaging materials,Red chilly,Salt,*Besan*,and other spices from Patna city.	(i)Packaging Materials for rice, wheat flour , *Besan* and *maida* from Muzaffarpur and Delhi. (ii)Packaging material for snacks from Kanpur, Delhi and Ranchi.
2. **Corrugated Box manufacturing units**	Packaging boxes	Wood, Pulp and Flute(*Pluff)*	Pulp and Flute(*Pluff)*	*Pluff* from Patna and Buxar

Source: Primary Survey, 2021



	Agro-Processing Industry	Food Processing Industry	Corrugation Industry
■ Local Workers	8%	76%	100%
≡ Workers from other Districts	92%	24%	0%

Figure - 2

Source: Primary Survey, 2021

The small- scale industries located in the rural-urban fringe of Patna have employed local labourers as well as from other districts and continued to work even during Covid-19 pandemic (Figure:2).Percentage of female workers is found to be more in corrugation industry as it

Picture 1 : A glimpse of production in corrugation units

requires less physical stress in comparison to agro-processing units, where it is required to lift heavy weights and work on heavy machinery(Picture-1). The facility of food and lodging are provided to the workers of other districts. The industries boost the local economy by using local raw materials in bulk and produce different city market-based products to boost the economy of the district and state of Bihar.

In the rural-urban fringe of Patna varied small- industries are currently working which are driven by many factors and indicate towards upcoming self-reliant Bihar in industrial sector.

(i) Availability of basic infrastructure: The role of infrastructure in industrial development is crucial, as World Bank 1994 *states that there is a close relationship between infrastructure and economic development.* It is the key stimulus to development specially in case of developing countries like India and developing states like Bihar where small firms cannot thrive without infrastructural support. Development of infrastructure contributes to economic development by increasing productivity and providing amenities to the public which ultimately improves the quality of life. The two most vital infrastructure required for industries are:

(a) Electricity: Industrial development can not be achieved without requisite energy infrastructure. Uninterrupted supply of energy leads to efficient performance of the production and manufacturing units. The present study reveals that there is on an average 22.5 hours of electricity supply in a day which promotes industrial development and makes a positive impact on development of small-scale rural industries. The continuous electricity supply is an important factor contributing in establishment of several Rice Mills, Flour Mills, and Food Processing industry and corrugation industry in the study area.

(b) Transportation infrastructure : It is vital for the industries as low level of infrastructure can create hindrance in industrial growth. Increased transportation cost has negative impact on overall cost of commodity in the market and same is true in case of industrial development (Celbis et al.,2013).

(ii) Good linkage with the city: The rural-urban fringe is in close proximity to both rural areas as well as city centre. So, it depends largely on rural areas for raw materials for food-processing industries to local market (*mandi)* and other necessary items are brought from Patna city market. The Parsa Bazar Railway Station is nearest to the study area. The study

revealed that fairly good road and railway connectivity with the central city of Patna is one of the key drivers of development of small scale rural industrial hubs in this area.

(iii) Demand at the local and regional market: The goods produced at the fringe of city Patna has great demand at the Central urban market and nearby local markets. This facilitates the continuous production of varied commodities such as variety of snacks, *besan, Sattu*, wheat flour and rice mainly. The corrugated boxes produced here are very much in demand at City centre even throughout the COVID-19 pandemic, manufacturing of corrugated cardboard boxes continued in order to meet the demands of the city to package food and other consumer products including medical and pharmaceutical products, tissues, masks and several hygiene products.

(iv) Cheap and bigger space: Fringe provides the benefit of bigger land at lower price which is one of the major determining factors in growth and development of small-scale rural industries at the Fringe of city Patna (Primary survey,2021). One of the major challenges faced by individuals in setting up any industry is constraint of enough land resource, but at fringes cheaper land is available in comparison to central city.

(v) Raw materials and cheap workforce: The raw materials for the food processing industries are available at the local market of city Patna and packaging materials are brought from Ranchi, Kanpur and Delhi. For the corrugated box industry, raw materials come from Patna and Buxar mainly and goods are transported mainly to Patna and local markets. Abundant casual labourers are also available for these industries generally at lower wages. They come mainly from nearby fringe villages and Buxar, Muzaffarpur, Chhapra, Siwan, Hajipur as well (Primary Survey, 2021).

To transform Bihar form an agrarian economy to an industrial economy, there should be a deliberate and effective functioning of these industries at the rural-urban fringe of Patna.

SWOC Analysis

The sustainability of these small-scale rural industries located at the rural urban fringe of Patna largely depends on finding out the strengths to eradicate the weakness, to identify the opportunities and to prepare well for threats and transforming them into new opportunities for the further growth and advancement. The drivers leading these industries towards progress and factors holding it back are also important. The problems and prospects are better identified by taking the opinion of the various associated stakeholders for improving policy implications and understanding the grassroot level problems. It would be a step forward in modification of the industrial policies for growth and development of the rural industries.

The study reveals that linkage of fringe with Patna and surrounding rural areas, utilisation of local raw material, availability of required infrastructure mainly roadways, transportation facility, electricity, water, etc. and capacity to meet the demands are the leading strength (Figure:3) while 74% of the population agreed that there is lower investment in comparison to profit made by these units and availability of cheap land and labour are also important drivers of these industries.

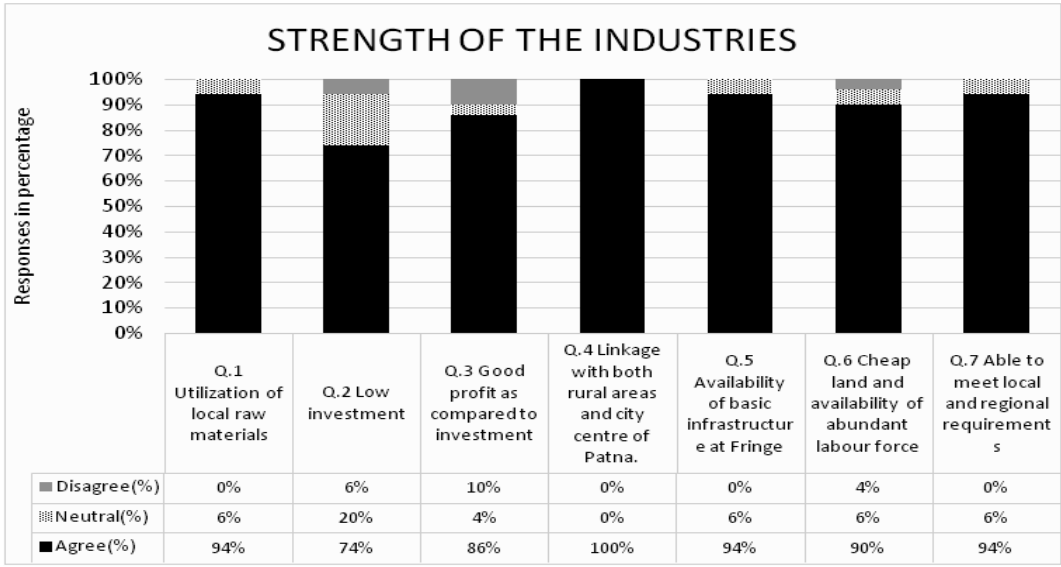


Figure - 3

Source: Primary Survey, 2021

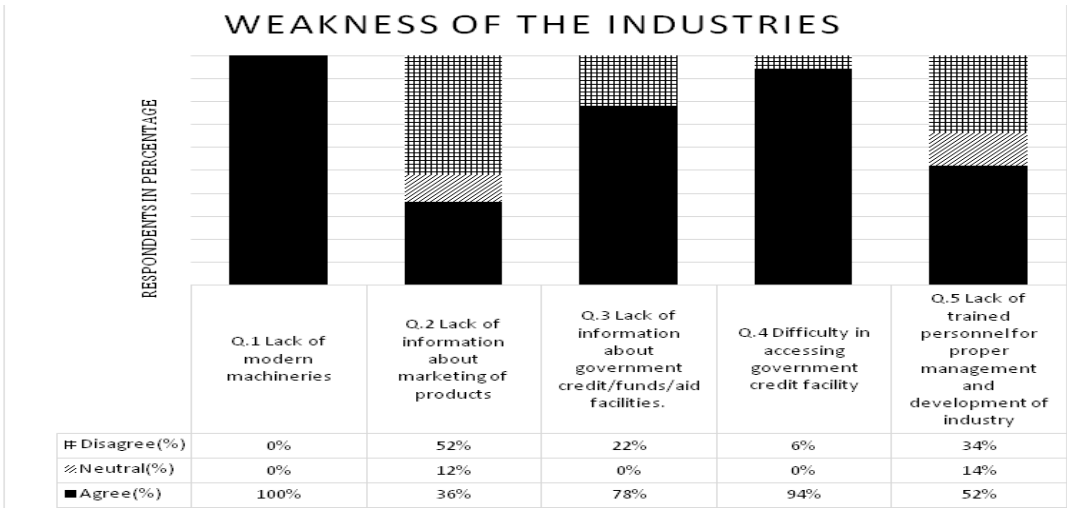


Figure - 4

Source: Primary Survey, 2021

A majority of the respondents find lack of modern machineries at the selected industries as well as difficulty in accessing government credit facility and other aids are chief weakness holding back the growth of these industries(Figure:4). About 78% of the population lacks in information about government funds and credit facilities which is a major constrain along with lack of trained personnel as 52% of the population agreed that despite having information about government schemes and aids it was difficult to access those facilities for buying new

advanced machineries either due to lack of documentation or reach. Paving new path for making investment easy could be a step in advancing towards secondary sector.

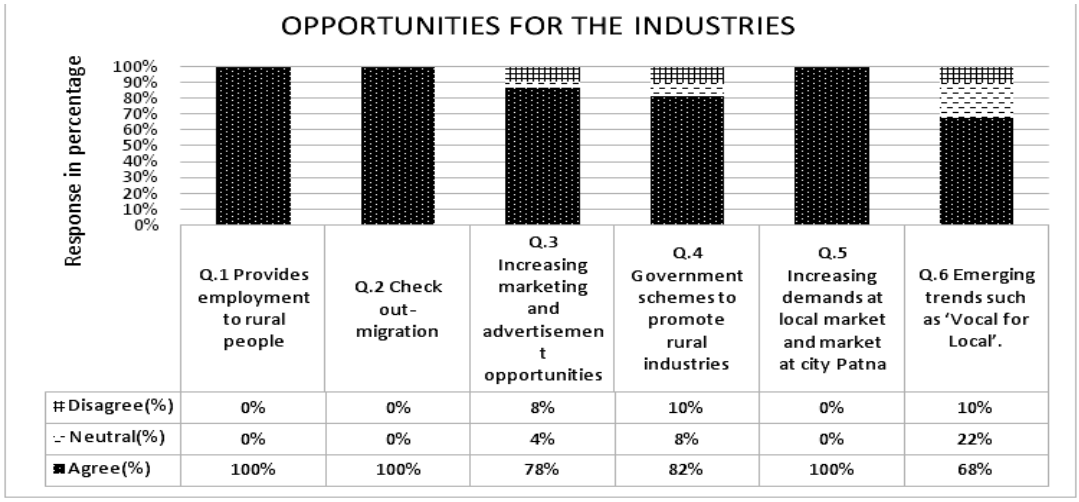


Figure - 5

Source: Primary Survey, 2021

Urbanization leading to influx of population in the city centre as well as in fringe areas continuously increase demands at local market and market at city of Patna, emerge to be the biggest opportunity for these small-scale industries(Figure:5). These industries also provide employment to local and regional labourers who take a plight to other states and thus checks migration but still further setting up of more such units would definitely bring a major change in out-migration scenario of Bihar. Increasing social media marketing and campaigns such as 'Vocal for local' infuses hope for further increase in demand of these local products which stands nowhere in competition to the products of large scale industries.

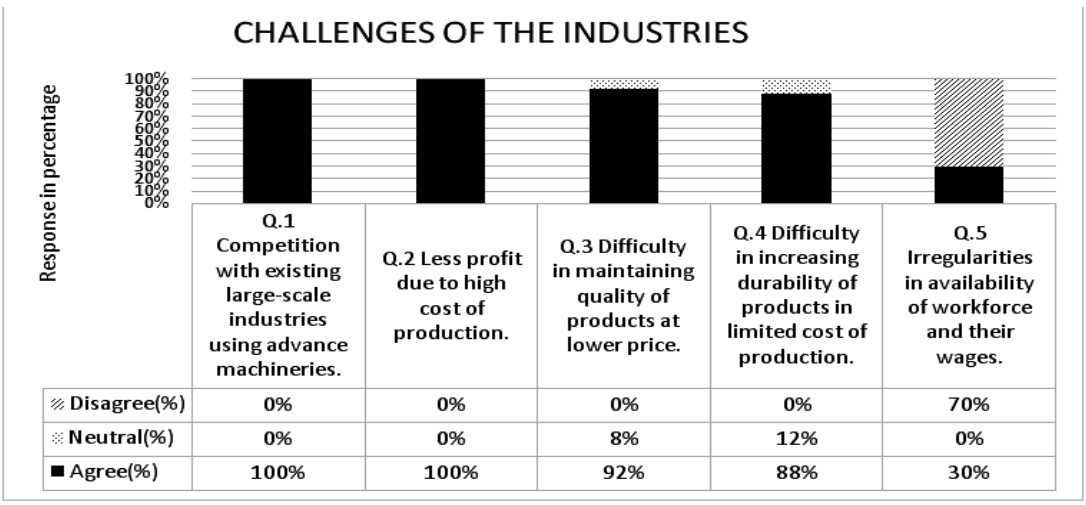


Figure:6

Source: Primary Survey, 2021

In spite of several strengths and opportunities the small-scale rural industries located at the fringe of Patna faces several threats like competition with existing large-scale industries which uses advanced machineries and have huge investment thus making more profit, has come up as the strongest challenge for the industry(Figure:6). Less profit due to high cost of production and difficulty in maintaining the quality and durability of product stands in the way. It is found that these industries sometimes face irregularity in availability of workforce but to cope of with the irregularities to a certain level they have adopted the method of providing food and lodging to the workers who come from far places or from other districts of Bihar. However, it was found that the wages are very low which makes the workers to move eventually to other states.

Conclusion and Suggestions

The study reveals that proximity to city, availability of basic infrastructure, procurement of local raw materials, availability of market and labour are the main actors responsible for the development of small-scale rural industries in village Mahuli and Simra located in fringe of Patna. These industries provide employment to local skilled and un-skilled workers of surrounding rural areas. These industries have been set up with investment of less than one crore, work with limited manpower and fewer obsolete machines, additionally they face competition with large scale production units, thus, are forced to compromise with the quality of products in order to keep up with the price of large scale industrial products but still act as lifeline of industrial economy for Patna, by stabilizing per capita income and reducing regional disparity from financial point of view.

The stakeholders' willingness to move from traditional to technological methods of production and reduction in cost of production would be a step forward in dealing with the threats from market competition and further development of an agro-based industrial hub in the locality, as the fringe areas have become most suited location for industrial de-concentration in changing urban landscape.

Recent programmes like 'Awareness Programme on Procurement and Marketing Support Scheme' and 'Entrepreneurship Awareness Programme' held in the year 2021in Patna and 'The Udhyog Samvad' portal are hopeful steps by the government of Bihar which would further focus towards diminishing the threats and challenges and looking forward to opportunities of all sorts. Geographical factor is important in development and functioning of these rural small-scale industries hence, proximity and connectivity must be improved at the fringe villages, along with modifications in the existing industrial policies and industrial development and de-concentration plans so that Patna and Bihar as a whole steps ahead towards a manufacturing economy.

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URBAN FLOOD RISK ASSESSMENT AND ITS DISASTER MANAGEMENT FOR DISASTER RISK REDUCTION: A CASE STUDY OF PATNA DISTRICT, BIHAR

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Abstract

Patna is among one of the fastest growing urban centres in India, with a population of more than 2.35 million (United Nations, 2018 and https://en.wikipedia.org/wiki/Patna, 2022). Patna, the capital city of Bihar offering some of the best facilities in terms of infrastructure, transport, health and education facilities. The main responsible causes of urban flood in Patna city is uneven distribution of rainfall coupled with haphazard urbanisation, unplanned city growth, encroaching upon and filling up natural drainage channels system and urban lakes to use the high-value urban land for buildings and other developmental processes.

The current study is rooted on primary data and descriptive analytical approaches. The research methodology comprises a blend of extensive review of literature and inductive reasoning applied to observe data on factors presumed to be linked with disaster preparedness. The investigation starts with a review of structure of preparedness plan of the study area, Patna, Bihar. Simple statistical calculations and ratios have been used to divulge the relative significance of preparedness, awareness, current conditions etc. Both qualitative and quantitative methods have been used in the study.

This research paper provides a detailed description of a survey conducted on disaster preparedness and management of Patna district, Bihar. The thrust area of this research paper is to understand the chances of improvement, highlighting how well the per cent respondents are able to decipher the guidelines issued by the government, or the information provided by the same. It also covers a small portion of disaster and flood hazard in particular. We believe that in order to implement effective flood mitigation planning, various actors and stakeholders need to harness indigenous knowledge and participate in discussions with local communities to see how their different approaches can work in a complementary way towards the disaster risk reduction methods and towards sustainability. This research paper aims to suggest various ideas to improve the transfer of scientific knowledge into policies and to increase mutual understanding, partnership, and cooperation for better policy outputs in Sustainable Development.

Keywords: Urban Flood, Vulnerability, Urbanisation, Disaster Risk Reduction, and Sustainable Development

Introduction

The United Nations Office for Disaster Risk Reduction (UNDRR) defines a disaster as, "a serious disruption of the functioning of a community or society involving widespread human,

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property, economic or environmental losses and impacts which exceeds the ability of the affected community or society to cope with using its own resources". In the context of Patna, the chances of a potential disaster or precisely a hazard are more than an actual disaster itself.

The UNDRR has defined a hazard as, “a process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.” Looking at the present situation of overcrowding, unplanned urban growth and lack of planning, the vulnerability of the metro to a hazard cannot be ignored. Further, this research paper explores all possible angles of the issue under disaster risk management (Alexander. 2013).

As the world is progressing day by day, we can find the glimpse of technology everywhere. We have created possibilism everywhere. In this technocratic world, modern industries are found everywhere like IT, Petrochemical, cement, machineries etc have developed to a very large extent. Urban centres, which are a hub of these institutions including educational institutions also. India being a developing country still in the way of formulating policies for redistribution of resources. Thus, the serious concern is about resource concentration at few places which are generally at urban centres. With a high resource base, the urban centres attract a huge chunk of population which generally includes skilled and unskilled workers as well as students.

Patna has gradually developed as educational hub to facilitate quality education among students, who come from rural, interior Bihar or from other states for pursuing their education here in this city. In the last few decades, the per cent respondents of Patna witnessed the emergence of one of the world's most extensive development of education centres like University of Patna, IIT, AIIMS etc. Urban centres are densely populated and urban population are the most vulnerable for urban flood. It is not only the event of flooding but the secondary effect of exposure to infection also has its toll in terms of human suffering, loss of livelihood and, in extreme cases, loss of life.

The urban areas are paved with roads and there is concretization everywhere thus, resulted in to discharged heavy rainwater can't be absorbed into the ground due to drainage constraints leads to flooding of streets, underpasses, low lying areas and storm drains. Major cities in India have witnessed loss of life and property, disruption in transportation, communication and power and incidence of epidemics due to flood. Most of the cities are located near the bank of river are flooded during monsoon period due to overflow of water. For e.g., Mumbai floods in 2006 caused havoc in the whole city. Hence, flooding phenomenon and its management in urban areas should be dealt with utmost care and immediate attention.

Increasing trend of urban flooding is a universal phenomenon and which poses a great challenge to urban planners (Asia Pacific Disaster Report,2012). Problems associated with urban floods range from relatively localized incidents to major incidents, resulting in cities being inundated from hours to several days. Therefore, the impact can also be widespread, including temporary relocation of per cent respondents, basic infrastructural damage, contamination in water quality more importantly the associated spread of epidemics. Flooding in cities is a major issue in many parts of the India and it is a natural disaster that takes place every year.

Urban flooding has been increasing in India, severely affecting major cities. Some of the most significant events of urban flooding include Mumbai Floods of 2005, Kolkata in 2007, Delhi in 2009, Bangalore in 2015, Patna Floods in 2019 and the Hyderabad floods of 2020. Flooding in India reaches its peak during the monsoon season. There are times when storm surges at coastal cities can cause flooding as well. Other causes include failure to release water from dams. It can also have a severe impact. In addition, the urban heat island effect has resulted in an increase in rainfall over urban areas. Global climate change is resulting in changing weather patterns and increased episodes of high-intensity rainfall events occurring in shorter periods of time (Cross, 2001). Moreover, the consequent rise in sea-level poses an added threat to the cities in the coastal areas.

Study Area

Patna is the capital and largest city of the Indian state of Bihar with an estimated city population of 2.48 million in 2021(https://worldpopulationreview.com/world-cities/patna-poupulation, 2022). It is second largest city in eastern India after Kolkata. It covers 250 square kilometres area and over 2.52 million persons. It is 18th largest urban agglomeration in India. Patna is situated on the bank of the river Ganga towards it south in eastern part of India and cutting across rivers like Gandak Punpun and Son. Patna encompasses a total geographical area of 136 km^2. Out of which, the municipal area covers almost 99 km^2 andremaining area of 36 km^2 comes under the suburban area. Patna city lies on the geographical coordinates of 23° 18' 0" N, 82° 40' 0" Elongitudinally lying at an average elevation of 53 m (174 ft).A unique and defining feature of the study area in terms of its geographical attributes is the confluence of rivers. A narrow strip of somewhat high land about 8 kilometres in width along the southern bank of the Ganges having very fertile soil and alluvial fertile plains in the remaining portions (Figure 1)

Figure 1: Study Area, Patna, Bihar

Source: https://www.gis.bih.nic.in/DEPTS/PoliceSts.aspx, 2022

It is joined by four other rivers: Ghaghara, Gandak, Punpun and Son. Patna is unique in its own way of having four large rivers in its vicinity. It is the largest riverine city in the world. Mahatma Gandhi Setu built over river Ganga assumes the status of being the longest river bridge in India measuring 5575 m. in length.

Data Base and Research Methodology

This research paper is based on primary survey conducted in 2021 - 2022. Sample size has been taken as 200 respondents. The data has been collected, analysed and processed with the help of statistical techniques. Excel is used for making various graphs and pie diagrams. Q-GIS has been used for making layout map and location map of Bihar. Secondary data has been collected from census of India and survey of India. With all these almost important of the observational skills very used while conducting the survey for analysing the surrounding and problems related to the topic.

The questions collectively are classified based on urban flood risk assessment and disaster risk reductions. Simple Random Sampling (SRS) have been used to select the students, residents, and family which have been able to represent the whole scenario of capital city of Bihar i.e., Patna.

A well-prepared questionnaire and discussion with respondents have been used to collect the primary data. Observation method is also used in the study. Interviewer as well as respondents both were involved in collection of data. All information is recorded by the interviewers. The data has been analysed and processed with the help of statistical techniques. All these important observation skills were used in surveying and analysing the problems related to the topic.

Results and Discussion

National Disaster Management Authority (NDMA, 2006) is an agency of the Ministry of Home Affairs whose primary purpose is to coordinate response to natural or man-made disasters and for capacity building in disaster resiliency and crisis response. The agency is responsible for framing policies, laying down guidelines and best practices and coordinating with the State Disaster Management Authority (SDMA) to ensure a holistic and distributed approach to disaster management. A hazard becomes a disaster when causalities came in to existence and the major reason behind causalities to occur is unawareness & panicking. One would not panic at such times only if he/she is well aware of dos and don'ts in such a case.

Awareness Among Stakeholders Regarding Flood in Patna, Bihar

The capital city Patna being located on the bank of Holiest River the Ganga had experienced some of the most disastrous floods many times in the history which caused severe death and destructions. During the survey conducted in March 2021, 92 per cent of respondents stated that they were aware of the term flood and its coping mechanism & safety measures during disaster while on the other hand 8 per cent of respondents replied in may be which means they won't be aware of the term flood and its management or they would be slightly ware of it (Figure 2).

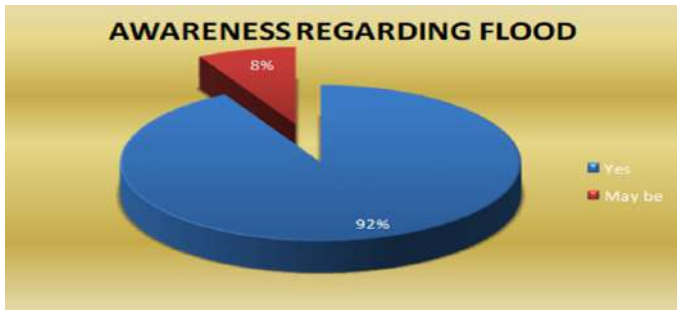

Figure 2: Awareness regarding Flood in Patna, Bihar

Source: Based on Primary survey, 2021-2022

Patna is bounded by three major rivers i.e., Ganga, Punpun, and Son. Floods in north Bihar increase the water levels in these rivers too. As city's natural drains excess run off in to these rivers and if this coincides with heavy rainfall, there may be a disaster. Areas along the bank of river Ganga and other low-lying area of the Patna city like *Rajendra Nagar, and Kankarbagh* are flooded during every monsoon, as the natural channels are blocked and improper drainage system are responsible for causing urban flood here.

Patna being an ancient city has improper town planning. The low-lying areas are densely populated and these populations become most vulnerable during flood. Almost in every monsoon, Rajendra Nagar and Kankarbagh are flooded with rain water.

Awareness Regarding Flood Prone Areas

Flood is caused by various reasons which include physical and metrological features like heavy rainfall, improper city planning, chocked drainage system, haphazard construction, settlement on low lying area, and inefficient sewage system.The average precipitation here's about 1130 mm per year (India Meteorological Department, Met Centre Patna, 2022). In a situation of heavy rainfall there is water logging in low lying areas like *Kankarbagh, Gardanibagh, Rajendra Naga and Ashok Rajpath in Patna.* The inefficient drainage system and chocked drainage system create more challengeable situation of water logging in this historic city. The unplanned town with high population destiny in low lying areas poses serious threat during flood hazard (Figure 3).

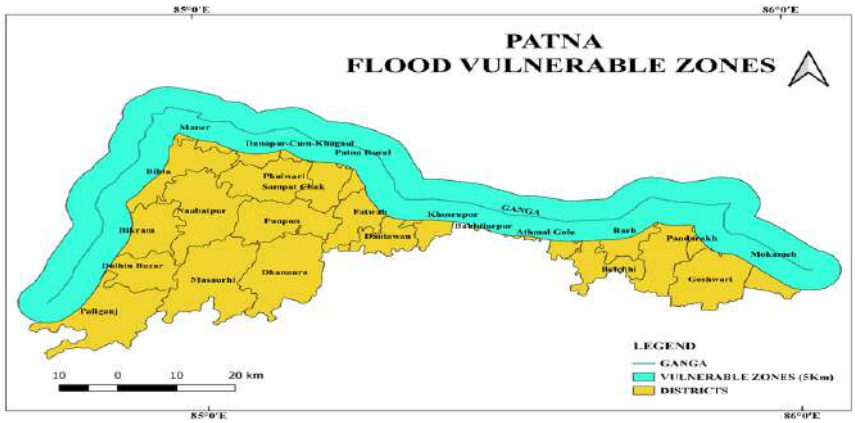

Figure 3: Flood Vulnerable Zones, 2022

Source: Based on Primary and Secondary Data, 2021-2022

During the survey, 68 per cent of respondents stated that heavy rainfall is responsible for flood in Patna. While 80 per cent stated that increase in flow of river Ganga during monsoon period cause flood in Patna as the city is situated on the Bank of River Ganges. While on the other hand 92 per cent of respondents highlighted the problem of improper drainage system in the city and pointed it as major factor which is responsible for causing flood in Patna followed by 68 per cent of respondents stated that nearness to the Ganga River is major cause of flood. Another 64 per cent of respondents stated that natural causes are responsible for causing flood followed by 48 per cent of respondents who highlighted the problem of improper city planning and regarded it as cause of flood in the city.

Following the incessant rainfall, the districts along the river Ganga i.e., Patna is facing a severe flood situation. Water has entered the low-lying areas in many districts including Patna. In the situation of heavy rainfall, the city is full of water especially in the low-lying areas because of chocked drainage, filled man-hole and improper sewage system. During south-west monsoon, the surging water level, the areas near to the Ganga experience flood like situations like *Digha, Gaighat, and Ashok Rajpath* etc in Patna. During the survey, 72 per cent of respondents stated that *Gaighat* and 76 per cent of respondents stated *Kankarbagh* being prone to flood. 44 per cent of respondents stated that *Danapur* is prone to flood. While 68 per cent respondents stated for *Patliputra* colony followed by 60 per cent stated for *Ashok Rajpath* and 28 per cent of respondents stated that *Gardanibagh* is prone to flood (Figure 4).

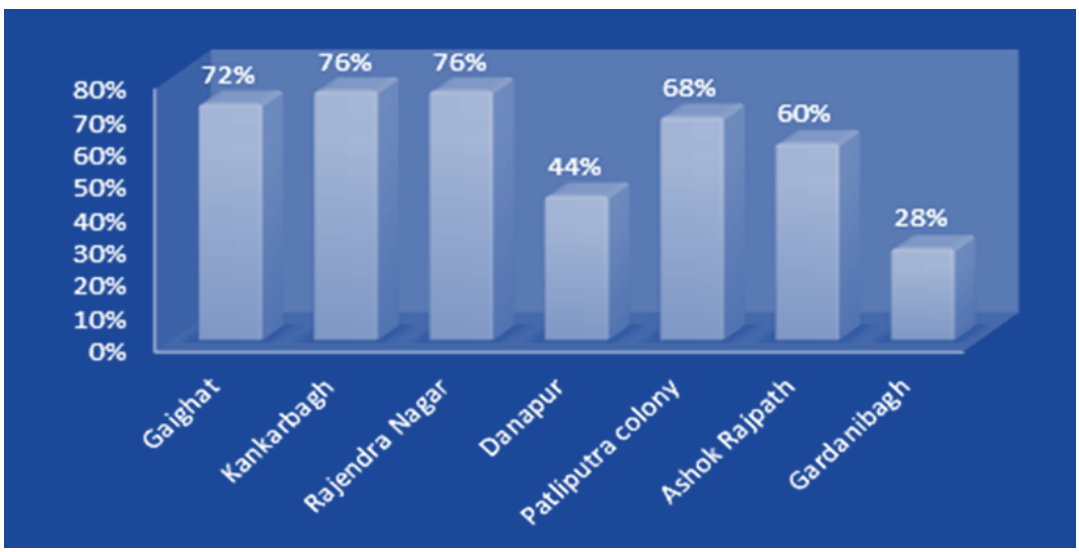

Figure 4: Awareness regarding Flood Prone Areas, Patna, Bihar

Source: Based on Primary survey, 2021

According to primary survey, 2021-2022, *Gaighat, Kankarbagh and Rajendra Nagar* are highly vulnerable area of flood in Patna during the monsoon periods.

Awareness Regarding Various Reasons that Causes Flood in Patna

There can be several reasons behind urban flood, and we have mentioned plenty of it in our options. Well talking about the Poor Drainage System that has full agreement with the 50 per

cent of respondents, it is the most prominent reason for urban flood according to the respondents as the drainage system of Patna City is not appreciable, lack of management and due to waterlogging it is not functioning well. Poor urban planning in a river side city comes second in the row behind the reason of urban flood (41 per cent respondents). Well as a native, my opinion is also the same. Urban planning of Patna is quite outdated. Climatic Change has a severe impact on occurrence of flood that's why 30 per cent respondents have mentioned it. Construction with no regard to the natural topography & geomorphology has come as a major reason behind urban flood as it has 30 per cent respondents. Nowadays Urbanization has become hindrance in several aspects, urban flood is also one of the reasons behind it, counting 24 per cent respondents on it. Construction in vulnerable areas is also a major reason for urban flood, holding 22 per cent respondent by their side. Role of technologies helps us in several aspects and outdated technologies are not so helpful in today's era, 22 per cent respondents have identified the importance of technologies. Corruption is also a reason because the Governments are just uttering promises not delivering it, 14 per cent respondents think that it can be a reason behind urban flooding (Figure 5).

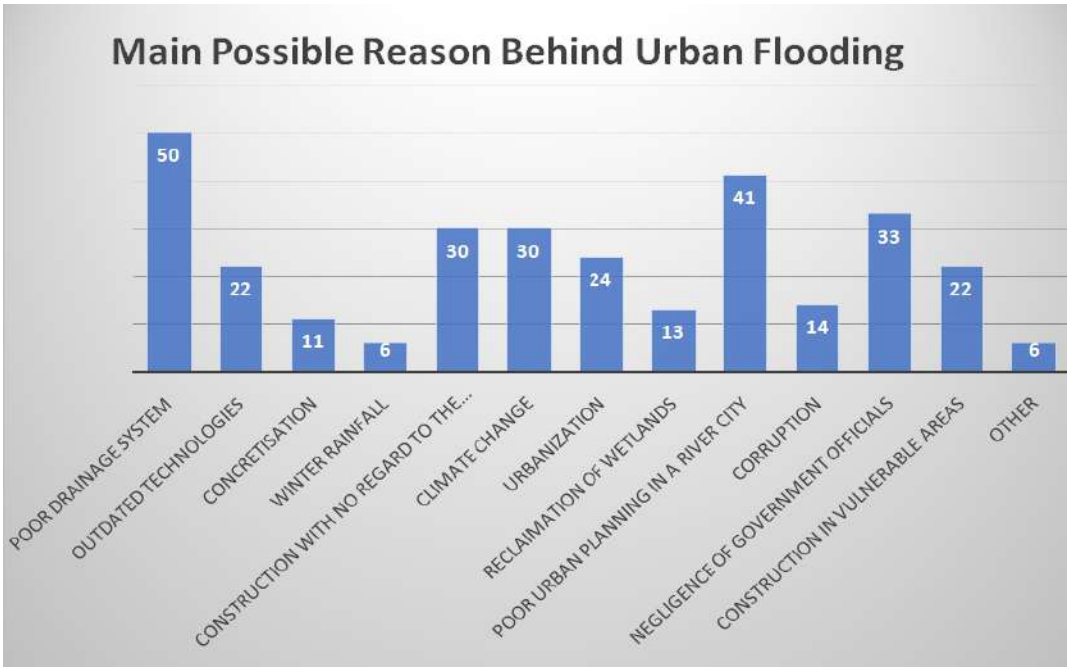

Figure 5 : Main reasons responsible behind urban flooding

Source: Based on Primary Data, 2021

Reclamation of wetlands restores degraded wetlands to their former hydrological and ecological functions. Wetland reclamation is the rehabilitation of the degraded wetlands habitat, reconstructing the impacted habitat as closely as possible to its original condition with respect to hydrological, ecological, and morphological components. 13 per cent respondents have chosen it. “Concretisation” is suffocating trees and greens and turning the city into an urban heat island

with extremely low groundwater and threats of floods looming large in monsoons due to surface run-off. 11 per cent respondents have mentioned it. Winter rainfall brings moderate to heavy rain in low-lying areas. They are the cause of most winter and post-monsoon season rainfall across north-west India. Only 6 per cent respondents have mentioned it.

Reclamation restores degraded wetlands to their former hydrological and ecological functions. Wetland reclamation is the rehabilitation of degraded wetlands habitat, reconstructing the impact on habitat as closely as possible to its original condition with respect to hydrological, ecological (vegetation, habitats), and morphological (soil) components.

Awareness Regarding Endangered Areas for Future Flooding

Talking about endangered areas for the predication of future flood, we have given several options which can be endangered in terms of flood in future. I would like to categorise them in Highly Vulnerable, Moderately Vulnerable and Least Vulnerable zones for the better understanding. Through the eyes of 50 per cent respondents, we are analysing the data (Table 1).

- Highly Vulnerable (More than 50 per cent respondents)- *Rajendra Nagar and Kankarbagh* lie in this category. In terms of present scenario or talking of future aspects, these two places are highly vulnerable.
- Moderately Vulnerable (25-50 per cent respondents) - *Digha* with 27 per cent and *Kurji* with 21 per cent are in the moderately endangered zones for future flood.
- Least Vulnerable (Less than 25 per cent respondents) - Least endangered zones for future flood are Boring Road with 9 per cent, *Mithapur* with 17 per cent, *Patliputra* with 15 per cent and *Ashiana Nagar* with 5 per cent. We can consider these places in a safe count in comparison to others and also in terms of present scenario and as well as in the context of future.

Table 1:Awareness Regarding flood prone areas

Highly Endangered	Moderately Endangered	Least Endangered
Rajendra Nagar **(45 per cent)** *Kankarbagh* **(43 per cent)**	*Digha* **(27 per cent)** *Kurji* **(21 per cent)**	*Boring Road* **(9 per cent)** *Ashiana Nagar* **(5 per cent)** *Mithapur* **(17 per cent)** *Patliputra* **(15 per cent)**

Source : Based on Primary Data, 2021

We have asked respondents about possible risk of flood in the future and most of the respondents have answered according to the structured questionnaire, where we have asked about impacts of flood in affected areas. Here, talking about future probability respondents have voted in the same pattern as found through structure questionnaire, where the threat of loss of property is the most (42 per cent respondents). It may be seen in Fig. 6.

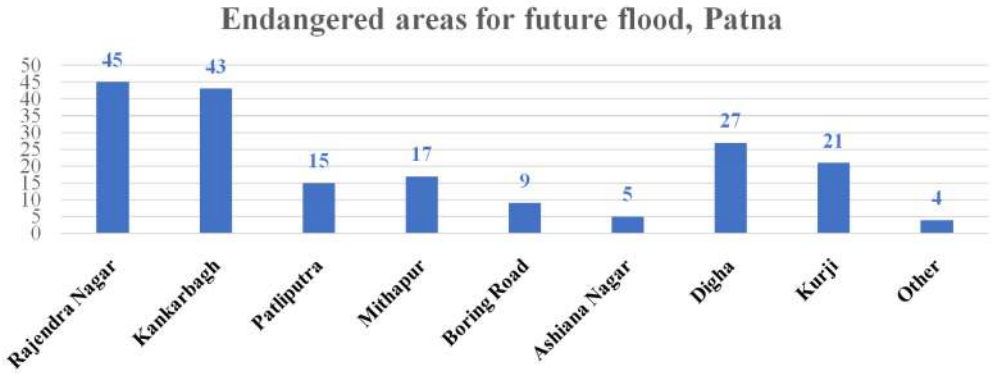

Figure 6 : Awareness regarding future areas of endangered flood, Patna

Source: Based on Primary survey, 2021

Another major threat is infrastructural damages as it holds 41 respondants. Third major threat is loss of life (40 per cent respondents). We have replaced cattle lives with agricultural damages and 33 per cent respondents have voted about it. Talking about agricultural damages Patna is a fully built-up city and it has less space for growing crops like cereals but we count green vegetables in the outskirts of Patna with very low count. So, ultimately flood may not be a reason that can hamper crops but loss of green vegetables crops are always expected.

Knowledge Regarding Loss Due to Flood

A flood can bring several consequences. According to people's perceptions, 46 per cent respondents have replied to the loss of property damages due to flood during the monsoon periods. loss of property is also due to lack in infrastructural facility. Well at the time of flood, human beings along with their belongings started to get themselves at a safer place, those I often left are cattle. Loss of cattle lives comes at second place (around 41 respondents). Infrastructural damages holds the third position with 38 per cent . Chances of loss of life are yet minimal but 34 respondents have voted for it. Rest 9 per cent respondents have voted for "Other", which can be agricultural damages, mass migration, political implications etc (Figure 7).

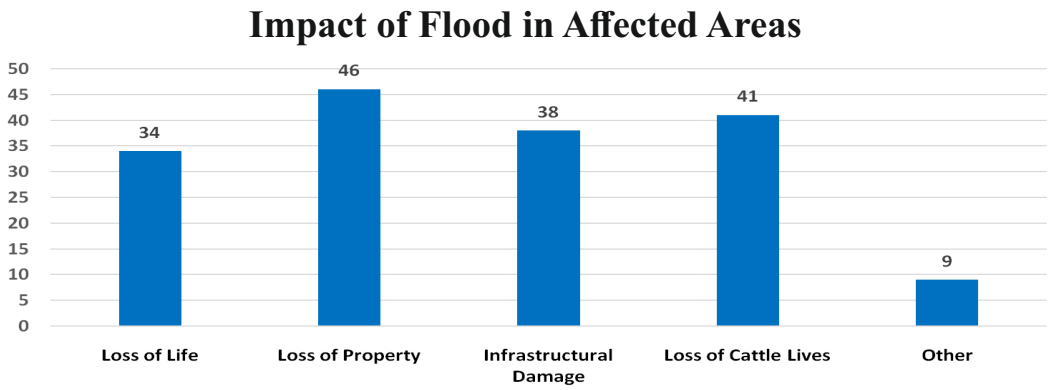

Figure 7: Damage Due to Flood

Source: Based on Primary Data, 2021

Every year, floods wreak havoc in Bihar, causing extensive losses and deaths. This year, 2021; 7.54 lakh hectares of agricultural land has been destroyed. In 2018, the same figure was only 0.34 lakh hectares, and even one year before it was 2.61 lakh hectares.

(https://thewire.in/environment/floods-bihar-agricultural-land).

In fact, since independence, floods in Bihar have affected 2.24 million hectares of agricultural land in all, and precipitated losses worth Rs 768.38 crore between 1953 and 2017.The pressure from floods also destroyed half a dozen embankments along the *Gandak and Boorhi Gandak* rivers. (https://thewire.in/environment/flood-bihar-agriculture-land).

In 2016 about 4.1 lakh hectares of crop-land, worth Rs 443.53 crore, was damaged. Over 16,700 houses also incurred damages, worth Rs 44.26 crore, while 254 per cent respondents and 246 livestock died. The loss of public facilities amounted to Rs 40.97 crore. The total damage was estimated to be in 2017, the floods reportedly affected 1.71 crore per cent respondents in Bihar and wreaked havoc over some 82,000 hectares. The waters also damaged 1.18 lakh houses and killed 514 per cent respondents and 373 livestock. Worth Rs 528.76 crore.

(https://thewire.in/environment/floods-bihar-agricultural-land).

During the survey, 76per cent of respondents stated that the loss could be loss of lives while 84per cent of respondents stated that there could be loss of agricultural land (Figure 8).

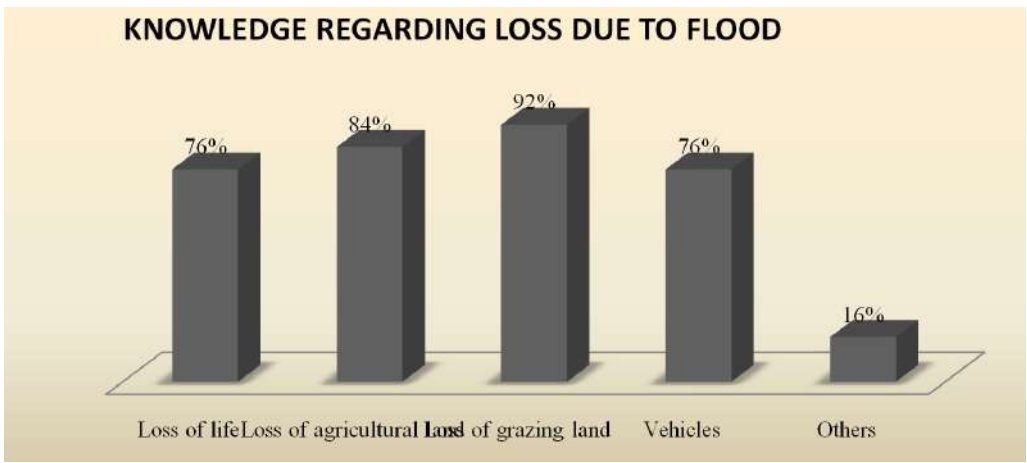

Figure 8 : Knowledge Regarding Loss due to flood

Source: Based on Primary Survey, 2021

92 per cent of respondents stated that there could be loss of grazing land while another 76 per cent of respondents stated that there could be loss of vehicles and 16 per cent of respondents stated that there could be loss of others which include loss of building, property, roads etc.

People's Perception related to Coping Mechanism of Urban Flood Management

1. Regular Urban Planning

Regular urban planning will play a key role in reducing the after effects of flood. Drainage system should be properly planned and managed in urban areas so that it can allow water to

pass through it. 96 per cent of the respondents acknowledged that proper urban planning can play a significant role in tackling the flood.

2. Afforestation

Planting of trees helps in channelizing the flow of water as well as percolation into the ground prohibiting the stagnation of water. 88 per cent respondents agreed with afforestation strategy to be used to tackle flood condition.

3. Control on land use /land cover

Land use / land cover plays an important role in flood management in many areas. The conventionally channelized lands reduce the impact of flood. 92 per cent respondents of the survey responded that control on land use/land cover should be followed sustainably to minimise the flood disaster.

4. Agricultural Activities

Urban areas are distinguished from the rural areas primarily based on the type of economic activity i.e., urban areas mostly engaged in tertiary and secondary activities wherein rural areas are mostly engaged in primary (agriculture and allied activities). Perhaps due to occupational structure of urban areas only 4 per cent of respondents responded that agriculture activities can be used to tackle flooding condition in urban areas.

5. Construction of proper drainage system

Drainage system help the water to out flow from a particular area and prohibits stagnation of water which results into flood. In the survey 88 per cent of respondents viewed that construction of proper drainage system can play a major role in tackling of flood.

6. De-congestion of city

The de-congestion is a process of removing densely populated things from a city to its periphery. It is called as decongestion of city. Only 10 per cent of respondents agreed that the decongestion of city can play a major role in overcoming flood condition.

Government Initiatives / Programmes and impact on Susceptibility of Flood

Livestock development

The livestock in any economy especially like India plays a very vital source of national income in agriculture and rural economy. Livestock development and management leads to inclusive growth thus is a pro poor strategy as expressed by Honourable President Ram Nath Kovind. This sector along with contribution in GDP, is a major employment generator, asset creator, and coping mechanism against crop failure and social and financial security. The Bihar Livestock Development Programme (2017-2022) can prove a very significant step on this way as it aims to increase the quality and quantity of animal health services to minimize diseases. Other schemes of state government in this area include Poultry Farming Scheme, Goat Development Scheme, Animal Health Care Program, Artificial In Vitro Program, Reinforcement plan of Bihar Livestock Development Agency, Patna, Animal Cruelty Reduction Plan, Scheme for cattle development, Bihar Animal Science University etc. In our survey moderate number of respondents rated that government should focus on livestock development to mitigate flooding conditions.

Employment Guarantee Scheme

The early responders to any disaster are the locals. Other than humanitarian and infrastructural loss the monetary loss of respondents becomes irreplaceable as the victims already are poor and middle-class respondents. The monetary loss could be compensated through employment guarantee scheme. The schemes like Mukhyamantri Nishchay Swayam Sahayta Bhatta Yojana were launched on 2nd of October, 2016 where unemployed youth between the age of 20-25 years who is in search of employment, will be given Rs.1000 per month for a maximum period of two years, being implemented by Planning and Development Department, Govt. of India. Satat Jeevikoparjan Yojna (SJY) promising 24 months livelihood and mentoring through dedicated community Cadres Master Resource Persons (MRP), Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) would lead to productive absorption of under-employed and unemployed labour force in the rural areas. This programme is very important in the context of Bihar, because only 11 percent of the respondents in the state live in urban areas. In our survey per cent respondents responded that government should focus moderately and highly on employment guarantee scheme to mitigate the flood condition.

Infrastructure Development

The loss of infrastructure is one of major effects of any disaster so in flood. In urban areas the impacts on infrastructure are more compared to others as being involved highly in tertiary and secondary services. The schemes like Pradhan Mantri Aawas Yojana-Gramin (PMAY-G), Indira Aawas Yojana (IAY) especially after flood becomes vital for reconstruction. The infrastructure development should be flood resistant and sustainable to minimize further loss of infrastructure in any unforeseen situation. In our survey, respondents responded that government should highly focus upon infrastructure development to mitigate the flooding condition in the urban areas. The schemes like Urban Infrastructure and Governance (UIG), Namami Gange, Integrated Housing and Slum Development (IHSDM), Rajiv Aawas Yojna etc can also prove beneficial as mitigation strategy in Patna Urban Flood.

Drainage Development

Drainage can play a major role in mitigating the flooding condition. In our survey respondents rated the drainage development as moderately, highly and very highly, needed to overcome the flooding condition. Drainage planning would lead to minimization of loss to flood disaster as it'll itself divert the excess water to the areas needing it.

Preparedness Plan to Mitigate Flood Condition

In our survey we had provided respondents many options as like, mock drills, spreading awareness, regarding evacuation zone, preparing disaster team and storing a lot of food.

In our survey when we ask per cent respondents about the importance of mock drills and their addition in preparedness plan along with their role in flood management. 88 per cent of respondents replied that mock drills are important to include in preparedness plan to mitigate the flood conditions.

In our survey 80 per cent of respondent its viewed that spreading awareness regarding evacuation zone and addition of preparedness plan can play a major role to mitigate the flooding condition. In our survey 96 per cent respondents responded that preparing disaster

team can play a major role in mitigating flood conditions and should be included in preparedness plan. In our survey 32 per cent of respondents responded that the program of storing a lot of food should be included preparedness plan to mitigate the flooding condition.

How to Make Respondents Alert regarding Flood Disaster?

In our survey we have provided per cent respondents with lot many options regarding how they will make alert regarding flood disaster followed by preparedness plan. Respondents suggested that the sufferers could be made alert by;

i) Constituting a rescue team,

ii) Preparing a route map for evacuation, and

iii) Making announcement by public sound system.

Furthermore, 44 per cent of respondents responded in fovour of making preparedness plan, 88 per cent respondents responded that we can alert by preparing a rescue team and spreading awareness regarding flood disaster.

In our survey 68 per cent of respondents responded that we can alert the people by making a route map for evacuation zone which can help them to evacuate the place during the disaster or flooding condition. In our survey only 4per cent of respondents responded that we can make alert through announcement by local government.

Disaster Risk Reduction and its Sustainability

To maintain the sustainable growth of the state, there is a need of planning for flood management. As floods cannot be controlled completely so planning for flood management implies to get maximum benefit in the given circumstances (Arnold, 2008).

Drainage Planning- In drainage planning the drain flow plays an important role in the direction of water flows of underground water. Drainage planning should identify all the underground drainage networks, clearly showing foul and surface systems (Pathak, 2009).Per cent respondents have also considered this particular management strategy as the most important. There is a need for better and latest drainage planning for the sake of per cent respondents living in Patna. *Ease at construction* and *cost effectiveness* are the two major attributes underlying the adoption of structural measures in the state of Bihar. A major portion of embankments measuring 3732 km have been constructed as of March, 2013 and the remaining is under construction which is expected to be completed very soon (WRD, Govt of Bihar, 2014).

Water Sensitive Urban Design- It is a land planning and engineering design approach which integrates the Urban Water Cycle, including stormwater, ground water and waste water management and water supply into urban design to minimise environmental degradation and improve aesthetic and recreational appeal (Pandey et.al., 2019). It is the second most voted management with 35 per cent respondents. This management can help in several aspects in improvising the loopholes of Patna's Drainage System.

Development of Sponge city- It is an ecosystem based on holistic approach, integrated with urban planning and development to address storms including pluvial flooding as well as other urban water and environmental issues (Pandey et.al., 2017). In the world context China has

initiated this concept to the real world. 27 per cent respondents have voted for it knowing the value and functions of sponge city.

Enhancing the Carrying Capacity of Channels: - There is a continuous rise in the level of river-beds due to heavy loads of silts. In fact, Patna is situated in middle Ganga plain where deep-cut loaded silts of rivers and channels started to gradually make bottom level deposition. It makes river bed/channel bed shallow. As a result, there is tremendous pressure on the existing embankments. For example, River Gandak presents a classic case to this witnessing a rise in its river bed of the order of 1.8 meters (approx.) during the past three decades. Consequently, the heavy silt carried and brought chokes the moth of rivers, reduces its carrying capacity and puts the near by areas especially cities at high risk of flooding. Patna also faces this kind of situation at an alarming level.

Such a problem in urban areas is giving rise to urban flooding, which should be dealt with sound and rational method involving the practices of dredging and desilting with a view to improve the natural drainage (Fuchs, 2018). This technique re-defines and modifies the existing carrying capacity of channels thus making the river flow very smooth and gentle, overlooking the possibility of any flood in near future. However, government support in terms of provision of subsidy is deemed to be necessary due to its inherent high execution cost and other interrelated problems.

Regularization of Flood Plain Zoning: There should be regularization of **Flood plain zoning (FPZ)** for quick and timely dissemination of '**potential loss information**'. Such an approach in terms of flood prone zoning is likely to put a check and cease its irrational, indiscriminate and unplanned development both in terms of protected and unprotected areas (Singh, 2005).

At the time of disaster immediate responses play an important role but it should be according to the type of disaster and the ongoing situations. Following are the options:

- Call disaster management cell of the area
- Restricting the use of electrical devices
- Saving essentials along with lives
- Help Others

Helping each other can boost the process of disaster management. Reaching out with the disaster management cell of the area will help in assessing the flood affected area as well as per cent respondents. Restricting the use of electricity can reduce the risk of short circuits and can save many lives. The post disaster management strategies of the government, it will help in overcoming the havoc created by the disaster (Blaikie et.al., 2014). We had asked respondents to suggest about some bullet points of post-disaster management strategies. They have mentioned it sequence wise that what should be done first and then accordingly.

I. **Providing immediate relief to the flood affected person :** This can save several lives. Through this initiative respondents who are trapped in disaster prone places can be rescued.

II. **Sanitization of the area** will help per cent respondents as well as fauna of the affected area in maintaining basic hygiene. Sanitization can also reduce the risk of spreading of communicable diseases.

III. **Hazard, Risk & Vulnerability assessment of the area**: There is a need to collect related information from various sources including satellite sources. There after simulation models can be developed to assess the future risk of disaster and also how to make risk management sustainable.

IV. **Reconstruction of damaged infrastructures:** Respondents who lost their property could get financial support for rebuilding it. If there is any sort of infrastructural damage of government offices and monumental buildings can be fixed under this step by the government.

V. **Providing incentives to the poor :** Almost all respondants were of the opinion that the worst sufferers are the poor people and they must be provided support and incentives so that demographic chaos may not emerge during the flood or even after the flood.

VI. **Capacity Building** is defined as the process of developing and strengthening the skills, instincts, abilities, processes and resources that organizations and communities need to survive, adapt, and thrive in a fast-changing world. This approach must be taken as a part of flood risk management in the affected areas.

Conclusion

The preceding analysis reveals that there are major faults in development and management planning leading to plethora of destruction and damage during floods. Overburdened drainage, unregulated construction, no regard to the natural topography and hydro-geomorphology together contribute to make urban floods as a man-made disaster. Cities like Patna, Hyderabad, Mumbai relies on a century-old drainage system, covering only a small part of the core city. Climate change is expected to affect flooding through changes in rainfall, temperature, sea level and river processes. Climate change will exacerbate the existing effects of flooding on infrastructure and community services, including roads, storm water and wastewater systems and drainage, river flood mitigation works, and private and public assets including houses, businesses and schools. Climate change may change flood risk management priorities and may even increase the risk from flooding to unacceptable levels in some places. It is therefore important that flood risk assessments incorporate an understanding of the impacts of climate change on the flood hazard.

Managing present-day and future risk from flooding involves a combination of risk-avoidance and risk-reduction activities. The treatment options could be a combination of avoiding risk where possible, controlling risk through structural or regulatory measures, transferring risk through insurance, accepting risk, emergency management planning, warning systems, and communicating risk (including residual risk) to affected parties. The best combination will consider the needs of future generations and not lock communities into a future of increasing risks from flooding. Urban Flood management will not just help control recurring floods but also respond to other fault lines, provide for water security, more green spaces, and will make the city resilient and sustainable.

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ECONOMIC POTENTIALITY AND PROSPECTS OF NATURAL REGION IN CHOTANAGPUR PLATEAU

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ABSTRACT

Chotanagpur forms a distinct geographical region defined by its varied topography and man's activities ranging from primitive to modern. The spatial variations in geographical elements bring out the heterogeneous relief, plateaus, steep scarps, tangled hills, and extended valleys that play a great part in the divisions of regions of the Chotanagpur plateau. The emphasis is to explore and interpret the physical, economic, and potential activities of each natural region and highlight the problems, and prospects for sustainable development of the regions. Therefore, an attempt has been made to divide the Chotanagpur plateau into natural regions, to analyze and interpret the physical and economic potential activities of regions, and to highlight the problems, prospects, and sustainable development of the regions. Chotanagpur has a very high potential and rich resource base but losing very fast its premier position in the country. There is an urgent need to protect and utilize all resources at micro-level units for the regional and economic development of Chotanagpur natural regions. The study suggests that after facing various problems, like resource depletion, environmental pollution, and ecological and social concerns, the Chotanagpur region has a very high resource potential base. Therefore, it is an urgent need to protect and utilize all resources at micro-level units for regional and economic development.

Keywords: Potential, Natural region, Economy, Resources, Geology, Ecosystem, Utilization

Introduction

The Chotanagpur plateau is a distinct natural region. It occupies a portion of the area of Jharkhand state. There is regional inequality in landforms which accounts for great diversity in the economic potentiality of the region. It is defined by varied topography and human activities from primitive to modern. Physical (relief, altitude and geological structure), economic (rural, industrial, mining, manufacturing), and resource (land, water, forest, mineral and power) development varies from one region to another. It consists of a series of plateaux of varying elevations, hills, and hillock and intermountain valleys of varying width and size which descends from north, south and east to the main plateau of Ranchi (Singh and Kumar, 1970). Thus, its land is polygenetic and composite. Towards the north, the plateau region descends gradually to the Middle Ganga Plain. To the east, this region fades away into the plain which constitutes the agro-economic region. Economically, all the regions have great

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significant mining segments and promising manufacturing or industrial belts of India. It is a storehouse of almost all minerals of high economic importance to India. Natural resources including land; water; forests; mineral and power provide the basic foundation to a large number of industries for economic development and have led to the growth of industrial cities such as Ranchi, Bokaro, and Jamshedpur (Ram 1968). The value of such resources depends on scientific and technological knowledge, cultural attitudes and the feasibility of their economic utilization. Chotanagpur plateau is relatively rich in all these resources and yet, paradoxically enough, has remained a poor state. Rapid changes in land use and emergent economies' coexistence with the traditional economy have tremendous potential for development. This region has been the nucleus of sociological, anthropological, and geological studies because of its complex geology and tribal culture.

Regions are determined and further divided into individual units according to the degree of homogeneity of the various geographical phenomena. The natural regions have an added advantage as they are more or less unchanging. The political boundaries are man-made and are liable to frequent changes, hampering comparisons over time. The political units or administrative divisions do not carry us far because these units have essentially been created, and recreated according to administrative convenience. More often they were cast for political control rather than for administrative efficiency, which demands a more pragmatic and scientific organization of space. This trend may carry us astray from geographical realities. Some units are too large or too small or too heterogeneous or too much otherwise to be taken for geographical regions. They are found to be "anachronistic and irrational, blurring rather than heightening the reality of human reigns". In the recent past overexploitation of resources with the thrust of rapid economic development has posed many themes of research in Chotanagpur region. Unfortunately, there is little substantial work on natural regions and their development. Given this overview, the purpose of this paper is to present the economic potentialities and prospects for the development of the Chotanagpur Plateau.

MATERIAL AND METHODS

Objectives of the Study

The main objectives of the study are to (i) divide the Chotanagpur plateau into the natural or formal region based on relief, (ii) explore and interpret physical, economic and potential activities of each natural region and (iii) highlight the problems, prospects for sustainable development of the regions. The study is mainly based on secondary sources of data collected from various government reports and downloaded from websites. Further, the literature was published in the form of research papers, and books were also consulted to substantiate the work. Initially, the study explains the natural regions of the Chotanagpur Plateau region which has been classified based on structure, lithology and geomorphic character. Then regions are carved out by superimposing different map layers (relief, physiographic, land use and population distribution). Each of these regions has homogeneity from natural potential

viewpoint. Besides relief the other order marked in the nature of economy which has distinctive regional personality, and providing distinctive 'living space' with different set of factors. Each of these contrasts has been the guiding principles behind the divisions. The regions have been explained concerning geographical, geological, drainage, climate, soil, resource richness and to certain extent population characteristics. Finally, the major problems have been identified based on which major potential areas have been suggested from the future development perspectives.

Study Area

The Chotanagpur Plateau is the easternmost continuation of the termination of the peninsular plateau of India. It is surrounded by hills, intermountain valleys, rivers, streams, and forests. This study is concerned only with the portion that lies in Jharkhand state and characterised by complex physical, economic and social features. The region has an amorphous shape bounded by fertile alluvial Middle–Ganga Plain in the north, Odisha in the south, West Bengal in the east and Uttar Pradesh and Chhattisgarh in the west. It extends eastward as the Rajmahal Hills overlooking the narrow plain on the right bank of the Ganga and forms a distinct geographical region. The anatomy, age, resources, climate, and human resources portray its distinct characteristic to curve it out as a geographical region (Singh and Kumar, 1970). Chotanagpur delimited relatively greater uniformity of terrain in the form of predominantly plateau topography at different elevations. The Chotanagpur region consists of a series of uplifted plateau surfaces at different elevations, interspersed by scarps, valleys and rugged terrain (Ram 1991). It is characterized by complex geological structures. Geologically, the area is overlain by Chotanagpur granite gneiss formations. It has a close relation to minerals, which acts as a transport corridor leading to transparent vaults in Chotanagpur.

The area comes within the tropical monsoon season. It experiences three seasons: summer (March–May), rainy (June–October), and winter season (November- February). The mean annual rainfall in the area is 1400 mm. Thus, the area experiences high rainfall for a long span from June to October. Large areas are under the forest (29.76 %). The fertile slopes and valleys are given to agriculture which is, however, handicapped by poor soil cover, erosion and lack of irrigation.

It comprises 24 districts (Census of India, 2011) under the administrative boundary of the Jharkhand state **(Figure 1)** and covers an area of about 77,096 km², constituting 2.34 % of the total area of the country. Chotanagpur Region is the home of 3,29,66,238 people comprising 2.72 % of India's total population (2011). Population density is 413 persons per km² (Census of India, 2011), which is marginally higher in comparison to India (382 persons per km²). The proportion of the population living in urban areas is 20%. Culturally, the region is well-marked for its tribal population. also a politically recognized cultural unit inhabited originally by aboriginal tribes.

Figure 1: Administrative Divisions of Jharkhand

RESULTS AND DISCUSSION

Natural Regions of Chotanagpur Plateau

In Chotanagpur plateau relief, altitude, geological structure and physical conditions distinguish one natural region from the other. Relief plays a great part in characterizing the major divisions while geology forms an important basis for the regional divisions and alignment of the structural formations and physical conditions form an important basis for the agro-economic regions, (Karan,1953). The plateau has been divided clearly by its natural features and is unified by other features which give the region its distinctive quality and mark it out from the rest. The region is divided into landform units considering structure, litho logy and geomorphic character. Then regions are carved out by superimposing different maps (relief, physiographic, land use and population distribution). But each of these regions has homogeneity from the natural potential viewpoint. Thus, Chotanagpur Plateau has been divided into different natural/geographical regions on the basis of relief/altitude (NATMO) and placed into the following categories (Figure 2).

1. **The Western Higher Plateau** (Altitude above 900 metres)
2. **The Central Plateau** (600-900 metres)
3. **The Lower Plateau** (300-600 metres)
4. **The Uniform Surface Regions** (below 300 metres)

These are discussed below in detail.

1. The Western Higher Plateau: Chotanagpur plateau portrays its distinct characteristic to carve it out as a geographical region. This micro-region of Chotanagpur has within its ambit with highlands, plateaus, peneplains, dissected rims, ranges, interfluves, valleys, etc., of

varying elevations, magnitude, morphology, climate and vegetative covers. However, small a region within its compass creates an environment to register man's activities in harmony with its limitation of geo-economic resources. The height of the plateau ranges above 900 m and has a distinct Pat region located in the south western part of the Chotanagpur plateau. This region lies to the west of the Lohardaga district in Jharkhand. It occupies parts of Khuti, Chatra, more area of Latehar and a smaller area of Gumla districts of Jharkhand. It has been carved out by the tributaries of the North Koel to the north and by the Sankh to the south into many isolated mesas or the lofty, flat-topped hills known as 'Pats'. The altitude of the Pat region ranges between 900 to 1200 m and consists of several smaller plateaus ending in imposing scarps, picturesque ghats on steep lands. The general slope of the region is towards the north and the east. The Pat region is drained by several rivers flowing towards the north, east and south. River Nakti, Bahera, and Chaupat are draining towards north and merged with the river North Koel. This topographic region has also given rise to tributaries of the South Koel and tributaries of the Damodar River which flow towards south and east, respectively. The eastern portion of the Pat region is attached to the western Ranchi Plateau and acts as a divide between the North Koel and the South Koel basin. The climatic conditions are slightly different from other regions of Chotanagpur.

The forests play a great role in the economy of this region. The important forest products are timber, lac and the manufacture of cutch (kath). The region is covered with dry deciduous dense forest dominated by plentiful Sal, Bamboos, Gamhar, Kusum, Shisham and Sabai grass and Palas. Due to the poor, gravelly nature of the soil, cultivation is restricted. Few pockets of agricultural land on the descending slopes where reflect rice culture in the lowlands and dry crop culture on the uplands. The region as a whole is very sparsely populated and unevenly distributed. Netarhat is a small town within the larger 'Pat' region. It is a resort town at the junction of the Ranchi and Palamau districts. The highest waterfall is Burhaghagh on the river Burha in this region. This is comparatively one of the least developed regions in the Chotanagpur plateau.

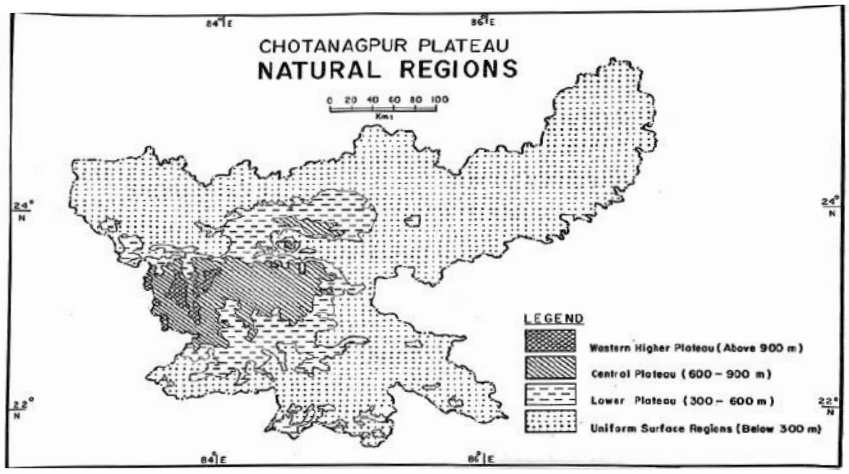

Figure 2: Natural Regions in Chotanagapur Plateau

2. The Central Plateau: The Central plateau is located in the central part of the Chotanagpur plateau and the height ranges between 600 and 900 metres. It includes two most distinct physical units i.e. Ranchi plateau and the Hazaribag plateau. The Ranchi Plateau is located in the heart of Jharkhand state and is bounded by the faulted Damodar trough in the north and Simdega plateau and Porahar highland in the south, the Panch Pargana plain in the east and Pats in the west. It comprises most areas of Ranchi, Khunti and about half of the area of Gumla district. It is bounded on all sides by steep scarps. Physically it has a rolling level surface with residual hills, composed of resistant rocks. A long range of hills, in the form of an arc, bounds the area on the west. The area is composed mostly of granite, gneiss and old Dharwar rocks which rise gradually to the west. It slopes towards the south and the east. The drainage of the plateau is shared by the Subarnarekha and the South Koel River.

The Ranchi plateau is an agro-forest region. Earlier, the plateau was covered with dense forest, but presently, the central and eastern parts have been almost denuded of forests and left with only small jungles with very few big trees in scarp areas. Important trees are Sal, Asan, Gamhar, Kendu, Semal, Mahua, Jamun, Kathal etc. The agricultural economy is predominant in the region. The cultivable lands fall into two classes: terraced lowlands on which rice are the important crop and the uplands which produce coarse rice, millet, pulses and oilseeds. Apart from food crops, this region is important for horticulture. Mango orchards and other fruit trees are common in all villages. These days' cultivators also grow seasonal fruits and vegetables on the demand of urban centres.

The Hazaribag plateau lies between the North Koel basin in the west and southwest, and mica belt in the north, and the Damodar Valley is in the south. In the east, it extends up to the eastern limit of the Hazaribag district. This plateau region covers most of the parts of the Kodarma, Chatra, and Ramgarh districts. It is a broad undulating plateau, engirdled with seven hills: Sitagarh, Bamhanbai, Silawar, Bhuswa, Bandang, Belian and Canary, This region, consists mostly of gneisses and granites rocks and occupies a two-thirds area of the region. Physically the plateau consists of three separate patches arranged in an east-west elongation by the deeply eroded valleys of Konark and Bokaro rivers: (1) the Upper plateau (2) the Lower plateau (3) The North western plateau fringe. The Upper plateau is bounded by the north scarps of Damodar Valley in the south and, on the other side; it is bordered by a steep scarp with an average elevation of 600 m. The lower plateau occupies the northern and eastern parts and has an average elevation of about 300 m. On the west, it merged with the North Koel basin; on the east, Dhanbad peneplain and the north-east with the mica belt, on the north-west, it drops the plateau fringe which forms the third unit of the region occupying dissected hilly area of extreme north western Hazaribag. The lower surface forms a broad undulating plateau with terraced valleys and a skyline broken by isolated relict hills such as Parasnath. Forest and agricultural economy is the main potentiality of this region. The important crop is rice which is grown on the terraced lowlands. The bar land is given to vegetables. Maize, millets, ragi (marua), pulses and oil seeds are also cultivated on the tanr lands.

The region reserved good quality of coal beds at the upper and lower Karharbari seems a high calorific value and is used in the railways. Coal and mica resources have given rise to mica processing industries as well as coal mining activities. The region is served by electricity from Bokaro and Telaiya plants. Since the development of roads and railways, there has been a marked increase in cultivated area. The market centres Chatra, Simaria, Tandwa and Gidhaur are connected with Hazaribag town. The region is the hub of road transport which radiates in every direction from Hazaribag town.

3. The Lower Plateau: The lower plateau includes three distinct units i) Kodarma Plateau or lower Chotanagpur Plateau, ii) the Rajmahal Hills, and iii) the Southern Adjoining Highland and the height ranges from 300 to 600 metres.

(i) The Kodarma plateau is located on the northern fringe of the Chotanagpur Plateau and extends south-west to north-east direction. It has carved out its geography in harmony with its diverse relief, forested land, agricultural make-up and mica mining belt. The belt coincides with the Dharwar outcrop and forms a series of Ghats or scarps to the Ganga Valley. The greater part of the plateau is flat undulating terrain composed of gneisses, granites, mica schist, pegmatites and dolerites dykes. The slope of the plateau is towards the north. The contour lines of 150 and 300 m demarcate its northern fringe. Many rivers with their feeders have their sources on their dissected rim. The Panchanan, Sakri, Harohar, Kiul, Chandan, etc., have their source head in the northern rim of the Kodarma Plateau region. The soils are generally sandy on the slopes, but in valleys and basins, they are argillaceous. In other parts of the plateau, the soil is clayey. About one-third of the area is under forests and scrubs. The best forest occurs on the northern scarps in Hazaribag (including Kodarma forest). In Hazaribag and Gaya the forests are kept better and consist of sal in association with other trees found in Chotanagpur. The Kodarma Plateau is known for Mica resource region of Chotanagpur. The mica industry of Chotanagpur is of enormous importance to India and the world. Nearly 70 % of the world's sheet mica comes from this belt. The largest part of the mica belt falls within the Kodarma district. The chief centers of mining are Dhorakhola, Domchanch, Masnodih, Dhad, Gawan, and Tisri.

(ii) The Rajmahal Hills region lies in the north eastern rim of the Chotanagpur plateau. The Rajmahal hills stretch in a southwest-to-northeast direction roughly from the Moor Valley to the Ganga in the north. The region consists mainly of a series of hills and small plateaus intersected at comparatively short intervals by several transverse river valleys. The western and south western parts of the region are an upland tract consisting of long spurs with alternating valleys. It is bounded by the alluvial track of the Ganga plain on all sides except in the south and west. It has an extremely varied topography. It forms a part of Gondwana land. It extends from Sahibganj near the Ganga to Nagalbanga close to the south-eastern boundary of the district of Sathal Pargana except for a narrow strip of the alluvial plain of north and east.

The valleys that lie between the undulating ridges are full of fertile soil and used for growing rice crops. It is grown mostly in the valleys and terraced slopes and accounts for about half of

the total cropped area. The next important crop is maize. Wheat, barley, linseed, millet and pulses are grown on the uplands. The hills are thickly forested and are inhabited by Santhals and other primitive tribes. The economy of the region depends on the product of the forest. Sabai grass is grown wild on the hills and is used as raw material for the paper mills at Kolkata. On the uplands, forest cover is with Sal as the predominating species. Wood cutting, cattle rearing, poultry keeping and vegetable growing are the side occupations of the tribes of the region

(iii) The Southern Adjoining Highlands region lies in the southern part of Chotanagpur. It includes Kolhan Highlands, Dalma Highlands, and Dhanjori Highlands. It has varied relief and a diverse economy. It covers the district of Paschim Singhbhum. It is also called Kolhan iron-ore region. The Kolhan iron ore region is mainly a mining region and comprises the hilly areas of Kolhan and Parahat in the southern and western parts of the Purbi Singhbhum district. The Dalma range runs from Ghatshila in the west to Dunadih diagonally across the Subarnarekha River. The Mica-Schist Plain Region runs from west to east forming a natural corridor between Dalma Highland in the north and Kolhan and Dhanjori Highland in the south..The region consists of a plain surface in the north eastern part around Chaibasa town and a rolling plain studded with hillocks and granitic boulders. It slopes from south to north along the Kharkai Valley and southwest to northeast along the Garra valley. The rest of the region on the north-west, west, south-west and south is dissected and largely forested surface. The region has a complex geological history. It consists of metamorphic sedimentary rocks, with which basic igneous rocks and large intrusive masses of granite are associated. The Dalma and Dhanjorei lavas are the most extensive and attain the highest relief with a diversified economy. The iron-ore range runs south of Gua in the form of a horse-shoe closed towards Odisha and open with ends. The south eastern corner of the region is drained by the affluent of the Baitarni. The region receives an annual rainfall between 1400 and 1600 mm on the surrounding hills and scarps. The Highland region is hot during summer and cold during winter. About one-third of the region is under moist deciduous forests consisting of a sal tree. The rich flora and fauna of the region have directed the Government to preserve the forest wealth. The soil of the region varies from valley to highland. The agricultural economy is predominant with rice as the leading crop. Other crops like maize, oilseeds, pulses, etc., are also grown. Gram is also relatively important in this region because of the heavy soils.

4. Uniformed Surfaces or Plain Regions: This region includes three river basins, namely, a) the north Koel basin, b) the Subarnarekha basin, and c) the Damodar river basin. The height of the regions is below 300 m. They are located in western, central and southern part of the plateau region.

(a) The North Koel basin lies in the western part of the plateau. It forms a triangular piece of land with the apex at the foot of the Pat region and the Son at its base. This region is characterized by varied relief, fertile alluvial soil, scrub forests, and agriculture. The surface is

extremely rugged. The area of the basin is demarcated by the plain in the north, the Pat region in the south, the Hazaribag Plateau and the Damodar basin in the east, the water divide between the North Koel River and the Kanhar river in the west. Structurally, the basin area presents some contrasting features. It contains geological formations of the Vindhayans in the north-western corner and hard gneisses and granite in the south near the Pat region. The geological formations of different rocks have given rise to variations in the landscape. The basin contains fertile alluvial soil on the surface but the basement rocks are igneous, metamorphic and sedimentary. The principal rivers are the Koel, the Auranga, the Amanal, the Garu, the Orangai, the Banki, etc.

The climate of this region is dry and bracing. The average annual rainfall is 1330 mm. The *sal* is the principal tree found in the forests and usually occupies the lower slopes of the highlands. The important forest products are timber and lac. The forests play a great role in the economy of the region. The relief and the shallowness of the soil are the limiting factors to the development of agriculture. The North Koel Basin reveals variation in cropping patterns. The dominant crop is rice and to a less extent, wheat, barley, maize, gram, tour and other pulses are grown throughout the valley region. The Koel valley coalfields of Daltonganj, Hutar and Auranga are important in registering economic elevation. The population is primarily rural. There are very few urban centers in the region. The region is well served by transport facilities. It is well connected by railways and roads. The railway running along the valley of the North Koel River has helped much towards the prosperity of the region.

(b) The Subarnarekha basin region lies in the south eastern part of the Chotanagpur Plateau and forms a distinct physiographic unit. It covers a narrow elongated shape from north to the south territory of Purbi Singhbhum district. It is lying mainly in the valley of the river Subarnarekha. It presents variegated landscapes and litho-logical characteristics. To the east lies uplands of Jhalda-Baghmundi and the Dalma Ranges. In the south, the Dhanjori Range and South Kolhan highlands separate it from the Bamanghat plain and Baitarini basin of Odisha. The region comprises some areas of Ranchi, Purbi Singhbhum and Paschimi Singhbhum. There are residual hills spread all over the valley. It is an extensive highland of varying elevation in the south but turns into a series of low broken ranges in the west. The region has a complex geological history which accounts for the great diversity of landforms, ranging from the high Ranchi plateau to the relatively flat lower plateau. The geological structure of the area consists of granite-gneiss batholiths to the north and south and two geo-anticlines separated by geosynclines running through the region.

The Subarnarekha valley contains varying soils. The upper portion contains lateritic soil while the lower portion contains gravely soil. It also contains red soil of residual and alluvial origin. It is not very fertile. The alluvial soil deposited by the Subarnarekha and its tributaries covers the plain area. The region is drained by the river Subarnarekha and its tributaries. In this region agricultural land dominates with patches of forest cover and human habitation. This area is,

however, important for agricultural purposes and divided into first order, comparatively level plains embanked for rice cultivation; second, the open valleys with low alternating hills which have been carefully leveled and grow rice. The area is rich in mineral wealth in which huge deposits of copper, iron ore, manganese, china clay, asbestos, apatite, limestone, steatite, slate and kyanite occur in Dalbhum. They are best developed and formed at Rakha mines, Mushabani, and Dhobani. Important iron ore mines are Gua, Manoharpur, Noamundi, Jamda, Lukidburu, etc. The river bed of Subarnarekha contains gold along with sand (Sinha and Singh, 2003). Almost all iron ore and copper mines are linked by rail route which facilitates the transportation of minerals and the movement of people. The Subarnarekha valley, through which the main line of the Bengal Nagpur Railway passes, gives easy access to Kolkata. The area also covers National and State Highways. National Highway NO.33 covers Chaibasa, Chkardharpur and Ranchi roads. Airstrips are available at Jamshedpur and Ranchi.

(c) The Damodar basin occupies a sunken trough in the middle of the Chotanagpur plateau extending in an east-west direction between Hazaribag in the north and Ranchi in the south Chotanagpur plateau. It covers large areas of the Gondwana trough. The Damodar Valley is characterized by narrow and wooded steep hills and a scar on the south. The hills are covered with forests. Rajrappa waterfall is a discordant junction below which an imposing gorge and many juvenile features produce a classic segment of landscape. The topography in its course is varied and undulating. The undulating nature of the topography and the faulted nature of the strata have not only favoured the extraction of coal but also provided suitable sites for damming the river (Qureshi, 1990). The region has a complex geological history because of its relation with an ancient landmass of the Gondwana land and prolonged denudation, igneous intrusion tilting, warping upheaval, etc. The faulted basin of Damodar has rock formation of the Gondwana period from the Hutter coal field in the west to the Jharia and Raniganj coal field in the east. The lower Gondwana made up of sandstones and sales contain storehouses of coal seams, the richest, largest and most productive coalfields of India (Ahmad, 1965).

The Damodar basin is a highly mineralized region in India. The Gondwana sedimentary rocks in the valley are the largest, richest and most productive coalfield in India. Most of the coal seams are quite thick and lie in horizontal strata which enable easy mining. The Damodar basin has encouraged industrial growth because of coal resources, power plants, a dense network of transport and other industrial infrastructure. In the lower part of the valley particularly in Dhanbad and Bokaro districts, the landscape resembles mineral-based potential land. Dhanbad with many mining and industrial activities is an industrial node that has developed a complex form with intensification in the use of its resources. Sindri, the largest fertilizer plant and cement works is a well-planned industrial landscape. Thermal plants, washeries and growing industries have brought a consequential change in the former industrial environs of Dhanbad. Gomia, Bermo, Chandrapura and Maraphari have already engraved an industrial landscape. The hilly areas are forested. The forests are mixed deciduous type. On lower slopes

it consists mainly of sal, shisham, semal, piar, kusum, and mahua etc. trees. Lac, bersabai, dhak, grass, bamboo and thorny plants are also forest products. Cultivation has been extensively damaged by coal mining which created agriculturally negative lands. The agricultural pattern of the region is similar to the other parts of Chotanagpur. The crop pattern is controlled by two chief crops, rice and maize. The other important crops are ragi (marua), oil seeds and pulses. Fruits and vegetables are also grown.

Problems and Associated Issues

The Chotanagpur plateau is a poverty-ridden land. Almost 50 % of its total population is below the poverty line. About 80 % of the population is dependent upon rain fed-based agriculture and productivity is very low (Ram, 1991). There is regional inequality in the distribution of land resources in the region. The exploitation of different resources has increased, but they have contributed less to the economic growth of the region. Resources are not available for utilization or the development of the region. The state is responsible for safeguarding resources but with no right to their beneficial use. The rural areas are not directly benefitting from the development of resources rather they suffer a deteriorating environment. Chotanagpur, as a result of mining and industrial development, has been modified and is continually changing. The development of coal mining in Damodar valley, iron mining in Kolhan, copper mining in eastern Singhbhum, mica in Kodarma and Giridih, and quarrying of bauxite in Ranchi have brought changes in the use of agricultural land in the surrounding regions. Accordingly, the heavy industries at Jamshedpur, the copper smelting industry in the Moshabani- Ghatshila area, and the varied industrial development in the Damodar basin have their impact on the economy, land use, and population of the immediate environment. Because of population pressure, food crisis, and excessive exploitation of resources, many minerals will be depleted shortly, which needs conservation and judicious utilization.

Human and their activities such as food production, industrial development, energy production, and urbanization are transforming the earth's system at various scales ranging from local to global making problems for the region. The destructive influence of agricultural and animal husbandry practices on unsuitable lands and the destruction of forests are all caused, directly or indirectly by population growth pressure (Kumar and Saikia, 2020). Urbanization, deforestation, growth of the human population and economic wealth of people has significantly increased the degradation of natural resources in the region. During the last two decades, the changes that are being realized in the region in terms of production, water quality, water quantity, and biodiversity and carbon storage have shown a decline in all the major ecosystems. Forests, wetlands, and other natural places are shrinking to make way for people and their homes, farms, and factories. Therefore, it becomes important to prevent further degradation of natural resources and carefully manage them to ensure their sustainable utilization.

Many environmental issues such as pollution, deforestation, agriculture, and land and soil degradation are important problems. Environmental air pollution, water pollution, and

garbage pollution are all challenges for the region and its development. Within less than fifty years, the whole of Chotanagpur has changed from a mountainous, lush-green, dense forest area with numerous wild lives and plenty of falls and rivers with clean waters into an area with bare mountains without much of trees and nearly no wild animals and with dry waterfalls and rivers full of polluted waters. The fresh, cool and soothing breeze which was so abundant in this region, until a few decades back, is rare now; and instead now has dusty, hot and smoke-full aerosol air. Smokes, full of suffocating gases, especially during late afternoons, almost every day, on the National Highway may be experienced by anybody. Likewise, the fly ash and the smoky dust deposits may be seen near any of the cement factories and thermal power projects. More or less the same picture exists wherever there are coal mines and washeries and other mines and mineral-based industries. The situation is indeed alarming every day.

Resource conservation involves using, managing and protecting resources so that they are not wasted, depleted, or degraded and are available on a sustainable basis for the present and future generations. There are many environmental issues in the region but environmental awareness has created a sense of conserving natural resources. In recent times, several management tools are being applied for sustainable development actions. The impact statements are prepared to assess the effect on human beings, plant and animal life, soil, water, air, climate, material assets as well as cultural heritage. All developmental activities take into consideration risk, social, economic, cultural and health and other relevant factors in different regions depending upon the requirements. The Jharkhand government has prepared an Action Plan for the development of the state at the district level.

Economic Potential and Prospects of Chotanagpur

The first effective measure to integrate this hilly inaccessible tract to the Chotanagpur Plateau was taken in 1772. In the succeeding period, road links were constructed to exercise effective control over the Chotanagpur region. Subsequently, the area was systematically surveyed which brought to light vast natural mineral resources deposits of coal, iron ore, copper, mica, and other important minerals. The extension of railways prompted by the desire to exploit these minerals brought further economic and administrative integration with other areas. The structural base of the region provides a series of batholithic intrusions of granite into Dharwar strata, which were intensely metamorphosed by genetic movements. No doubt, the area has been stable but minor geomorphologic changes have taken place in the form of faulting, warping, tilting, igneous intrusions, etc. The earliest geological formations of the area had indeed been reduced to peneplain but later structural disturbances have created unevenness in the land surface. Erosion agents have also made additions to geology in the area. It is considered as a storehouse of resources and economy of the country. Therefore, its economic potential can be seen in various sectors discussed below:

Agricultural Potential: Agriculture is the mainstay of the people. It is the basis of the economy of the region, basic employment and primary income-generating activity. The agricultural economy of the region depends on nature. Agriculture constitutes the main source of

livelihood among tribes, rural development, employment and occupation, agro-industries, food and nutrition security growth and survival, social, economic and cultural conditions and poverty alleviation (Surayya et al, 2008). Large areas are densely forested. The fertile slopes and valleys are given to agriculture which is, however, handicapped by poor soil cover, erosion and lack of irrigation. The low investment, low productivity, mono-cropping with paddy as the dominant crop, inadequate irrigation facilities and small and marginal holdings are the characteristics of the whole Chotanagpur region. The character of farming has changed. Most of the crops and farm produce are now raised for nearby mining and industrial centers. The dependence of agriculture on the vagaries of the rain God can be gauged from the fact that as much as 92 % of the total cultivated area is un-irrigated. Not only productivity is low, it varies considerably among districts in the region. If the decision-makers explore the potential and give a boost to the sector, it can make the livelihood security of the people better.

Forest Potential: Forest resources are considered as a commodity of high value across the state as most of the locals are dependent for their daily subsistence needs mainly for food and fuel wood. Forests play an important role in the economic and socio-cultural lives of the people, especially tribal community and the rural people who depend on forests for livelihood in this region. The region is covered with dry deciduous dense forest dominated by plentiful Sal, Bamboos, Gamhar, Kusum, Shisham, Sabai grass, spear grass (Andropogon contortus) and Palas. These grasses are chiefly used for paper manufacturing and thatch making. Commonly extracted forest products are timber, lac, kath, fuel wood, fodder, medicinal plants and a range of Non-Timber Forest Products (NTFPs) based value-added industries and their organized marketing system should be promoted (Kumar and Saikia, 2020). They have multiple roles to play in the inclusive economic development of the region. The region is renowned worldwide for its tasar and kuchai silk. Large numbers of commercially important medicinal plants are found in the forest of Jharkhand. The livelihood of tribal population heavily depends upon NTFPs for their nourishment. Kendu leaves collection occurs in a short span of two months in West Singhbhum (particularly, Kolhan, Kharsawan and Saraikela) region for the cultivation of cocoons (silk worm) is one of the major sources of income for them. The Chotanagpur has more than 15 % of forest which is dense to moderately dense forest. Further, it is also covers a significant portion under open forest (Table 1).

Table 1: Types of Forest Cover in Chotanagpur, 2021

Forest Cover	Area (km^2)	In Per Cent
Dense Forest	2587	3.25
Moderately Dense Forest	9667	12.13
Open Forest	11219	14.07
Non Forest	56241	70.55
Total Geographical Area	79714	100

Source: Based on India State Forest Report, 2021

Mineral and Industrial Potential: Chotanagpur region can be rated as one of the richest regions of the country so far as potential and production of mineral resources are concerned (Karan, 1953).The mineral belt lies to the south of Jamshedpur and in the Damodar basin. It produces 37.5% of the mineral production of India and is designated as the 'Mineral Monarch' of the country, which seems to be true in both variety and richness. With its noteworthy deposits of coal and iron ore it is often labelled as the 'Rhur of India,' (Thakur, 2015). If produced minerals had been put to industrial uses they would have given a stable industrial base, but the local situation is quite different. The region is storehouse for several minerals like iron-ore, graphite, limestone, bauxite, copper, apatite, kyanite and feldspar, coal, mica etc (Table 2). Coal, and iron ore are the basic minerals needed for the growth of industries which in turn is vitally necessary for the region's development. The region accounts for about 31 % rock phosphate, 23 % iron ore (haematite), 30 % apatite, and 20 % copper ore, reserves of India. Similarly, other minerals are also of economic significance. It is expected that the region is also rich in emerald minerals.

Table 2: Reserves of Minerals in the Chotanagpur Plateau

Minerals	Unit	Total Reserves
1. Iron ore (Hematite)	'000 tonnes	26888
2. Graphite	tonne	19426
3. Kyanite	tonne	426240
4. Limestone	'000 tonnes	783
5. Bauxite	tonnes	1418794
6. Felspa	tonne	1654621
7. Asbestos	tonne	154893
8. Dolomite	'000 tonnes	24916
9. China Clay	'000 tonnes	202244
10. Fire Clay	'000 tonnes	66454
11. Copper ore	tonne	288423
12. Coal	'000 tonnes	131763

Source: Based on Indian Mineral Yearbook, 2018, (Part-1), Jharkhand, 2019-2020

The significant reserves of these minerals make the region highly potential and also the base for the development for heavy industries. In spite of emphasis on regional development during the past five decades and rapidly increasing mineral output, no manufacturing industry except for the two biggest steel plants Bokaro and Tata Iron Steel Company (TISCO), was initiated in this region. In the manufacturing sector, industries with the brightest future are those related to iron and steel: metal fabrication, production of wires, nails, galvanized sheet-working hardware, aluminum hardware, and hollow-wire. Among mineral industries, much scope exists for cement, refractoriness, potteries and sanitary ware, abrasives, paints, and mineral wood. Among forest-based industries, lac, tasar, bidi, furniture, and paper and animal products such as bone meal, glues, and leather tanning can be developed. The Government has proposed setting up a number of new industries in the region but the program is yet to take working shape.

Human Potential: The development of mining and industrial centers has not only modified the natural or physical landscape but also the old pattern of settlement and human occupation. The labour force of the mining and industrial centers is drawn from the countryside and some much farther away. In this way, there has been a shifting of population from rural areas to urban centers and a consequent decrease in the pressure of population on land. New settlements have sprung up. The development of roadways and railways has also changed the economy of the hinterland trade. It is important to emphasize that transport is welding all these minerals and industrial and agricultural regions of Chotanagpur, into one major economic region of India. If the development of the entire area is well planned and efficiently carried out and managed, this will produce an economic region of world importance. For the region as a whole, the industrial potential is very high for the rich resources because of the rapidly growing demand and increasing urbanization. There is an urgent need to develop mineral, industries and power resources at the micro level (Thakur 2004).

Power Potential: For the development of iron and steel, copper, cement, engineering and basic industries Chotanagpur has adequate power resources in the form of thermal and atomic powers. The increasing demand for electricity and the limited possibilities of increasing power generation from hydro and nuclear stations led to increasing demand for coal (Dayal 1977). The hydel power potential is also remarkable. Among the significant schemes are the Tiliaya dam and hydroelectric power plant, and the Bokaro thermal power station units of the multi-purpose Damodar valley project, the Subarnarekha valley project, the Koel basin project and other projects that have been developed in the region. Thorium and uranium, the atomic energy minerals, are the tremendous source of power in the region. Jharkhand state is particularly, rich in mineral and power resources but the situation is like sailing in a sea where there is "water, water everywhere but not a drop to drink." The state has the responsibility of safeguarding these resources but not to right of their utilization for the development of immediate areas (Thakur, 2015). Under different Five Year Plans, a unified scheme of agricultural, mineral, industrial and power development has been envisaged under the Jharkhand government.

Tourism Prospects: The immense potential exists for developing a systematic tourism infrastructure that will bring financial revenue. The greatest potentiality for expansion of industries in proximity to the cities of Ranchi, Bokaro, and Jamshedpur is the result of (1) vocational advantage and market, and (2) in part, the incentives given by the government in terms of provision of land, electricity, water, and other faculties.

Synchronizing with these developments is the rise of various urban settlements in the former forest-covered areas of the plateau. Another significant development is the integration with neighbouring regions. There is a need to consult local communities at the time of planning and to enforce any waste disposal mechanisms at the outset of the operations and even afterward (Thakur 2007). Reuse and recycling of waste materials to handle with the waste problem, which is taking a heavy toll on our topsoil, needs to be worked out for specific solutions. The

necessity of having the mining and processing industries in proximity is very important (Prasad 2008). Then only the economic potential of the region can be harnessed.

Conclusion

The study has revealed that Chotanagpur Plateau is a distinct natural region defined by its varied morphology and man's activities ranging from primitive to modern. The region has produced distinct anatomy, age, climate, forest cover, resources, minerals, agricultural pattern, and human resources. The geological structure, relief, altitude, and vegetation with resources and associated economic developments distinguish one region from another. Physical conditions, particularly relief, and altitude form an important basis for the delimitation of the natural region. Each region is clearly defined by its distinctive features and is unified by well-marked geographical features which provide the region its distinctive quality and marked it out from the rest. Accordingly, the region is divided into landform units considering structure, lithology, and geomorphic character. The region is, therefore, classified into different formal natural regions and presents an account for the potentiality of the area. The study suggests that after facing various problems, the region has an excellent raw material base; industrial potential base for development but the area is restricted because of financial constraints and faulty government policies. Unfortunately, the region is fast losing its premier position in the country owing to industrial stagnation. There is an urgent need to carry out detailed investigations on the geographical distribution patterns, utilization patterns, feeding ecology and protect all resources at micro-level units for local and regional development of the Chotanagpur region.

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SKEWED SEX-RATIO, MARRIAGE DYNAMICS AND FEMALE MIGRATION: AN INVESTIGATION FROM A HIGH FEMALE DEFICIT REGION IN INDIA

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ABSTRACT

Despite improvement during the last decade, sex ratio remains as abysmal particularly in northern and north-western parts of India. The social impact of high masculine population in forms of marriage squeeze, mass bachelorhood, bride purchasing, female trafficking and sexual violence across the region have started emerging up In India, Eastern Rajputana is one of the female deficit regions where historically the sex ratio has much imbalanced. Addition to that, its ecological crisis made it much severe regarding getting a bride for marriage and hence, a considerable male population remains a lifelong bachelor. In the context, the lifelong bachelorhood is not only a socio-demographic issue but has a much impact on the individual's health and social and economic status of his household. The study is an exploratory in nature and aims to explore dynamics between skewed sex ratio, local nuptial structure and pattern of cross-cultural female migration using Census of India 2001 and 2011 data and empirical evidences collected from the study region. Primary, as well as secondary data, has used for the study. The mixed method has been for analysis. The preliminary findings showed that apart from the socioeconomic status of households, ecological crisis through the economic status and livelihood of households influence the marital status of male and hence the proportion of bachelor increases consistently in the study region. There was a deficit of 150 women for every 1000 men in this region. Bachelorhood among older males was also prevalent as 4% males in 30+ ages were unmarried with highest in Dhaulpur (7%). Inter-district female migration pattern shows that there were more female in-migrants than males in this area from long-distance, poor, dissimilar cultural regions of India. These pockets were from Manipur, Assam, Darjeeling, West Bengal, Bihar and Jharkhand.

Keywords: bachelorhood, female-deficit, marriage-migration, Rajputana, skewed sex-ratio.

Introduction

The deficit of women in India's population has been documented ever since the first decennial numeration of people conducted in the late 19th century (Backer, 1991; Das, 2009; Guilmoto, 2009, 2012, Kaur, 2004).Over the span of more than a century, the deficit has progressively increased as evident from the sex ratio of the population; the number of women per 1000 mens steadily declined from 972 in 1901 to 933 in 2001 (Guilmoto, 2009; Roy et. al., 2018; Visaria, 2003). In the latest census of 2011, it was 940 females for every 1000 males, which indicates a slight improvement from the previous census but overall, there were more than 356 million less women than their men counterparts (Census of India, 2011). Yet the absolute number of

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missing women in India has increased from 37 million in 1980 (Das & Li, 1999; Sen, 1992) to 46.35 million in 2001 and 49.73 million in 2011 (Census of India, 2001, 2011; Kulkerni, et.al. 2013; Roy et. al., 2018). What has been convincingly demonstrated that the primary factor contributing to the deficit of women in India is higher mortality among women than men from early age of12 months to almost upto the end of their reproductive period (Kaldwell, 2005; Kaur, 2004, 2008; Roy, 2018). This deficit of females can be attributed directly to human interventions, such as sex-selective abortions, the gender biased allocation of resources in infancy and childhood and the influence of gender-iniquitous social relations throughout the female life cycle (Blanchet, 2005; Das et. al., 2009; Goldman, 1984; Goodkind, 2011; Guilmoto, 2009; Kulkarni, 2010; Sen, 1992). Miller (1981) states that 'the problem is that son preference is so strong in some areas of India and amongst some classes that daughters must suffer in order that a family's personal and culturally mandated needs are fulfilled'. Using the state level data, for 2001 and 2011, Kulkerni et al. (Published in The Hindu, 2013) identified that the north-south divide in the share of missing women. The missing women were from the states with higher per capita income, having significant proportion of SCs/STs and higher crime against women and higher proportion of women in reproductive span (Jiang & Sánchez-Barricarte, 2013; Kaur, 2008; Rahman, 2014). However, the relationship was found adverse in the states with higher female literacy and female work participation which are the indicators of women's empowerment (Hesketh& Zhu, 2006; Hudson & den Boer, 2004). In the contiguous region from north to west of the country, the deficit of girls increased between 1981 and 2001 (Kulkarni, 2010; Visaria, 2003a) and further in 2011 (Kulkerni, 2013).

A key effect of the skewed sex ratio is what demographers call a 'male marriage squeeze', implying a shortage of brides and therefore an excess of bachelors in the society (Billing, 1991). Based on simulation models on impact of skewed sex ratio on marriage squeeze in China and India, Guilmoto (2011) it is found that the number of men unable to find a spouse is going to rise in China (from 3% now to 15-21% in 2060) and India (below 10% by 2050). But its rate and direction will depend upon the rate of birth of males. However, age is not the only factor for the marriage squeeze but it is also associated with cultural phenomenon (Billing, 1991).

The male marriage squeeze gives females an advantage in the marriage market (Billing, 1991; Miller, 1981). However, despite the deficit of women, whose impact is being felt when procuring brides, the social norms have not yet undergone a shift (Jiang & Sánchez-Barricarte, 2013; Visaria, 2003b). The combined effect of patriarchal structure and values and the practice of getting rid of daughters is such that certain social groups in these states have started facing deficit of brides for their sons. Reportedly, a few men are forced to remain bachelors and for some others brides are being brought (cross-cultural or cross regional marriages) or bought by paying bride price from scheduled tribes and other groups from faraway places, including other states (Visaria, 2003a; Blanchet et al., 2003, Kaur, 2004 & 2010). Available literatures and reports on Indian situation suggested that in these regions, due to scarcity of marriageable females a considerable number of bride migration/ bride purchasing takes place from other parts of the country (Manjul, post on *NMCI,* 2007). Currently, UN-commissioned report on human trafficking in Haryana explained that skewed sex ratio forces marriage migration and

resulted in trafficking of women from across the country. Gurgaon and Faridabad are the major destinations for the girls and women trafficked for domestic work and a large number of them even become victims of sexual exploitation and the similar situation has also been reported in the regions of Western Uttar Pradesh, Punjab and Rajasthan where brides trafficking is spreading like communicable diseases (Kaur, 2004, 2008; Roy et., al., 2018).

Study Area

Demographic context:

Demographically there is an almost contiguous belt extending from north west of India to parts of Rajasthan, Gujarat and Maharashtra, the under valuation of womenis evident interms of excess of males over females (Guilmoto, 2009; Roy et. al., 2018; Visaria, 2003a). This is also the region where historically, deficit of women in the total population has been quite high. The predicted causes of the decline in females' population were mainly the strong son preference among the communities like Jats and other higher caste communities (Patel, 2007; Purewal, 2010) of the region, and less affinity to daughters due to high dowry prevailing in the society during their local marriage customs. Paradoxically, the states having highest per capita income exhibit such a skewed sex ratio in males' favour (Guilmoto, 2012, Hudson & den Boer, 2004; Kaur, 2008) result into female deficiency and male surplus. The available literature and studies clearly indicate high incidence of bride purchasing and female trafficking in certain pockets of north-western states in India (Kaur, 2004; 2010; Blanchet et al., 2003). They are brought from the states like West Bengal, Bihar, Jharkhand, Odisha, and South India.

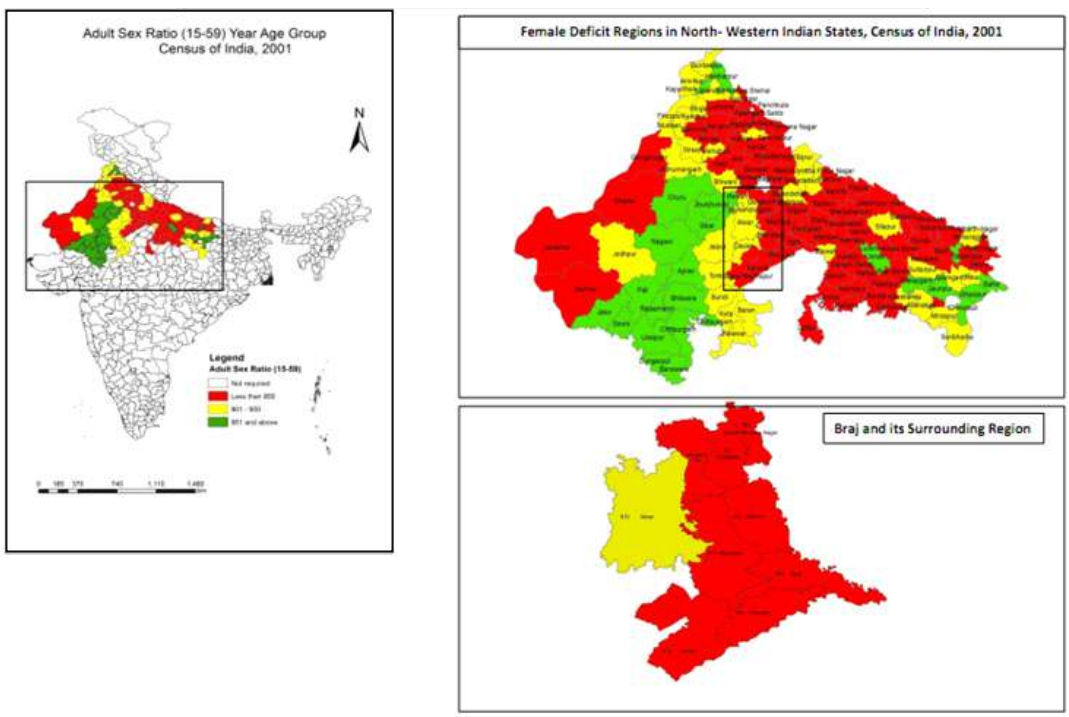

Figure 1 : Relative location of study area and adult sex ratio (15-59 Year Age Group)

Geographical and cultural context: Besides the adverse sex ratio, there are some inherent socio-economic and geographical factors which multiply the problems of eligible bachelors. The study area is located in the bordering districts of UP, Rajasthan and Haryana which comes under ecologically vulnerable zone and culturally it falls in Eastern Rajputana region. Geographically, the Eastern-Rajputana region and its surroundings, comprises with the area of western-southern Uttar Pradesh (Mathura and Agra districts), Southern-eastern Haryana (Mewat and Palwal district) and north-eastern Rajasthan (Dhaulpur, Bharatpur, and South-eastern part of Alwar). The region is surrounded by Arawali Range in west, by the river Yamuna in north and Chambal River in south-eastern part. It exhibits geographical contrast in terms of Yamuna flood plains in Mathura, Bharatpur and Agra, hilly rugged undulated terrain in the western part of Bharatpur and Dhaulpur, and riverines in the central and southern parts. It is located in Yamuna-Chambal *doab* but ironically, due to its rugged terrain and hot and dry climate, it experiences the water scarcity as the major problem. Due to such geographical set up this region is one of the backward regions of the country. Even located in the proximity to the India's capital, having seventh wonders of the world the Taj Mahal in its fold and being a part of mythological birth place of Lord Krishna, this region has been economically poor and backward.

Need for the Study

Sex ratio imbalance and its surplus of males in this region have received a great deal of attention in the recent past. Preference of son and neglect of girls clearly reflect demographically skewed sex ratio, major reason for mass bachelorhood and male marriage squeeze (Kaur, 2008; Patel, 2007; Purewal, 2010; Tarannum, 2007). The deficit of females creates marriage crisis for males in their local community and many of them are forced to purchase brides from other parts of the country. Severity of the problem has been highlighted in local newspapers and the cases of bride purchasing from poor regions of India has been regularly reported. The three phenomena, the skewed sex ratio, male marriage squeeze and cross-cultural female marriage migration are interrelated (Miller, 1981; Patel, 2007; Purewal, 2010; Tarannum, 2007). But majority of the literature have focused on causes of skewed sex ratio and limited work has been carried out in exploring situation of mass bachelorhood/singlehood in the rural setting of the study region and socio-cultural status of such imported brides. Thus, there is a need of further investigation into the issue systematically to get better insight.

Apart from that the study area bears a typical set up of ecological and demographic crises which draw our attention to investigate the problem in-depth. There is a need to explore and document the secondary factors which influence the regional demography in these female deficit regions. Thus, the major objective of the present study is to explore the spatial demography and its impact on local or regional demography and emerging issues of ecological and demographic crises in this region.

The study is based on the enquiry of few fundamental questions like what is the prevalence of bachelorhood in the rural areas of the districts under study? How does the local demographic phenomenon affect the regional demography in terms of migration of brides from other parts of the country? Is there any development of corridor between the bride demand and supply zone?

If it leads to female marriage migration from other regions, then who are these women and under what situation they are forced for marriage? Likewise, there are many other socio-cultural aspects which need in-depth enquiry. This paper attempts to seek answers to some of these fundamental questions to understand the phenomena of skewed sex ratio, nuptial pattern and female migration.

Material and Method

This is an exploratory nature of research. It relies on both primary and secondary data sources and adopts both quantitative and qualitative methods of data analysis. Data from census 2001 and 2011 are used to study the sex ratio, nuptial pattern and female migration in the region. Mean age at marriage for males is taken from DLHS third round of 2007-08from the DLHS-3 Reports of Haryana, Rajasthan and Uttar Pradesh (IIPS, 2010). For further exploration of the dynamics of skewed sex ratio, marriage and female marriage migration, and in order to fill the information gap of secondary data, the information was gathered through observations, interviews of seven key-informants and in-depth interviews of 20 respondents (13 imported brides, 6 bachelors, and one husband of imported bride). Before going into results and discussion of study it is important to define the variables and their method of computation used in the study. They are explained below:

Sex-ratio is ratio of males to females or vice-versa. This study uses feminine, masculine, non-child and adult sex ratios. Feminine Sex Ratio is calculated as ratio of number of females for 1000 males. This ratio indicates deficit of females over males. Masculine sex ratio has been calculated as number of males per 100 females. It is used for understanding the surplus of males over females. Non-child sex ratio refers to sex ratio for population 7 and above. Adult sex ratio is computed for the age group 15-59 years.

Marriage squeeze is a situation when number of males do not find spouse in their given administrative region. The simplest approach for measuring the marriage squeeze is based on the calculation of simple sex ratio. In demography, a person who is never married by age 50 is termed as lifelong never married (Jiang, 2014). It is seen that marriages are concentrated only over the few ages which is assumed as peak marriageable ages for marriage known as prime marriageable ages (Akers, 1967). Prime marriage age vary from region to region. Following the methodology adopted by Verma, (2003), and Kesarwani (2012)here we have also considered two indicators for marriage squeeze by considering the different prime age at marriage (a) marriageable age groups (x, x + n) as 15-49and (b) by considering the cultural practices that grooms are older than brides therefore male from 20-34 to female 15-29 age groups which can be measured as:

$$I=(n\,M\,x/n\,F\,x)\ *100, and$$

$$I=(5\,M\,x+5/5\,F\,x)*100$$

Prevalence of never married male (Bachelorhood) is the percentage never married in all 30+, 40+ and 50+, years of males to see the situation of singlehood.

Female marriage migration refers to marriage as a sole cause of female migration from other states to the study districts.

Result and Discussion

The results of the study are presented in two folds. First section presents the regional scenario of skewed sex ratio, nuptial dynamics and female marriage migration in the study area by using the secondary sources of data. The second section supplements gap of the first section and throw light on bachelorhood and imported brides using evidences collected through case studies from the field.

Imbalanced adult sex ratio: Sex ratio (number of females per 1000 males) is displayed in the Fig. 1 clearly indicates a geographical contiguity in its distribution in study states (Census of India, 2001). Areas under red colour indicates less than 900 women per 1000 men while green colour indicates areas of better sex ratio (950 and above). It is clearly illustrated that whole of the Uttar Pradesh except Eastern UP and few other patches, majority of Haryana and Punjab, and in Rajasthan the districts located at border of India-Pakistan and east of northern Arawali Mountain face an acute deficit of more than 100 women for every 1000 males as per census 2011.

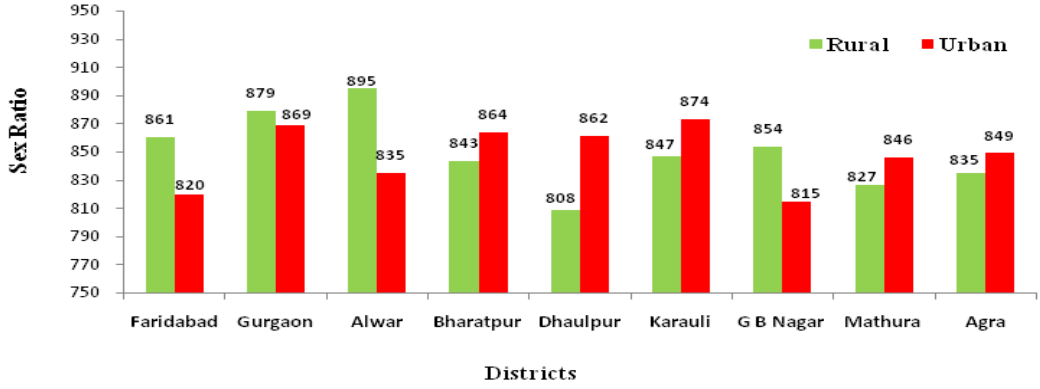

Figure 2 : Non-child (6+years) Sex Ration of Eastern Rajputana Region, Census, 2001

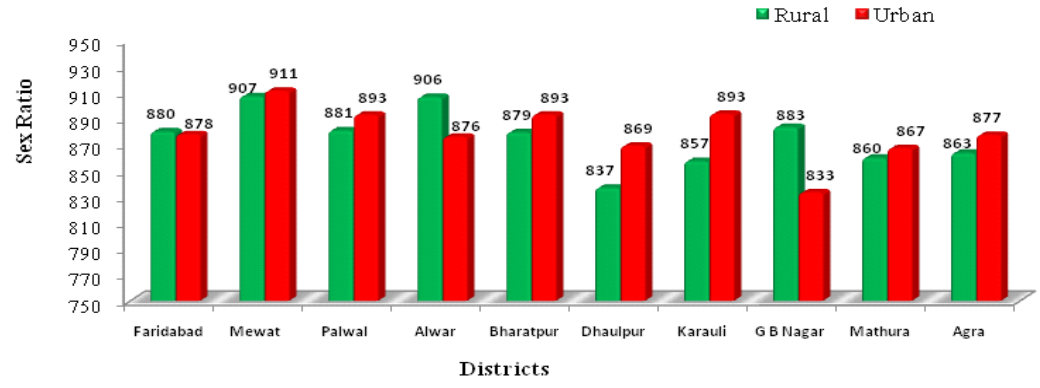

Figure 3 : Non-child (6+years) Sex Ration of Eastern Rajputana Region, Census, 2011

Male marriage squeeze: The size of the female population is profoundly less compared to their counter males in age group, and it reflected in demographically skewed sex ratio, and later on reason for mass bachelorhood and male marriage squeeze (Kaur, 2008; Roy et. al., 2018).The imbalance sex ratio in favour of males entails that some of the males will be unable

to find out their spouses in the same population. This will result into considerable proportion of bachelorhood and state of male marriage squeeze.

Table 1 presents the various sex ratio indices for measuring the marriage squeeze in the study area. In this table there are four sex-ratio based indicators. The first two columns present simple sex ratio (females per 1000 males) and deficit of females per 100 males. The third and fourth column presents sex ratio (males per 100 females) and percent excess of males to females in the population. Among all the three states, Haryana has highest deficit of females or excess of males. While at district level the gap was females' deficit was high ranging from 14-16 per 100 males in Dhaulpur, Karauli, Mathura and Agra. The last two columns are to measure marriage squeeze in the study area among the peak marriageable age groups i.e. that all the marriages take place between (a) 15-49 age group, and (b) marriages taking place in between 15-39 age group considering spousal gap of 5 years. Sex ratio more than 100 reflect male marriage squeeze while value less than 100 indicates female marriage squeeze.

The first indicator considers that all marriages will take place between 15-49 age groups. It demonstrates male marriage squeeze in all the districts and state ranging from 110 to 122 for every 100 females. All districts have higher MMS than their respective state level indicating that the problem in these states is more localized in study districts. At district level, Dhaulpur (122) consisted of highest male squeeze followed by Karauli and Mathura (118) in 2011. The second of marriage squeeze assumes that prime marriageable age for female is 15-29 years and for male it is 20-34. Interestingly the result shows that in the study districts there is shortage of female during 2011 except in Dhaulpur and Karauli. The data shows that if we consider five-year younger bride than grooms in this specific age group there are high number of females than males. In fact, there is a situation of female marriage squeeze. However, it is difficult to comment on this result at this level and it is beyond the scope of this study. It needs further analysis.

Table 1: Sex-Ratio in prime marriageable age groups and excess of male and deficit of females in rural areas of selected districts of Eastern-Rajputana region, 2011

Districts	Sex Ratio (F/1000M)[1]	% Deficit Female	Sex Ratio (M/100F)[2]	% Excess Males	Prime Marriageable Age M 15-49/F 15-49*100	Prime Marriageable Age M 20-34/F 15-29*100
Haryana	**882**	**12**	**113**	**13**	**114**	**96**
Gurgaon	878	12	114	14	113	98
Mewat	907	9	110	10	110	83
Faridabad	872	13	115	15	114	94
Palwal	880	12	114	14	115	91
Rajasthan	**933**	**7**	**107**	**7**	**107**	**93**
Alwar	900	10	111	11	111	95
Bharatpur	878	12	114	14	115	97
Dhaulpur	841	16	119	19	122	102
Karauli	856	14	117	17	119	103
UP	**918**	**8**	**109**	**9**	**108**	**88**
GB Nagar	878	12	114	14	112	92
Mathura	861	14	116	16	118	95
Agra	864	14	116	16	116	93

Source: ***C- Series,****Census of India, 2011*
SR[1]: *Sex Ratio: Number of females per 1000 males (Indian Standard)*
SR[2]: *Sex Ratio: Number of males per 100 females (International Standard)*

Mean age at marriage: India is noted for low mean age at marriage for both males and females. The mean age at marriage of males for study region is 21.3 years which is too low to the national average of 24 years. The lowest mean age at marriage for boys is recorded in the state of Rajasthan of 21 years. The districts of Rajasthan of study region have lower mean age at marriage for boys than its state average. In Uttar Pradesh 43.2 percent boys were married before the minimum legal age of marriage i.e. 21. Similar pattern has been observed for its districts of Mathura and Agra too and it is 21.9 years and 21.5 years respectively and followed by Haryana, 22.7 years. In Haryana 27.4 percent boys were married before attaining the minimum legal age for marriage. Boys married below legal age are highest in Mewat district 62.5 percent. One of the respondents stated that early marriage is a common cultural practice in the region. He expressed as, c*hildren should be tied in wedlock as soon as they grow up. Fixing the marriage is parents' responsibility. Sooner they get married, faster they take their own responsibility.*

Table 2. Mean Age at Marriage (MAM) in selected districts, DLHS-3, 2007-08

States/Dist.	MAM	States/Dist.	MAM	States/Dist.	MAM
India	**24**			**Study Region**	**21.3**
Haryana	**22.7**	**Rajasthan**	**20.7**	**UP**	**21.6**
Haryana (Rural)	22.3	Rajasthan (Rural)	20.2	UP (Rural)	21.2
Haryana (Urban)	23.9	Rajasthan (Urban)	22.8	UP (Urban)	23.9
Gurgaon	22.5	Alwar	20.5	GB Nagar	22.0
Faridabad	23.0	Bharatpur	20.7	Mathura	21.9
Mewat	20.0	Dhaulpur	20.5	Agra	21.5
		Karauli	20.6		

Source: *District Level Household and Facility Survey, 2007-08*

Prevalence of male bachelorhood: Table 3 highlights prevalence of singlehood in the 30, 40 and 50 years and above male population in the selected districts of the region as per census 2001 and 2011. The share of bachelors decreases with increase in age in the districts. As per as lifelong bachelors (50+) are concerned, in 2011 there were more than 4 hundred thousand bachelors male in UP's villages followed by Rajasthan (83 thousand) and Haryana (only 38 thousand) which accounts for 3.8, 2.3 and 2.7 percent of male population respectively. The first two states show worsening of the condition while improvement was recorded in Haryana since 2001. District level variation also shows that prevalence of lifelong bachelors was ranging between 2 to 3 percent with highest in Palwal (2.7%) within districts of Haryana. In Rajasthan and Uttar Pradesh all the districts under study had higher proportion of bachelors than state level except GB Nagar. Altogether, Dhaulpur had extraordinarily high share with 6.8% followed by Mathura (5.8%), Karauli (5.5%) and Agra (4.9%). If we compare with 2001 data, the improvement has been either negligible or rather the situation has worsened in 10 years of 21st century. The bachelors are called *Randuwe* in their local dialect which is kind of derogatory term.

Table 3. Share of never married males in 30+, 40+ and 50+ Age groups in Rural areas of Selected Districts, Census of India, 2011

	Haryana	Gurgaon	Mewat	Faridabad	Palwal	Rajasthan	Alwar	Bharatpur	Dhaulpur	Karauli	UP	GB Nagar	Mathura	Agra
30+	**4.0**	3.2	1.8	3.0	3.0	**3.0**	3.7	4.8	6.9	5.5	**4.8**	3.8	6.0	5.7
40+	**2.8**	2.2	1.7	2.0	2.5	**2.2**	2.9	3.5	6.1	4.8	**3.5**	2.7	5.2	4.4
50+	**2.7**	2.2	2.1	2.0	2.7	**2.3**	3.1	3.6	6.8	5.5	**3.8**	3.3	5.8	4.9
Absolute number of never married males in rural areas Haryana, Rajasthan and Uttar Pradesh, 2011														
	Haryana	-	-	-	-	**Rajasthan**	-	-	-		**Uttar Pradesh**		-	-
30+	143434	-	-	-	-	2,65,518	-	-	-		12,40,157		-	-
40+	64046	-	-	-	-	1,34827	-	-	-		6,52,089		-	-
50+	38415	-	-	-	-	83,315	-	-	-		4,26,357		-	-
Share of never married males in 30+, 40+ and 50+ Age groups in Rural areas of Selected Districts, Census of India, 2001														
Haryana					**Rajasthan**						**Uttar Pradesh**			
30+	**3.0**	1.9	-	2.8	-	**2.0**	3.0	4.0	9.0	5.0	**3.9.**	3.7	5.3	5.1
40+	**2.5**	1.8	-	2.8	-	**2.0**	3.0	4.0	8.0	5.0	**3.1**	3.3	4.7	4.6
50+	**3.0**	2.1	-	3.3	-	**2.0**	3.0	4.0	8.0	5.0	**3.3**	3.7	4.9	4.9

Source:*C-Series (2, 13 & 14)*, *Census of India 2001 and 2011, marital status of age and sex.*
*In **2001**, **Mewat** and **Palwal** were part of district Gurgaon and Faridabad respectively.*

Table 4. Correlation coefficient between prevalence of bachelorhood (30+, 40+ and 50+) sex ratio, marriage squeeze and MAM

	Male bachelors 30+	Male bachelors 40+	Male bachelors 50+
SR_M/100F	0.846**	0.810**	0.791**
SR_F/100M	-0.858**	-0.827**	-0.809**
Excess of males /100 females	0.846**	0.810**	0.791**
Deficit of females /100 males	0.860**	0.828**	0.810**
MSI1_SR(15-49)*100	0.906**	0.921**	0.900**
MSI2_SR_F(15-29)/(20-34)*100	0.686*	0.636*	0.585
MAM	**-0.286**	**-0.333**	**-0.404**

Source: DLHS, 2006-07(IIPS. 2010) (DLHS-3 Reports of Haryana, Rajasthan, Uttar Pradesh);Census of India, 2011 **(***Computed by author)*

One of the respondents expressed his estimate of bachelors in the region as:

In my village there are more than hundred bachelors. If you search, you will find a bachelor in every second household. In a family, if there is a more than one brother sibling, it is not necessary for everyone to get married. Few are bound to remain bachelors. -(A Bachelor of 52, Bhaderua, Mathura, U.P.)

Correlation was run between age specific bachelorhood and different indices of marriage squeeze (Table 4). The calculated value of correlation coefficient indicates that masculine sex ratio, deficit of women and surplus of males and marriage squeeze indices were highly and positively associated with prevalence of 30+,40+ and 50+ bachelorhood in the study area. Mean age at marriage was negatively related to the bachelorhood however the relationship was not significant. By looking at the coefficient we cannot conclude on causal relationship but we may conclude more is the skewed sex ratio in favour of male more is the marriage squeeze and higher is the incidence of bachelorhood in the society.

Qualitative insight into the issue of bachelorhood: As Table 3 indicates there were more than a million bachelors in the rural areas of selected districts. It is pertinent to know whether mass bachelorhood is a product of simply, scarcity of females and surplus of males or regulated by some additional socioeconomic, ecological and other demographic factors operating in the region. Some qualitative insights were collected through observations, interviews of respondents and key-informants to explore other factors working parallel for the mass bachelorhood and male marriage squeeze. Few of them are summarised below in specific context.

The economic factors: According to one of the key informants who is a biologist and activist working in the Bharatpur region states, *"The Eastern-Rajputana region has distinct geographical and ecological region. Today what you see in this region as a drought prone area, but before a century, it was a flood prone area. Due to meso-climatic change, rainfall pattern and rate of precipitation has also changed over the years.* He further adds*, "due to rain fed agriculture, scarcity of water, soil is becoming saline which altogether make farming difficult. Farming is just for subsistence and "now farmers have no choice rather than to search for their livelihood in nearby urban areas."*

A farmer,35-year-old, is one of the 100 bachelors in his Gujjar community-dominated village in Mathura. He owns 7 *bigha* of land. He reported that due to lack of irrigation facility and soil infertility, they could grow only one crop in a year. Thus, it is difficult to survive solely on agriculture. There is no other source of permanent income in the village. Alike, there are people in this village who also own land, but could not grow enough to fulfil their needs. As a result, they survive by working in other's field or nearby towns of Bharatpur and Mathura. He said that in this situation, it is very difficult to find a bride. *"If you do not have enough money, or any business or a government job, no one will prefer to marry their daughter to such a person".*

Another bachelor, of 37 years old from *Jat* community also highlighted the role of economic status on bachelorhood. He narrated, *"In our community/region, bride will be only available to those who have some source of employment. If I were employed even in any defence service, a number of girls would be in queue to marry me even at this age. There is no scarcity of brides for an employed youth. But who will take care of unemployed bachelors?"*

So, from the above cases it is clear that a regular employment or a house in town has become eligibility criteria for getting suitable life partner. Large agricultural land holding in the village does not draw any attention of bride's parents because of its poor productivity and agricultural hardship prevailing in the region multiplied by unsuitable and brackish groundwater for irrigation.

The social factors: Social factors also emerged as important consideration for singlehood of males. Usually, the people, who are not having good social status, are not pools of eligible for marriage. Preserving the caste is one of such concerns. Caste and religion are the most homogemic requisites for the socially accepted marriage. Mewalal has not opted for the option of marrying bride from far-off states because he is very caste-concerned. He says that agents bring bride from lower castes and marrying such girl is an issue of low prestige in the society. However, he realizes that he is now getting over aged for marriage and there is no woman in his house to look after the household chores. He expresses his grief, "after death of my mother, no one is in my house to do household chores, so at any cost I need a bride [or a permanent servant?]".He further adds that the situation has been changing. [Probably he thought the researcher is an agent]. He expresses his desire that he may marry an imported bride with a condition that she should take care of all our household chores.

Another social issue in the study area lies with children (especially the male) of *Paro* or *Molki* brides, who have not been given equal social status as of the youth borne of same caste-parents. These youth also encounter problems in finding suitable match as inter-caste or inter-religion marriage is not socially accepted. The bride and her children will always be considered as persons having lower social status and thus, they are not easily accepted in the society.

Although, with passage of time people have become little liberal but establishing marital relationship in such family is undertaken as a prestige issue. Samita Ben, 49 years old (this is not real name) from a village of Bharatpur, stated that *s*he came to village with her husband twenty-seven years back from Ahmadabad. Initially her new family and her neighbours did not see her with respect because she was 'Molki' (purchased bride). She says, "...now everything became fine, I used to go everyone's house to attend function or occasions". She used to think that everything is normal now. Further she added, "again after long time I realised that people have not accepted me as they were pretending, because my son's marriage was cancelled due to someone's comment about my social status as Molki. I am not worried about myself, but I don't think my sons will find a mate from this area because of my present social status".

Migration of women as solution to singlehood: As many of the literatures have revealed in a situation when sex ratio is in favour of men and shortage of bride and the solution lies in in-migration of women from different regions to the female deficit region for the purpose of marriage (Becker, 1991;Goodkind, 2011; Rallu, 2006). The 2011 census data is not published till date so the present study relies on 2001 data source. Table 6 presents the magnitude of migrant women to the study region who have reported marriage as the sole reason for migration. The state level migration data shows that Haryana is the highest recipient (20%) of women who migrated from other state for marriage purpose. For Rajasthan and U.P. also have the similar marriage in-migration of women ranges to 7% and 4% respectively. However, the absolute figure reached up to 600-700 thousand marriage migrants' women in Haryana and Rajasthan. While in Uttar Pradesh there were one million such women.

The marriage migration of women with break-up of migration duration presents clearer picture. Six to nine thousands of women came to these states during 2000-2001. In Haryana, within one year before the census, about 9,607 (1.4% of total duration) women came for marriages from other states. The pace of marriage migration of women from other states to this region was consecutively increased over the time. In five years of duration before the census 2001, about few less than a 0.2 million women came for sole purposes of marriage.

The similar situation also found in Uttar Pradesh, especially in western part of state and Rajasthan. Every seventh interstate marriage migrant women came to these states during 1995-2001. Though the proportion remains low but in terms of absolute number, the figure is significant and about hundred thousand women migrated to Rajasthan only for marriage purpose during 1995- 2001.

Balance of demand and supply: The Eastern and Western India have contrasting economic, demographic, social and geographical conditions but they prove to be complimentary to each other as far marriage is concerned. They function as demand and supply zones. In both places dowry in association with poverty is major problem. The youth, who have no regular income, no permanent job or no dwelling in city, more likely they would not get bride from their own community. They either remain bachelor or look east for brides. The brides from east also hail from poor socio-economic families, who neither afford dowry for their daughters nor keep them unmarried. That's why these daughters are either send with or sold to the groom of west who agrees for free marriage.

Role of network emerged as another important dimension in such marriages. Bride migration takes place through bride's relatives (who are already married in this region) or some professional agents. This shows that for getting a bride, local people also use the personal contact to already migrated brides and their native places. These contacts are the best source to manage the entire obstacle regarding fear of sending so far, the daughters and other economic exchanges among brides and grooms' family as a guarantor. It has become a large profitable market for those, who are providing the brides on their personal contact. So, the marriageable males who are unable to find their match locally they pay a good amount to those agents for the bride. These agents are well known and accepted members of the society who have direct or indirect any personal contact with brides' natal regions.

Conclusion

Skewed sex ratio and prevalence of bachelors in the society is closely related. Of all areas, Dhaulpur and Karauli in Rajasthan and Mathura and Agra, which are contiguous and located in vicinity, the problem is more sever. Haryana which has been matter of discussion for planners for low sex ratio show less severity of the bachelorhood but in contrast it is the bigger recipient of the female marriage migrant. While UP may emerge as a big marriage market for brides as there are more than 4 hundred thousand lifelong bachelors living in its villages as per census 2011.

The prominent finding of the study suggests that sex ratio is prime factor associated with some economic, social and ecological factors responsible for the cross-cultural and cross-regional marriage migration (Billing, 1991; Guilmoto, 2012; Kaur, 2013; Kulkarni, 2010; Roy et. al., 2018) in the Eastern-Rajputana region. Altogether, the presence of uneven landform, semi-arid (hot and dry) climate, scarcity of water, results into lack of sustainable source of livelihood for the villagers and aggravate the problem of bachelorhood and purchasing of brides. Poverty and practice of dowry emerged as prime factor responsible for scarcity of women and marriage migration. Though such cross-cultural and cross regional marriages are not accepted in both societies (Kaur, 2004, 2008). But the bride's family takes this relationship as a better way to

escape the social evil of marriage, dowry and burden of having unmarried daughter. On the other hand, at groom's side the brides are required for masculine need, work in household and agriculture field and produce offspring. Marriage is performed because it is considered compulsory not by considering the compatibility of the couples (Das et. al., 2009; Jiang&Sánchez-Barricarte, 2013; Hudson et. al., 2004).

There are two faces of this culture known as bride trade. One, bride get values in a new society and attain social as well as economic upward mobility (Goldman et. al., 1984; Guilmoto, 2009, 2012; Kaur, 2004, 2013; Kulkarni, 2010; Roy et. al., 2018). But in another side, if she is discriminated and humiliated at her groom's house, then she has no way to, compromise with her situation and perform all households' chores endlessly as slaves. Her condition becomes more pathetic, if she is unable to bear a child. In many cases she is also trapped by gangs of human trafficking and flesh trade. Even the children (particularly males) of these imported brides face severe identity crisis. For such children, there is hardly any chance to get a bride within his paternal community. Hence, they have to find spouse from their maternal community and thus vicious circle of singlehood and bride trade continues. Many studies have brought similar findings and similar stories to tell about the migrated brides (Blanchet et al., 2003; Kaur, 2010; Kaur, 2013).

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SPATIO -TEMPORAL ANALYSIS OF SEX RATIO IN BEGUSARAI DISTRICT OF BIHAR

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ABSTRACT

The sex ratio is an important constituent of population. It is defined as the number of females per thousand males. Sex ratio has great importance in the study of population because it is closely related to socio economic condition of area. Sex ratio influence many other demographic elements and socio economic condition of area. The balance between the two sexes is an important aspect of population structure. The objective of the study is to analyze the trends of sex ratio growth. To analyse the spatial variation in the sex ratio of the study area. To examine the sex ratio of different ages in Begusarai in 2011. To find out the reasons of declining sex ratio and to suggest some complementary suggestion for increasing sex ratio. Begusarai district of Bihar is selected as the study area. The study is primarily based on the collection of relevant data which include information from secondary sources such as District and Censes handbook of Begusarai district, different journals, newspapers and related websites etc. The collected data will be analyzed by statistical and cartographic techniques. The basic objective of this paper is to analyze the spatio temporal pattern of sex-ration in the context of process data of Begusarai district.

Keywords : Sex ratio, Demographic elements, Spatio- Temporal pattern, Spatial variation

Introduction

Sex ratio is an important indicator of social development of an area. It is of great significance in the study of population because it is closely related to socio economic condition of an area. Sex ratio influences growth of population, marriage rate and age, workers ratio and many other demographic attributes. Sex ratio is calculated differently in different countries. In India, sex ratio is calculated in terms of number of females per 1000 males. The overall sex ratio in India has traditionally been adverse to women and more so in case of urban area.

The balance between the two sexes is an important aspect of population structure. Sex ratio also influences the size of population, its fertility growth rate and several social attributes. It also determines the potential demographic dividend. The varying sex ratio is not a problem of only today but it has remained in some form since time immemorial but today it has taken a sinister look and now a serious social problem.

Due to the considerable influence on many other demographic elements, the sex ratio is fundamental to geographic analysis of any region as influences the spatial variation of fertility

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potential of population, the labour participation and the types of jobs based upon the typical varying physical and human characteristics of different regions. The present paper focuses on a micro level geographical analysis of such spatio-temporal variation in sex ratio taking empirical evidence from Begusarai district of Bihar state, India.

Objectives of the Study

A declining sex ratio reflects the gender discrimination in the Indian society. Female child is seen as a burden because after marriage they have to move to their in-laws house, so the investment in them such as for their proper diet, education, health is rarely taken seriously. The other problem is dowry system due to which a girl child has been considered as an unwanted child. The increasing gender gap in the society is certainly a social imbalance. The declining sex ratio has been a cause of steep rise in violence against women. It is estimated that 1.20 crore girls are born in India every year, about one fourth died before their fifteenth birthday because of female infanticide, discrimination in healthcare, maternal mortality, malnutrition as a victim of rape, dowry death and molestation. (Ministry of Health and Family Welfare, Govt. of India, 2011).

The main objective of the paper is as follows:

1. To analyse the population growth of the study area.
2. To find out the trends of sex ratio growth.
3. To analyse the spatial distribution of sex ratio in Begusarai in 2011.
4. To examine the sex ratio of different age groups in Begusarai in 2011.
5. To find out the reasons of declining sex ratio and to suggest measures to increase sex-ratio.

Source of Data and Methodology

The present study is largely based on the secondary source of data collected from District Statistical Department of Begusarai district and Census handbook of Begusarai district. The collected data is tabulated and processed with the help of simple statistical methods such as calculation or percentage. The data obtained from differences sources have been compiled, computed and analyses. The processed data is cartographically represented by maps prepared in ArcGIS. This would give an insight in to the spatial variation of the sex ratio in the Begusarai district.

Study Area

Begusarai district, located in central part of Bihar State, India, covers an area of 1918 sq. km and a population size of 29,70,541 persons (Census, 2011). In 1870 it was a subdivision of Munger district and in 1992 it became full-fledged district. The district is surrounded by Samastipur district on the North, by River Ganga and the Lakhisarai district on the south, Khagaria and Munger on the east and Samastipur and Patna districts on the west. It is located between $25^0$15' N and $25^0$45' N latitudes, and 85° 45' E and 86°36' E longitudes (Figure-1).

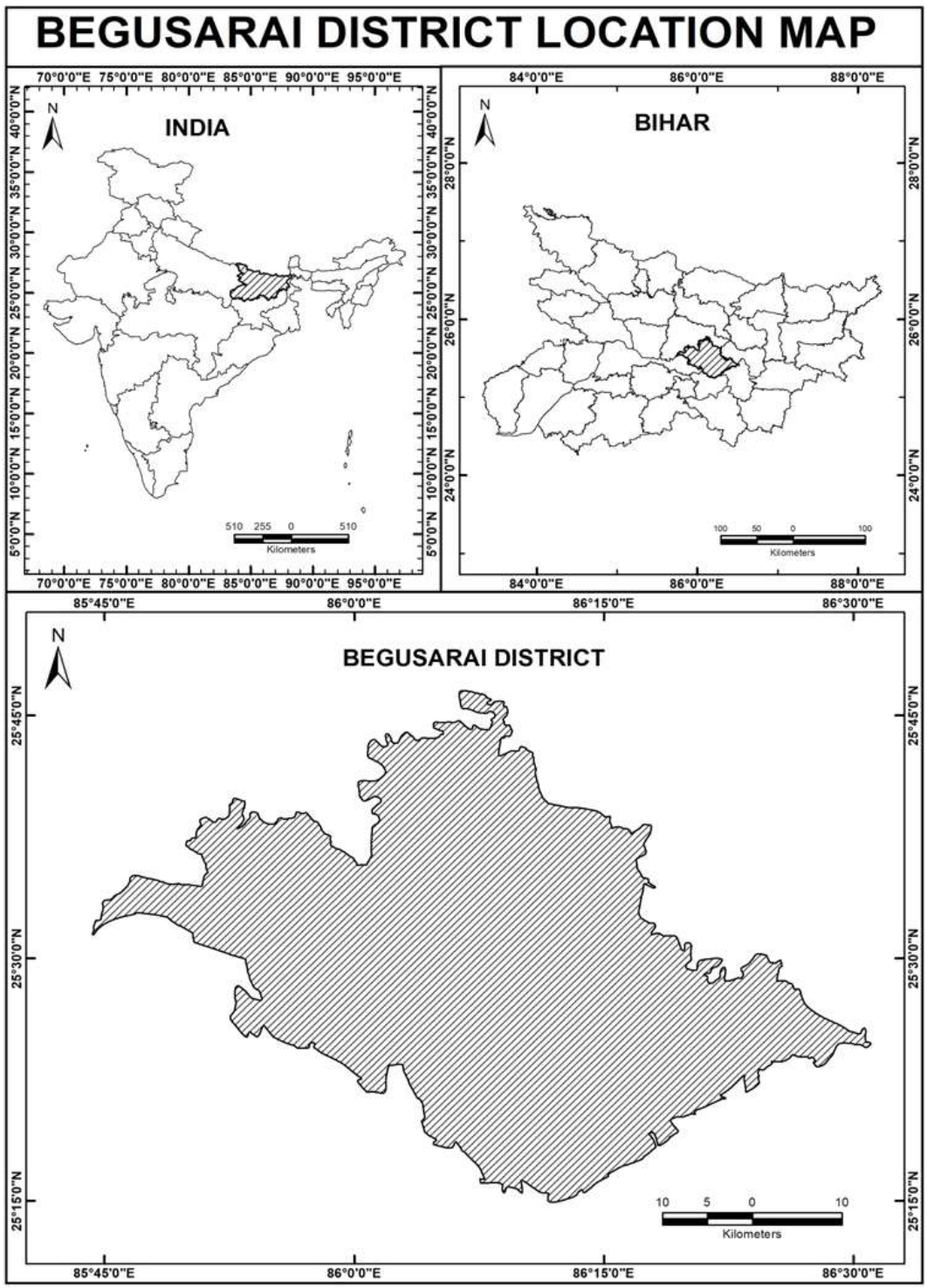

Figure 1 : Location map of Begusarai District

Results and Discussion

1. Growth of Population in Begusarai District

The population of the district was 28.4 lakh in 1951 in which number of male persons were 14.3 lakh and females was 14.1 lakh persons. In 1961 the total population was 33.8 lakh in which male population was 17.0 lakh and female population was 16.8 lakh, in 1971 populations was 38.9 lakh in which total number of male was 20.1 lakh whereas total number of female was 18.8 lakh (Census of India).

Table – 1

Begusarai: Growth of Population, 1951-2011

Year	Population (in lakh)		Total Population (in lakh)
	Male	Female	
1951	14.3	14.1	28.4
1961	17.0	16.8	33.8
1971	20.1	18.8	38.9
1981	7.5	7.0	14.5
1991	9.5	8.5	18.1
2001	12.2	11.2	23.4
2011	15.6	14.0	29.7

Source: Compiled from Census of India; Begusarai District Census Hand Book, 1951-2011.

In 1972 this part of Munger district was separated to form Begusarai district. In 1981 total population were 14.5 lakh in which number of male was 7.5 lakh and number of female was 7.0 lakh. In 1991 the total population rose to 18.1 lakh. The male population was 9.5 lakh whereas the female population was 8.5 lakh. In 2001 total population was 23.4 lakh in which total number of male was 12.2 lakh where as total number of female was 11.2 lakh. In 2011 the total population was 29.7 lakh in which the number of male was 15.6 lakh and total number of female was 14.0 lakh. So, it is clear that there is rising trend of population in the district but declining trend of sex ratio.

2. The Trend of Sex Ratio in Begusarai District

In the year 1951 the sex ratio for Begusarai district was estimated to 1022 which increased by 0.10 per cent in 1961 and became 1023. After that the sex ratio decreased to 940 for the next decade, the sex ration was same i.e. 940, but it decreased by 4.47per cent and became 898 in 1991. In the year 2001 the sex ratio was 912, higher than the year 1991 but by the year 2011 it decreased to 895.

Table – 2

Trends of Changes in Sex Ratio in Begusarai District

Year	Sex Ratio (Female per 1000 Males)	Change (in %)
1951	1022	2.40
1961	1023	0.10
1971	940	- 8.11
1981	940	0.00
1991	898	- 4.47
2001	912	1.56
2011	895	- 1.97

Source: Compiled from Census of India; Begusarai District Census Hand Book 1951-2011.

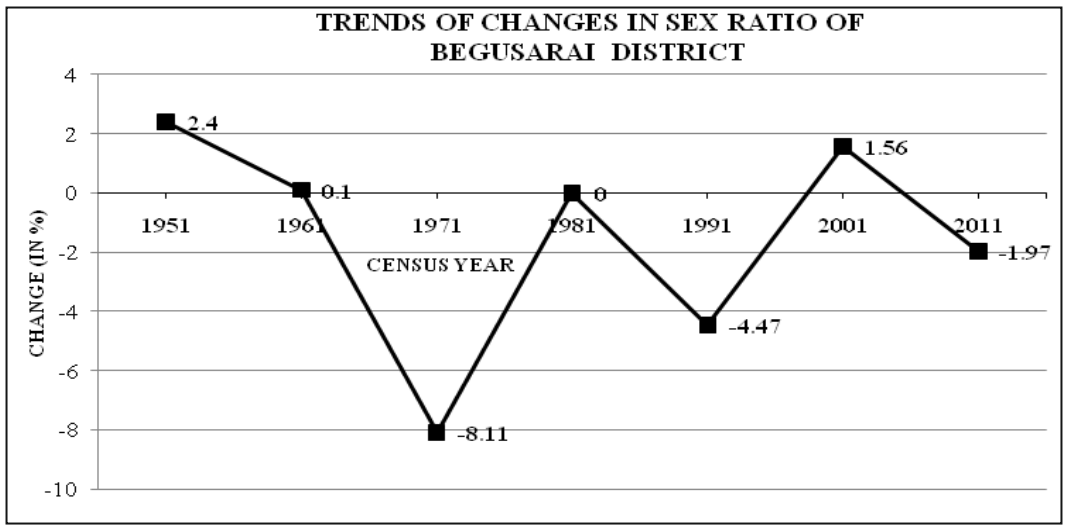

Figure 2 : Trends of Changes in Sex Ratio of Begusarai District

In the year 1951 the sex ratio of Begusarai was estimated to 1022 which was relative higher than the state of Bihar. Same trend was also observed for the year 1961. But after that there decreasing trend of sex ratio and on differences the sex ratio was recorded lower than the state Bihar. In 1971 the sex ratio of Bihar was 957 whereas the sex ratio of Begusarai was 940. In 1981 the sex ratio of Begusarai was again 940 slightly lower than the Bihar state. For the year 1991, there was decrease in sex ratio in Bihar as well as in Begusarai. In the year 2001, sex ratio was slightly increased for Bihar and became 919 from 907 and for Begusarai sex ratio increased to 912 from 898 in the year 2011, sex ratio again decreased for Bihar as well as for Begusarai in 2011. It was 918 and 895 respectively for Bihar and Begusarai.

Table - 3

Differences of Sex Ratio in Begusarai and Bihar (1951-2011)

Year	Begusarai	Bihar	Differences
1951	1022	1000	22
1961	1023	1005	18
1971	940	957	-17
1981	940	948	-8
1991	898	907	-9
2001	912	919	-7
2011	895	918	-23

Source: Compiled from Census of India; Begusarai District Census Hand Book 1951-2011.

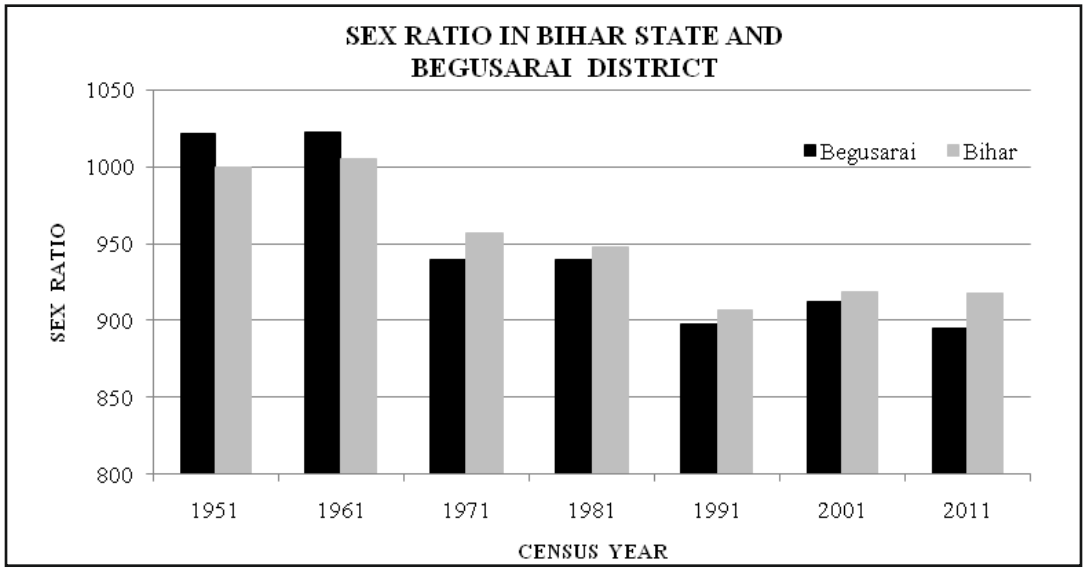

Figure 3 : Sex Ratio in Bihar State and Begusarai District

3. Block wise Spatial Distribution of Sex Ratio in Begusarai District, 2011

The sex ratio is an important tool for the regional analysis. The sex ratio varies from region to region depending upon several factors such as social, economic, political, science and technology etc. which have brought about the changes in living and socio-economic status of people leads to tremendous variation of sex ration in different regions. Therefore, the sex ratio indicates the development of that region. The lowest sex ratio range of below 880 prevailed around the Blocks Sahebpur Kamal and Matihani. Birpur, Barauni, Balia and Begusarai have sex ratio between 881and 890. Whereas three blocks Teghra, Bhagwanpur, Bachhwara have Sex rating ranging between 891and 900. The Blocks have sex ratio more than 901 but less than 910 are Garhpura, Bakhri, Dandari and Shamho Akha Kurha. The sex ratio in the ward which

ranging between 911 and 920 are Chhorahi, Khudabandpur and CheriaBariarpur. The Blocks have sex ratio above 921 in the district are Mansurchak and Naokothi.

The table 4 indicates that the sex ratio has distributed unequally throughout the district. Because of the male migration and there cultural and socio-economic status were imposed in that area.

Table - 4

Block wise Sex Ratio in Begusarai, 2011

Sex Ratio	Blocks	%
> 880	2	11
881 - 890	4	22
991 – 900	3	17
901 – 910	4	22
911 – 920	3	17
< 920	2	11

Source: Compiled from Census of India; Begusarai District Census Hand Book 1951-2011.

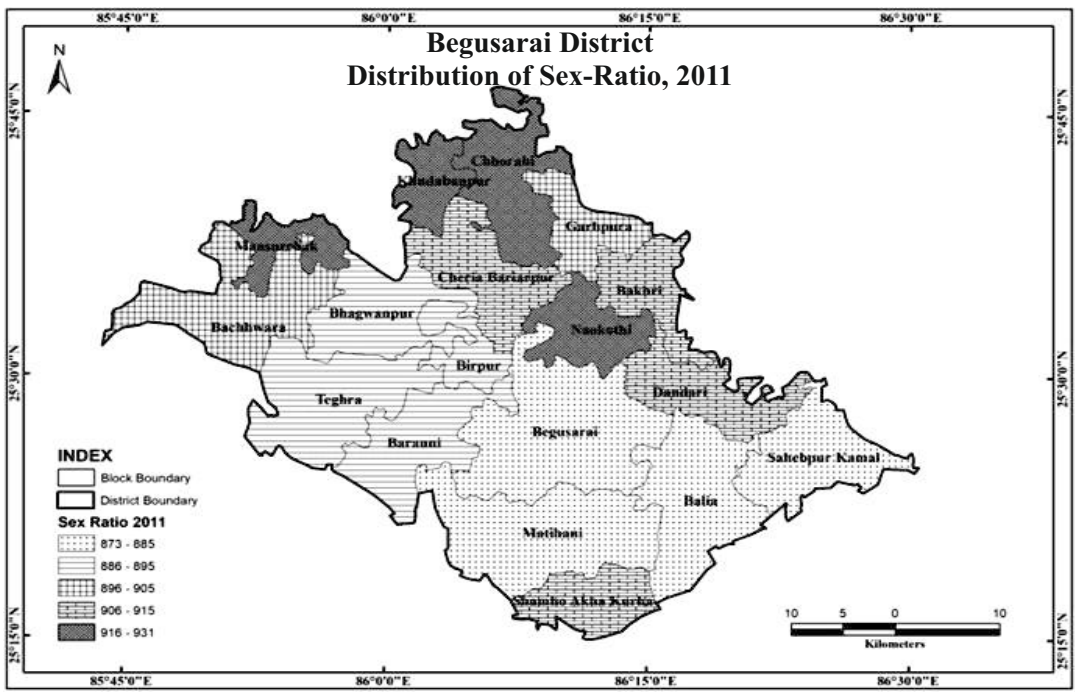

Figure 4 : Block wise Sex Ratio in Begusarai, 2011

4. Age specific Sex Ratio in Begusarai, 2011

The sex ratio is different in different age groups. The young (0-14), adult (15-59), old (60+) ages have different sex ratio (Table-5).

Table – 5

Age specific Sex Ratio in Begusarai, 2011

Age Group	Population		Sex Ratio (Female per 1000 Males)
	Male	Female	
0-14	6,33,220	5,76,247	910
15-59	8,22,322	7,27,011	884
60+	1,09,718	98,080	893

Source : Begusarai District Census Hand Book, 2011

It is clear from the above table that the age group between 0-14 has sex ratio 910, between 15-59 have sex ratio 884 where as the sex ratio for the age group 60 and above is 893. It shows that the sex ratio is relatively low in the working age group population. It is due to migration and some other social attributes.

Findings and Conclusion

On the basis of the present analysis it may be concluded that there is not even a single block in the Begusarai district in which sex ratio is balanced. Sex ratio in the Begusarai district is having decreasing trend. The highest sex ratio is only 921. Out of 18 blocks, only 2 blocks have sex ratio 921. The lowest sex ratio is 873. This shows that a lot of effort is required to increase the sex ratio in the district. The phenomenon of low sex ratio is mainly caused by social traditions, increasing demand of couples for male child in the home, inadequate medical facilities, relatively low literacy rate and due to both sex determination and discrimination.

Sex ratio refers to the ratio between men and women living in a region. In geography it is very important to know the region wise distribution of both male and female as it indirectly helps in knowing the regional pattern of development.

Skewed sex-ratio is the national pattern and Begusarai district simply substantiates the fact by providing micro-level evidences social harmony, economic prosperity, fertility, mortality, literacy, occupational structure and many other demographic, social and economic attributes along with level and trend of development largely depend upon the nature of sex ratio. Imbalanced sex-ratio needs to be brought near the optimal level and this could be possible when micro level/district level strategy is framed and implemented. The study of Begusarai district may be taken as a model frame for national strategy and time bound implementation of the strategic targets.

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वज्रपात एक प्राकृतिक आपदा : उत्पत्ति के कारण, परिणाम एवं प्रबंधन -बिहार के सन्दर्भ में

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सार

वज्रपात वर्तमान में एक गंभीर प्राकृतिक आपदा का अति सक्रिय आयाम के रूप में उभर कर सामने आया है। यह अत्यंत कम समय में जान–माल की क्षति पहुँचाने की दृष्टि से कुख्यात सिद्ध हुआ है। बिहार में इसकी सक्रियता मार्च से अगस्त के महीने में अधिक रहती है। पिछले कई वर्षों से जून– अगस्त का महीना भी वज्रपात की दृष्टि से अधिक खतरनाक सिद्ध हो रहा है। इस प्रकार की घटनाएं दो विपरीत आवेश के बादलों के टकराने से उत्पन्न होती हैं। इस दौरान बिजली की चमक के साथ भयंकर गर्जन भी पैदा होती हैं। इसी क्रम में विद्युत् आवेश पृथ्वी के धरातल की ओर प्रवाहित होने लगता है। इस आवेश के संपर्क में आने से मानव के साथ पर्यावरण को भी भारी नुकसान का सामना करना पड़ता है। भारतीय मौसम विभाग के अनुसार प्रतिदिन लगभग 44000 बार आकाशीय बिजली चमकने की घटनाएं होती हैं, और प्रति सेकंड करीब 2000 बार गर्जन उत्पन्न होती हैं। बिहार आपदा प्रबंधन विभाग के अनुसार,राज्य में पिछले पांच वर्षों में वज्रपात से लगभग 1000 से अधिक लोगों की मौत हुई है। इस मानसून वर्ष (3 जुलाई,2022 तक) में लगभग 80 से अधिक लोगों की मृत्यु वज्रपात से हो चुकी है। प्रस्तुत पेपर का उद्देश्य बिहार के बिभिन्न जिलों में वज्रपात की घटनाओं का न केवल अध्ययन करना है, अपितु आपदा प्रबंधन विभाग, बिहार एवं भारत सरकार के द्वारा इस दिशा में अपनायी जाने वाली नीतियों का मूल्यांकन के साथ – साथ महत्वपूर्ण सुझाव भी देना है, ताकि भविष्य में इन आपदाओं से होने वाली क्षति को न्यूनतम की जा सके। इस प्रस्तुतिकरण में बिहार आपदा प्रबंधन विभाग एवं भारतीय मौसम विभाग के द्वारा जारी किये गये आंकड़ों एवं कई मानचित्रों का भी इस्तेमाल किया गया है ।

मुख्य शब्दावली (Keywords) : वज्रपात, प्राकृतिक आपदा, विद्युत् आवेश, गर्जन, आपदा प्रबंधन,आवेशित बादल, लाइटनिंग तथा थंडर स्टॉर्म, सुचालक, इंट्रा–क्लाउड लाइटनिंग, इंटर क्लाउड लाइटनिंग, स्टैटिक इलेक्ट्रिसिटी, लाइटनिंग अरेस्टर ।

परिचय (Introduction)

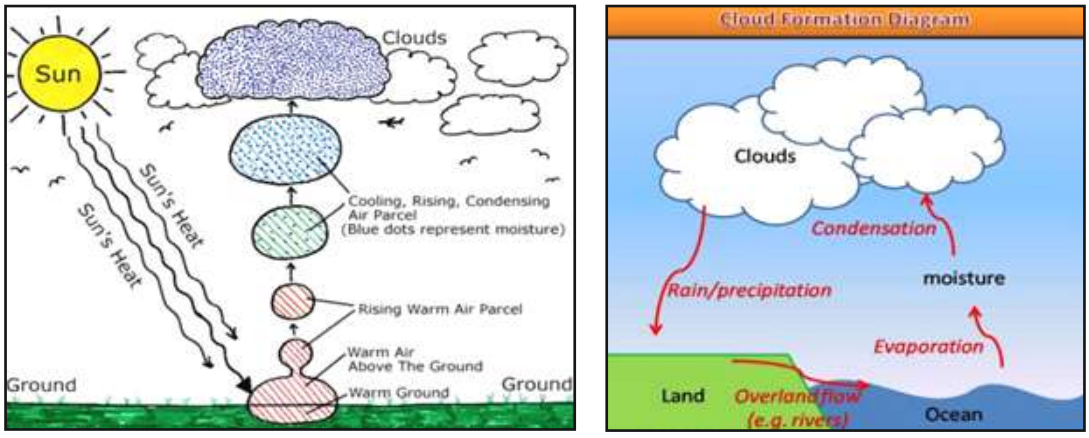
वज्रपात एक प्राकृतिक आपदा है। आपदा जोखिम न्यूनीकरण संयुक्त राष्ट्र कार्यालय (United Nations for Disaster Risk Reduction & UNISDR) के अनुसार 'आपदा 'उसे कहा जाता है, जिसके अंतर्गत– ''किसी समुदाय या समाज के सुचारु रूप से कार्य करने में एक ऐसी गंभीर बाधा जो व्यापक भौतिक, आर्थिक, सामाजिक या पर्यावरणीय क्षति उत्पन्न करती है और जिसके प्रभावों से निपटना, समाज द्वारा अपने संसाधनों का उपयोग करते हुए संभव नहीं होता है'' (UNISDR 2016)। विश्व स्वस्थ्य संगठन (WHO) के अनुसार ''आपदा एक ऐसी घटना है जो अस्तित्व की सामान्य परिस्थितियों को बाधित करती है और पीड़ित समुदाय के समायोजन की क्षमता से अधिक पीड़ा का स्तर पैदा करती है''।

* नेहाल अहमद, असिस्टेंट प्रोफेसर, भूगोल विभाग, गवर्नमेंट डिग्री कॉलेज, बगहा, प॰ चम्पारण, बिहार

भारतीय आपदा प्रबंधन अधिनियम, 2005 की धारा 2(डी) के अनुसार ''आपदा का अर्थ किसी भी क्षेत्र में प्राकृतिक या मानव निर्मित कारणों से होने वाली दुर्घटना, घटना, आपदा या गंभीर घटना या दुर्घटना या लापरवाही से है जिसके परिणाम स्वरूप जीवन का पर्याप्त नुकसान होता है, या मानव पीड़ा या क्षति और सम्पत्ति का विनाश या क्षति या पर्यावरण का क्षरण होता है तथा वह घटना ऐसी प्रकृति और परिणाम की हो, जिससे उभर पाना प्रभावित क्षेत्र के समुदाय की क्षमता से परे हो ''।

डिजास्टर (Disaster) शब्द मध्य फ्रांसीसी डेसस्तरे (desastre) और पुराने इटालियन डिस्ट्रो (disastro) से लिया गया है। इसका अर्थ बुरे दिन या बेड स्टार (Bad Star) होता है।

वज्रपात एक प्राकृतिक घटना है, जब आसमान से गरज के साथ लपलपाती हुई बिजली धरातल की ओर गिरती है, तो इस घटना को वज्रपात की संज्ञा दी जाती है। बादलों के ऊपर उठने के क्रम में तापमान में भारी गिरावट आती है। बादलों के ऊपरी भागों में तापमान हिमांक बिन्दु से काफी नीचे चला जाता है। तापमान इतना कम होने के कारण जलवाष्प बर्फ के रूप में परिवर्तित हो जाता हैं। बर्फ के यह सूक्ष्म कण हवाओं के द्वारा आपस में घर्षित होते हैं। इस घर्षण के दौरान इनमें विद्युत आवेश उत्पन्न होती है। विद्युतीय आवेश, आसमानी बिजली की उत्पत्ति का कारण बन जाता है। ऐसी परिस्थितियां तब उत्पन्न होती हैं, जब पृथ्वी का धरातल अत्यधिक गर्म होता है। तब इसके संपर्क में आने वाली हवाएं भी गर्म हो जाती हैं। गर्म हवाएं हल्की होने के कारण निरंतर ऊपर की ओर उठने लगती हैं। ऊपर उठने के दौरान ही अपने साथ–साथ वाष्प को भी लेकर जाती हैं।



चित्र 1 : बादल बनने की प्रक्रिया

धरातल से अधिक ऊंचाई होने के क्रम में तापमान में भारी गिरावट आने लगता है। यह गिरावट क्षोभ मंडल में प्रत्येक किलोमीटर की ऊंचाई पर 6.5 डिग्री सेल्सियस की दर से कम होता है। तापमान में हो रही इस भारी गिरावट के कारण वह वाष्प महीन बर्फ एवं तत्पश्चात बड़े बर्फ के टुकड़ों में परिवर्तित हो जाते है। हवाओं के द्वारा उत्पन्न बल के कारण यह बर्फ के छोटे–छोटे टुकड़े आपस में टकराने लगते हैं। घर्षण तथा रगड़ के कारण बड़े बादलों में ऋण आवेशित एवं छोटे बादल धन आवेशित हो जाते हैं। यह दो भिन्न प्रकृति के आवेशित बादल जब एक दूसरे के नजदीक आते हैं तो इनमें तेजी से आकर्षण होता है। जिसके पश्चात इन में जबरदस्त स्पार्क होता है। उस दौरान तेज चमक के साथ भयंकर गर्जन

होती है। इसे ही लाइटनिंग तथा थंडर स्टॉर्म कहा जाता है। लाइटनिंग चमक की घटना को कहा जाता है, जबकि तेज आवाज को थंडर स्टॉर्म कहा जाता है।

लाइटनिंग तथा थंडर स्टॉर्म की क्रियाएं साथ–साथ होती हैं किंतु प्रकाश की चाल अधिक होने के कारण वह हमें पहले दिखाई देता है, जबकि ध्वनि की चाल अपेक्षाकृत कम होने के कारण वह थोड़ी देर बाद हमें सुनाई देता है। इस घटना के दौरान विद्युत धारा का संचार होने लगता है। यही विद्युत धारा जब धरातल के दिशा में अग्रसरित होता है तब तेजी से किसी सुचालक की ओर आकृष्ट होता है। यह सुचालक ऊंचे वृक्ष, पर्वत, जल टावर, धातु या जीव–जंतु इत्यादि हो सकते हैं। इन सुचालकों से होते हुए विद्युत धारा प्रवाहित होते हुए पृथ्वी के धरातल में प्रवेश कर जाती हैं। इसी घटना को वज्रपात ठनका या बिजली का गिरना कहा जाता है।

चित्र 2 : वज्रपात का परिदृश्य

जब आसमान में बादलों के मध्य प्रकाश की एक चमक दिखाई देती है और फिर गड़गड़ाहट की आवाज होती है तो उसे बिजली चमकना कहते हैं। प्रकाश की तेज चमक जो हम बादलों में देखते हैं, बिजली कहलाती है। बिजली विपरीत रुप से आवेशित बादलों या आवेशित बादल और पृथ्वी के बीच के वातावरण में एक विद्युत निर्वहन है। आकाश में विद्युत आवेशों द्वारा बिजली उत्पन्न होती है। भारी काले वर्षा वाले बादल को तूफानी बादल कहा जाता है। जब आकाश में एक तूफानी बादल विकसित होता है, तो तेज हवाएं बादल के माध्यम से ऊपर की ओर चलती हैं और बादल में मौजूद पानी की बूंदों को एक दूसरे के खिलाफ रगड़ खाने के लिए प्रेरित करती हैं। जल की बूंदों के आपस में रगड़ने से घर्षण के कारण बादल में अत्यधिक बड़े विद्युत आवेश उत्पन्न होते हैं। जल की छोटी–छोटी बूंदे एक धनात्मक आवेश प्राप्त कर लेती हैं और हल्की होने के कारण बढ़ती हवा के साथ बादल के ऊपरी भागों में चली जाती हैं, दूसरी ओर पानी की बड़ी बूंदे ऋणात्मक आवेश को प्राप्त कर लेती हैं और भारी होने के कारण बादल के निचले भागों में आ जाती हैं। बादल का शीर्ष भाग धनात्मक हो जाता है, जबकि बादलों का निचला हिस्सा ऋणात्मक हो जाता है। जब एक तूफानी बादल के ऊपर और नीचे विपरीत विद्युत आवेश की मात्रा बहुत अधिक बढ़ जाती है, तब बीच की हवा में विद्युत आवेश तेज गति से बहने लगती है। जब किसी बादल के धनात्मक और ऋणात्मक आवेश आपस में मिलते हैं तो वे आकाश में बादल के बीच विद्युत की चिंगारी उत्पन्न करते हैं। जिसे हम चमकते हुए रूप में देखते हैं। बादलों के मध्य तीव्र स्पार्क तथा चमक के कारण इतनी अधिक मात्रा में ऊष्मा पैदा होती है, जिसके कारण आसपास की हवाएं अत्यंत गर्म हो जाती हैं। इस गर्मी के कारण हवा तेजी से फैलती है और तेज आवाज पैदा करती है। जिसे हम गर्जन या गड़गड़ाहट कहते हैं। बिजली सामान्यता आकाश में एक बादल के भीतर मौजूद

होती है। इसे सीट लाइटनिंग कहा जाता है। बिजली की चमक बादल और पृथ्वी के बीच भी होती है। इसे कांटा बिजली के नाम से जाना जाता है। यदि एक तूफानी बादल जिसके तल पर ऋणात्मक आवेश होता है। वह किसी ऊंची इमारत के ऊपर से गुजरता है, तो वह भवन के छत पर धनात्मक आवेश उत्पन्न करता है। जब बादल के तल पर विद्युत आवेश अत्यधिक हो जाते हैं तो आवेशित बादल के तल पर मौजूद विद्युत आवेश अचानक भवन की छत पर प्रवाहित होने लगते हैं और हमें बिजली की एक चमक इमारत की ओर आती हुई दिखाई देती है। इस प्रकार बिजली पृथ्वी और उसकी ऊंचाई से टकराती है। साथ ही बिजली पृथ्वी या उसकी ऊंची संरचनाओं पर तब प्रहार करती है जब किसी ऊंची इमारत पेड़ या किसी अन्य वस्तु के माध्यम से बादल और पृथ्वी के बीच विद्युत आवेश प्रवाहित होने लगता हैं। पहाड़ी क्षेत्रों में बिजली गिरने की घटनाएं अधिक होती है, क्योंकि ऐसे क्षेत्रों में बादलों और धरातल की बीच की ऊंचाई कम हो जाती है। विमानों की तुलना में धरातलीय संरचनाओं पर बिजली का प्रभाव अधिक देखने को मिलता है। इसका प्रमुख कारण यह है कि विमानों के ऊपरी परत को विद्युतरोधी बनाई जाती है तथा यह निचले बादलों से काफी अधिक ऊँचाई पर उड़ाए जाते हैं। आमतौर पर ऊंची इमारतों, कारखानों की चिमनियाँ और रेडियो टावरों पर बिजली इसलिए गिरती है, क्योंकि ये सभी लंबी रचनाएँ जमीन की तुलना में आवेशित बादलों के बेहद करीब होते हैं। बिजली की एक लैश बहुत सारी विद्युत ऊर्जा वहन करती है। जब बिजली किसी इमारत से टकराती है तो उसकी जबरदस्त विद्युत ऊर्जा के कारन इमारत में आग लग जाती है या उसकी रचना को गंभीर नुकसान पहुंचा सकती है। जब बिजली किसी पेड़ से टकराती है तो वह पेड़ को जला सकती है और भारी विद्युत ऊर्जा से उसे अत्यधिक नुकसान का सामना करना पड़ता है। जब किसी व्यक्ति पर गरज के साथ बिजली गिरती है तो उस व्यक्ति के शरीर में विद्युत ऊर्जा प्रवाहित हो जाती है, जिससे व्यक्ति गंभीर रूप से जल जाता है और उसकी मृत्यु तक हो जाती है। बिजली के कंडक्टर को स्थापित करके इमारतों और अन्य ऊंची संरचनाओं को बिजली गिरने से होने वाले नुकसान को रोका जा सकता है।

भारतीय मौसम विभाग के अनुसार प्रतिदिन करीब 44000 बार आसमान में बिजली चमकने की घटनायें परिघटित होती हैं। प्रत्येक सेकंड 2200 बार गर्जन पैदा होती हैं। बिजली आसमान से 3 लाख किलोमीटर प्रति घंटा की गति से गिरती है। आकाशीय बिजली में लाखों–अरबों वोल्ट की ऊर्जा होती है । संयुक्त राज्य अमेरिका में प्रति वर्ष 25 मिलियन बिजली चमकती है। (स्त्रोत : (Climate Resilient observing systems promotion council)

चित्र 3 : बिजली चमकने की एक घटना

अध्ययन का उद्देश्य

इस शोध प्रपत्र को तैयार करने का मूल उद्देश्य यह जानना है कि वज्रपात की घटनाओं का क्या कारण हैं। तथा इसकी बारंबारता में क्यों लगातार वृद्धि हो रही है। इस शोध का दूसरा महत्वपूर्ण उद्देश्य है कि आम लोगों में इस आपदा के विषय में पर्याप्त जानकारी दी जाए, और उन्हें जागृत की जाए। इसका उद्देश्य यह भी है कि इस आपदा प्रबंधन में सरकार सहित अन्य एजेंसियों द्वारा किस प्रकार की भूमिका निभाई गई हैं। क्या इस आपदा की प्रबंधन की दिशा में ठोस प्रयास प्रारंभ किए गए हैं? बिहार जैसे कृषि प्रधान राज्य में

यह आपदा गांव तथा खेतों में काम करने वाले श्रमिकों के लिए सबसे बड़ी चुनौती है। क्या वर्तमान प्रबंधन इस आपदा के टिकाऊ सतत समाधान की दिशा में सही अर्थों में सक्रिय है?

डाटाबेस एवं मेथेडोलोजी (Database and Methodology)

वर्तमान अध्ययन मूलतः प्राथमिक और द्वितीयक आंकड़ों पर आधारित हैं। प्राथमिक आंकड़ों का संग्रह शोधकर्ता ने स्वयं किया है। और द्वितीयक आंकड़ों का संग्रह मौसम विभाग पटना, आपदा प्रबंधन विभाग बिहार सरकार तथा भारतीय मौसम विभाग दिल्ली, तथा कुछ आंकड़े ऑनलाइन स्रोत से भी एकत्रित किए गए हैं। इन आंकड़ों को परिष्कृत कर मुख्यतः दंड रेखा चित्र तथा वृत चित्र के द्वारा दिखाया गया है। शोधकर्ता द्वारा अनुभवाश्रित विधि का भी प्रयोग किया गया है। आंकड़ों का संग्रह एवं उसके परिष्करण एवं उसके अपनाई गई मानचित्र विधियों से इस शोध प्रपत्र को गुणवत्तापूर्ण बनाने का प्रयास किया गया है।

अध्ययन क्षेत्र (Study Area)

बिहार देश का तीसरा सर्वाधिक जनसंख्या वाला राज्य है। 2011के जनगणना के अनुसार राज्य की कुल जनसंख्या 10,40,99,452 थीं। यह देश की कुल जनसंख्या का 8.60 प्रतिशत था। यहाँ की जनसंख्या घनत्व 1106 व्यक्ति प्रति वर्ग किलोमीटर है जो देश में अन्य राज्यों की तुलना में सबसे अधिक है। वर्ष 2022 में एक अनुमान के अनुसार राज्य की जनसंख्या लगभग 12.8 करोड़ है। यहाँ की एक बड़ी आबादी अशिक्षित होने के साथ गरीब और बेरोजगार हैं। बिहार राज्य प्रति वर्ष किसी न किसी प्राकृतिक आपदा का शिकार भी होता है। इसकी नियति में बाढ़ और सूखा मुख्य रूप से शामिल हैं। विगत कुछ वर्षों से राज्य में वज्रपात की बारम्बारता में वृद्धि होने से जान – माल का भारी नुकसान होने के साथ पर्यावरणीय क्षति का नया मंजर सामने आने लगा है. वैसे बिहार वज्रपात संभावित क्षेत्रों में मध्यम श्रेणी में शामिल है, किन्तु पडोसी राज्यों की तुलना में यहाँ क्षति अधिक होती हैं. अतः इस अध्ययन का मूल उद्देश्य वज्रपात की घटना के कारणों का अध्ययन कर भविष्य में होने वाली मानवीय एवं पर्यावरणीय क्षति के स्तर को न्यूनतम बिन्दु पर लाने से है।

मेघ गर्जन तथा वज्रपात के लिए तीन आवश्यक तत्व

ये हैं : 1. नमी 2. एक अस्थिर वातावरण, तथा 3. वातावरण को गतिमान करने वाला बल

बादलों के निर्माण के लिए नमी एक महत्वपूर्ण घटक है, जबकि वातावरण की अस्थिरता के लिए तापमान में अंतर होना जरूरी है। तापमान में इसी अंतर के कारण ठंडी और गरम हवाओं की उत्पत्ति होती हैं। ठंढी और गर्म हवाओं के मध्य घर्षण के कारण धनात्मक एवं ऋणनात्मक आवेश उत्पन्न होते हैं।

लाइटनिंग के प्रकार

ये हैं : 1. इंट्रा–क्लाउड लाइटनिंग 2. इंटर क्लाउड लाइटनिंग 3. क्लाउड टू ग्राउंड लाइटनिंग

जब एक ही बादल में ऊपर धनात्मक तथा निचले भागों में ऋणात्मक चार्ज होता है तो उस स्थिति में ये एक दूसरे से तेजी से आकृष्ट होती हैं। जिसके कारण तेज चमक के साथ गर्जन उत्पन्न होती हैं, किन्तु इनसे क्षति नहीं होती हैं। इसे ही इंट्रा–क्लाउड लाइटनिंग कहते हैं। इसके विपरीत जब मोटे बादलों के नीचे छोटे बादलों का निर्माण होता है, तब ऊपरी बादलों में पॉजिटिव तथा निचले बादलों में नेगेटिव चार्ज पैदा होने के कारण भयंकर स्पार्क होता है। इससे उत्पन्न स्टैटिक इलेक्ट्रिसिटी के कारण वज्रपात होता है। इनसे सर्वाधिक क्षति होती है। इसे ही इंटर क्लाउड लाइटनिंग कहा जाता है। क्लाउड टू

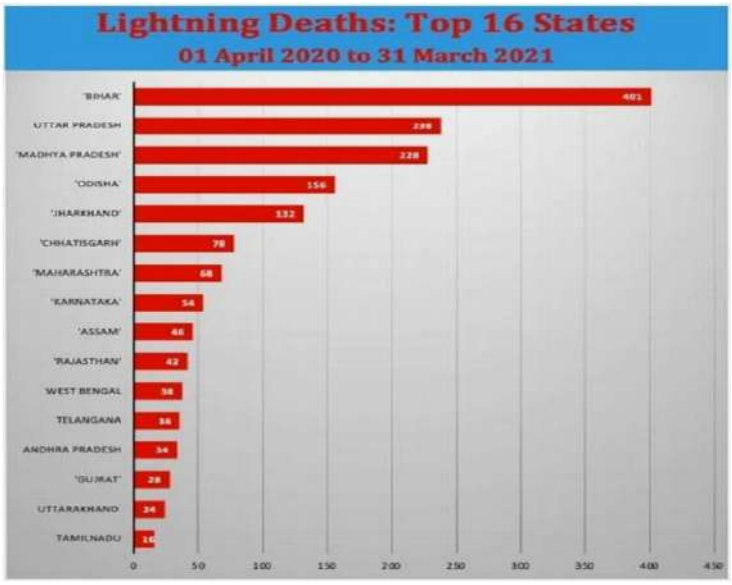
ग्राउंड लाइटनिंग के अंतर्गत बादलों में ऋणात्मक तथा धरातल पर मौजूद वृक्ष, टावर, छाता, तथा अन्य धात्विक वस्तुओं में धन आवेश उत्पन्न होता है। ये एक दूसरे की ओर आकर्षित होती हैं जिसके कारण तेज चमक तथा तीव्र ध्वनि उत्पन्न होती हैं। वृक्ष या टावर के सम्पर्क में आने से भयंकर क्षति होती है।

देश में प्रत्येक वर्ष वज्रपात से लगभग 3500 से अधिक लोगों की मृत्यु हो रही हैं। इनमें शीर्ष स्थान पर

चित्र 4 : लाइटनिंग की विभिन्न स्थितियों को दिखाया गया है।

स्त्रोत : Science Learning Hube and Beuro of Meterology

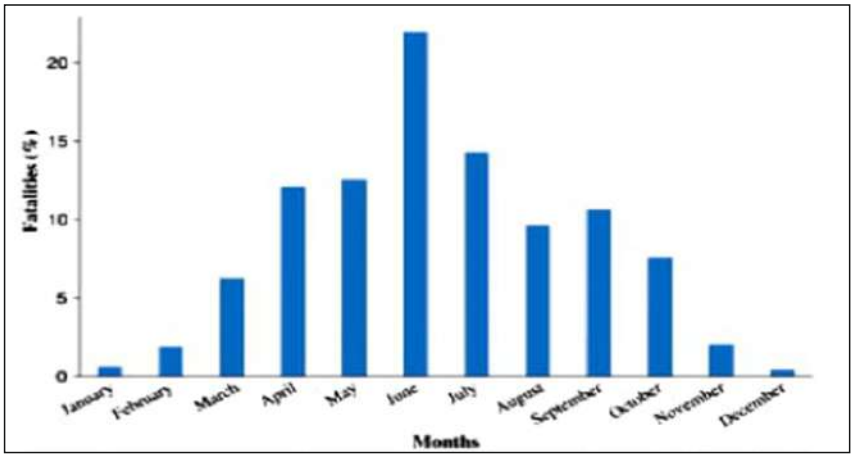
बिहार है। हालांकि आसमानी बिजली प्रभावित क्षेत्रों में बिहार मध्यवर्ती क्षेत्र में आता है। किन्तु मौसम तथा जलवायु में तीव्र गति से हो रहे परिवर्तन के कारण इसमें 10 प्रतिशत का इजाफा हुआ है।



चित्र 5 : अप्रैल 2020 से 31 मार्च 2021 के दौरान देश के विभिन्न राज्यों में वज्रपात से होने वाली मृत्यु को दिखाया गया है।

स्त्रोत : Climate Resilient Observing Systems Promotion Council

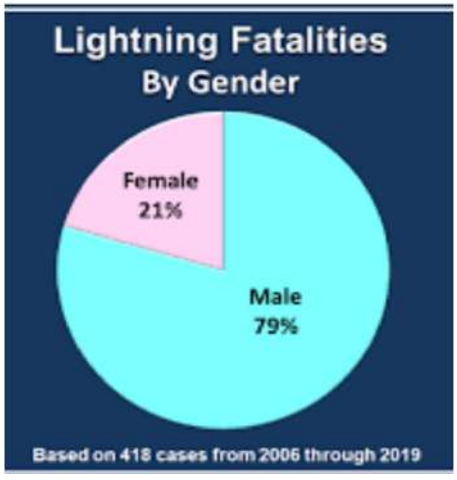
1 अप्रैल 2020 से 31 मार्च 2021 के दौरान बिहार में वज्रपात से मरने वाले लोगों की संख्या 401 थीं। जबकि उत्तर प्रदेश में 238, मध्य प्रदेश में 228 के साथ ये क्रमशः प्रथम, द्वितीय तथा तृतीय स्थान पर थे। 2010 में वज्रपात से बिहार में हुई भयंकर क्षति के कारण इसे प्राकृतिक आपदा की श्रेणी में रखा गया। वज्रपात का सबसे अधिक प्रभाव अप्रैल, मई तथा जून के महीने में देखने को मिलता है। इसे नीचे दिये गये ग्राफ के माध्यम से देखा जा सकता है ।

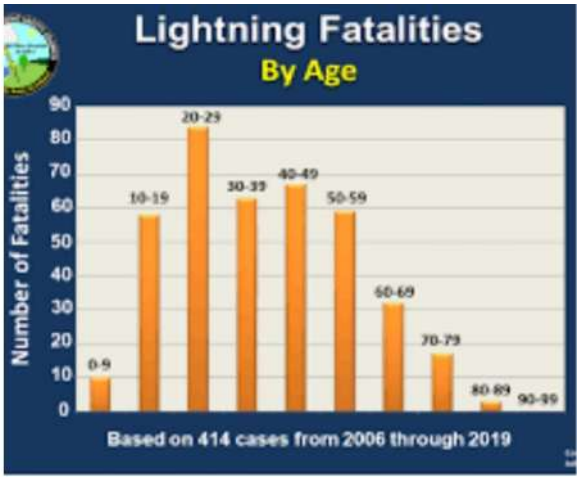


चित्र 6 : वज्रपात की बारम्बारता वाले महीने को दिखाया गया है।

स्त्रोत : National Weather Service, 2021

हालांकि देश में मार्च से अक्टुबर के बीच वज्रपात का प्रभाव सबसे अधिक देखने को मिलता है। लेकिन जून माह में बिहार के साथ–साथ देश में भी यह एक भयंकर आपदा के रूप में प्रकट होता है। ऐसा इसलिए होता है कि इन दिनों उष्ण और शीतल वायु के तापमान में अंतर बहुत अधिक होता है।





Source: National Weather Service, 2021

स्त्रोत : (www.jagran.com); (www.gaonconnection.com)

भारतीय मौसम विज्ञान विभाग, क्लाइमेट रिसिलेंट ऑब्जरविंग सिस्टम प्रोमोशन कौंसिल और वर्ल्ड विजन इंडिया के द्वारा जारी एक रिपोर्ट के अनुसार पिछले वर्ष (2021) में 1 अप्रैल से 31 जुलाई के दरम्यान वज्रपात से अकेले बिहार में 170 लोगों की मौत हुई थीं। जबकि उत्तर प्रदेश में 224, ओडिशा में 129 तथा झारखण्ड में 118 लोगों की मृत्यु ठनका गिरने से हुई थी। इस दौरान बिहार में बिजली गिरने की घटना 225508, ओडिशा में 900295, तथा झारखण्ड 453210 घटनायें हुई थीं । भारतीय मौसम विज्ञान विभाग के पटना केन्द्र के मौसमें वैज्ञानिक श्री आनंद शंकर के अनुसार, ''जब दो–तीन दिनों तक बारिश न हो और स्थानीय कारणों से मौसम गर्म हो जाए, तो ऐसे बादल बन जाते हैं, जिससे आकाशीय बिजली ज्यादा गिरती हैं।'' नेशनल वेदर सर्विस के अनुसार वज्रपात से मरने वाले इन लोगों में 79 प्रतिशत पुरुष तथा 21 प्रतिशत महिलाएं शामिल हैं। मृतकों में 83 प्रतिशत 20 से 29 वर्ष की अवस्था वाले युवा शामिल है। इन्हें डायग्राम के माध्यम से दर्शाया गया है–

चित्र 7 : अचानक होने वाली वर्षा के दौरान बिजली गिरने की घटनायें

वज्रपात आधारित आपदा का प्रमुख्य कारण-

1. जन जागरूकता का आभाव
2. अशिक्षा
3. वैज्ञानिक सूचना प्रणाली की कमी
4. खरीफ फसलों की बोआई के लिए कृषकों को घर से बाहर निकलना उनकी एक मजबूरी

वज्रपात से बिहार के प्रभावित प्रमुख जिले

वैसे तो राज्य के लगभग सभी जिलों में वज्रपात की घटनायें परिघटित होती हैं, किन्तु किशनगंज, कटिहार, पूर्णिया, अररिया, पूर्वी चम्पारण, पश्चमी चम्पारण पटना, गोपालगंज, समस्तीपुर और रोहतास मुख्य रूप से शामिल हैं।

13 जून, 2022 को बिहार के सीमांचल के कई जिलों में बिजली गिरने से 17 लोगों की मौत हो गयी थीं, वहीं 26 जून 2022 को 96 तथा 30 जून 2022 को 11 लोगों की मौत हो गयी। यानि विगत सात दिनों में राज्य में अकाशीय बिजली गिरने से 129 लोगों की मौत हो गयी थीं।

चित्र 8 : बिहार मध्यम वज्रपात संभावित क्षेत्र के अंतर्गत आता है।

नवादा के मिर्जापुर पंचायत में दो की मौत

गेसकौर प्रखंड के मिर्जापुर पंचायत के दो गांवों में वज्रपात से एक महिला समेत दो लोगों की मौत हो गई। यह हादसा तब हुआ जब ये लोग खेत में काम कर रहे थे। मृतकों में पवई गांव निवासी सजीवन माझी के 35 वर्षीय पुत्र पीरों माझी और सातन बीघा गांव निवासी 60 वर्षीया शाति देवी शामिल है। सातन बीघा की 60 वर्गीय मृतका शांति देवी खेत में मूग तोड़ रही थी, तभी वजपात की चपेट में आ गई। दोनों घटना की सूचना मिलते ही अंचलाधिकारी अलख निरंजन यादव और थानाध्यक्ष नीरज कुमार मौके पर पहुंचे।

गोविंदपुर में भी एक शख्स की मौत

नवादा के गोविंदपुर थाना क्षेत्र में गुरुवार की दोपहर रिमझिम बारिश हो रही थी। तभी वज्रपात होने से एक 28 वर्षीय पुवक की मौत घटनास्थल पर ही हो गई। युवक की पहचान पहरैठा गांव निवासी भोला राम के पुत्र महेश राम के रूप में की गई। महेश अपने ससुराल रोह थाना के मरूई गाव गया हुआ था। धान के बिचरे बोने के लिये खेत मे हल जोत रहा था तभी वज्रपात हुआ।

25 जून 2020 को वज्रपात से 83 लोगों की मृत्यु हो गयी थीं, इनमें ज्यादतर किसान और खेतिहर मजदूर थे । इनमें गोपालगंज–13, सिवान –6, पू. चम्पारण –5, दरभंगा –5, बांका –5, भागलपुर –6, खगड़िया –3, मधुबनी –8, नवादा –8, लोगों की मृत्यु हुई थीं, तथा दर्जनों घायल हुए थे। (स्त्रोत – प्राकृतिक आपदा प्रबन्धन विभाग बिहार सरकार)

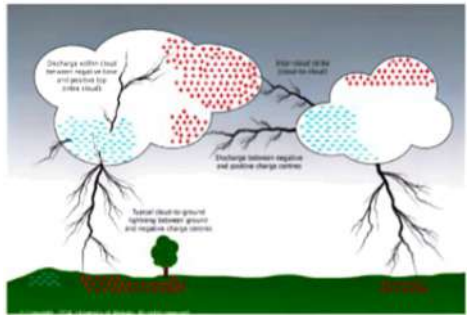
वर्तमान परिदृष्य (Present Senario)

बिहार में वज्रपात की स्थितियाँ लगातार गंभीर होती जा रहीं हैं इसका प्रमुख कारण यह है कि यह उत्तर में शिवालिक तथा दक्षिण में झारखण्ड के पठारी भागों से घिरा हुआ है। झारखण्ड की ओर से आने वाली

उष्ण आर्द हवाएँ शिवालिक पर्वत से टकरा कर बिहार के मैदानी भागों में गरज के साथ मुसलाधार वर्षा करती हैं। इस दौरान वज्रपात से मानव के साथ–साथ पर्यावरण को भारी नुकसान का सामना करना परता है। दूसरी ओर बिहार में वनों का आवरण कम होने के कारण वज्रपात की घटनाएँ अधिक होती हैं। झारखण्ड के वज्रमारा नामक गाँव में पहले वज्रपात से मानवीय क्षति अधिक होती थी, किंतु वह गाँव बांग्लादेश के मॉडल को अपना कर वज्रपात की समस्या से लगभग मुक्त हो चुका है। बिहार में वज्रपात की तीव्रता अधिक होने के पीछे निम्नलिखित कारण उत्तरदायी हैः

1. दो भिन्न आवेश के बादलो का टकराव
2. बाढ़ प्रभावित क्षेत्रों के विस्तार का होना
3. वनस्पतियों की कमी, विशेष रूप से ताड़ वृक्षों की अल्पता
4. समतल मैदानी भागों में जनसंख्या की अधिकता
5. वर्षा ऋतु से पूर्व उच्च तापमान में वृद्धि

जब बदलों में उपस्थित हल्के कण ऊपर चले जाते हैं तथा वह धनावेशित हो जाती हैं, और भारी कण नीचे विस्थापित हो जाती हैं तथा इसमें ऋण आवेश का संचार हो जाता है। ऐसा इसलिए होता है कि ऊँचाई बढ़ने के साथ क्षोभमण्डल में प्रत्येक किलोमीटर की ऊंचाई पर 6.5 डिग्री सेल्शियस तापमान में गिरावट आती है, इसे सामान्य ताप पतन दर कहा जाता है। इस कारण से ऊपर की वायु अत्यंत शीतल हो जाती है जबकि नीचे की वायु अत्यंत गर्म होती हैं। बदलों में मौजूद आवेश की भिन्नता के कारण ये एक दूसरे की ओर आकर्षित होती हैं। इस दौरान आपस में टकड़ाने से इलेक्ट्रिकल डिस्चार्ज होती है। इस दौरान चमक के साथ भयंकर गर्जन होती है। हालांकि दोनों घटनायें एक साथ होती हैं, किन्तु प्रकाश की चाल अधिक होने (3 लाख किलोमीटर/सेकंड) के कारण हमें रौशनी पहले दिखाई देती है, जबकि ध्वनि की चाल कम (331 मीटर/सेकंड) होने के कारण आवाज कुछ देर बाद सुनाई देती है। इलेक्ट्रिकल डिस्चार्ज के दौरान कई लाख गुनी ऊर्जा मुक्त होती है। इसी के कारण थंडरिंग एवं लाइटनिंग होती हैं। इसके पीछे स्टैटिक इलेक्ट्रिसिटी का सिद्धांत कार्य करता है।



बादलों में उत्पन्न विभिन्न आवेशों को प्रदर्शित किया गया है।

मेघ गर्जन विकास, विद्युतीकरण तथा अपव्यय के सभी चरणों से होकर गुजरती हैं। दिन के समय सूर्य की गर्मी के कारण हवाएँ गर्म होकर ऊपर उठती हैं। इनमें ऋण आवेश होता है। जबकि ऊपर की हवाएँ संघनित होकर धन आवेशित बादलों में परिवर्तित हो जाती हैं। इन दोनों अवेशों के बीच तेज घर्षण के कारण भयंकर आवाज के साथ स्पार्क होता है। इस प्रकार की स्थितियाँ सामान्यतः क्युमलो–निम्बस क्लाउड को विकसित करती हैं।

जल विद्युत् का सुचालक होता है। मानसून आने पर उत्तर बिहार में वर्षा अधिक होती है और बाढ़ आ जाती है। यह जल बिजली को आकर्षित करती है। वनस्पतियों में विशेष रूप से ताड़, बिजली को

आकृष्ट कर भूमि में स्थानांतरित कर देता है किन्तु बिहार में इनकी कमी के कारण ऐसा नहीं हो पाता है।

उत्तर बिहार के समतल मैदानी भागों में जन–घनत्व अधिक होने तथा वर्षा पूर्व तापमान में वृद्धि वज्रपात का एक प्रमुख कारण है। बिहार में जागरूकता की कमी, अशिक्षा, गरीबी तथा सूचना तंत्र की कमी भी ऐसी घटनाओं का एक अहम कारण है।

विश्लेषण (Discussion)

वज्रपात के दौरान सुरक्षा उपाय हेतु कई प्रकार की सावधानियों को बरतना आवश्यक होता है। कुछ उपाय निम्नलिखित हैं :

- सिर के बाल खड़े हो जाएं या झुनझुनी होने लगे तो फौरन नीचे बैठकर कान बंद कर लें। यह इस बात का संकेत है कि आपके आसपास बिजली गिरने वाली है।
- दोनों पैरों को आपस में सटा लें, दोनों हाथों को घुटनों पर रख कर अपने सिर को जमीन की तरफ जितना संभव हो झुका लें। सिर को जमीन से सटने न दें, जमीन पर कभी न लेटें।
- पेड़ बिजली को आकर्षित करते हैं, इसलिए पेड़ के नीचे खड़े न हों। समूह में न खड़े रहें, अलग–अलग हो जाएं।
- जहां हैं, वहीं रहें। हो सके तो पैरों के नीचे सूखी चीजें जैसे–लकड़ी, प्लास्टिक, बोरा या सूखे पत्ते रख लें।
- घर से बाहर हैं तो धातु से बनी वस्तुओं का इस्तेमाल न करें, बाइक, मोबाईल, लैपटौप, बिजली के पोल या मशीन से दूर रहें।
- बिजली से चलने वाले उपकरणों से दूर रहें। खिड़कियों, दरवाजे, बरामदे और छत से दूर रहें।

चित्र 9 : बिजली गिरने पर यह करें

1. अगर किसी पर बिजली गिर जाए, तो फौरन डॉक्टर की मदद माँगे ऐसे लोगों को छूने से आपको कोई नुकसान नहीं ।
2. अगर किसी पर बिजली गिरी है तो फौरन उनकी नब्ज जाँचे और अगर आप प्रथम उपचार देना जानते हैं तो जरूर दें। बिजली गिरने से अकसर दो जगहों पर जलने की आशंका रहती है– वो जगह जहाँ से बिजली का झटका शरीर में प्रवेश किया और जिस जगह से उसका निकास हुआ जैसे पैर के तलवे।

वज्रपात की स्थिति से निपटने के लिए सरकार के द्वारा उठाये जाने वाले प्रभावी कदम

वर्तमान में राज्य सरकार के द्वारा लाइटनिंग एवं थन्दरस्टॉर्म के विषय में पूर्व जानकारी एवं चेतावनी हेतु इंद्रवज्र तथा दामिनी एप्प बनाया गया है। दामिनी एप्प के जरिये 45 मिनट पूर्व सूचना प्राप्त की जा सकती है। बिहार सरकार इस आपदा से प्रभावित व्यक्ति के परिजन को 4–4 लाख रूपये भी देने की घोषणा 2010 में की थी। साथ ही घायल व्यक्तियों को मुत में इलाज की भी व्यवस्था की गयी है। टेलीवीजन तथा समाचार पत्रों के माध्यम से सरकार पूर्व चेतावनी के साथ निर्देश भी जारी करती है।

सारांश (Conclusion)

वज्रपात एक आकस्मिक एवं प्राकृतिक घटना है। इसे रोक पाना संभव नहीं है, किन्तु इससे होने वाले नुकसान को निम्नलिखित सुझावों पर अमल कर कम किया जा सकता है :

1. लाइटनिंग अरेस्टर का इस्तेमाल कर वज्रपात से होने वाली क्षति को रोका जा सकता है।
2. बड़े पैमाने पर ताड़ वृक्ष को लगा कर इस प्रकार के हादसे को कम किया जा सकता है।
3. पूर्व सूचना तंत्र को बढ़ावा दिया जाना आवश्यक है।
4. चौपाल के माध्यम से जनजागरूकता बढ़ाने की जरूरत है।
5. बर्षा वाली स्थिति में प्रायः घर से बाहर ना निकलें।
6. बारिश में यदि घीर जायें तो किसी पेड़ की जगह छुपने की बजाय किसी पक्के मकान में छुपे।
7. बारिश के दौरान मोबाइल का इस्तेमाल बिल्कुल ना करें तथा स्विच –ऑफ कर दें।
8. इलेक्ट्रॉनिक वस्तुओं का इस्तेमाल न करें।
9. घर के छत तथा आँगन में पड़ी हुई धातु से बनी वस्तुओं को हटा दें।

उपरोक्त सुझावों को अपनाकर वज्रपात के प्रभाव को यकीनन कम किया जा सकता है।

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भारत में जनसंख्या वृद्धि पर साक्षरता, विकास दर, सकल घरेलू उत्पाद एवं प्रति व्यक्ति आय का प्रभाव

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सार

जनसंख्या वृद्धि पर कई कारकों का प्रभाव पड़ता है। इनमें साक्षरता, विकास दर, सकल घरेलू उत्पाद एवं प्रति व्यक्ति आय का प्रभाव सर्वाधिक महत्वपूर्ण है। भारत के संदर्भ में यह सर्वाधिक उचित प्रतीत होता है। दिये गये आंकड़ों से इस अवधारणा की पुष्टि भी होती है। उपरोक्त कारकों की गत्यात्मकता के विश्लेषण से स्पष्ट होता है कि अधिक साक्षरता, तीव्र विकास दर और उच्च प्रति व्यक्ति आय वाले राज्यों में जनसंख्या वृद्धि दर निम्न स्तर पर है। केरल और गोवा इसके अच्छे उदाहरण हैं। इसके विपरीत कम साक्षरता, कम सकल घरेलू उत्पाद और कम आय वाले राज्यों में वृद्धि दर अधिक है। बिहार एक ऐसा राज्य है जहाँ तीव्र विकास दर के बावजूद जनसंख्या वृद्धि भी तीव्र है। वर्तमान भारत में जनसंख्या वृद्धि दरों में भारी विषमता है। बड़े राज्यों जैसे– बिहार, उत्तर प्रदेश, मध्य प्रदेश और राजस्थान में आज भी बढ़ती जनसंख्या एक चुनौती है। इसके विपरीत केरल, गोवा और तमिलनाडु जैसे राज्यों ने जनसंख्या वृद्धि पर पूर्ण नियंत्रण स्थापित किया है। भारत सन् 2045 तक जनसंख्या वृद्धि को स्थिर करने का लक्ष्य रखता है। इस लक्ष्य की प्राप्ति हेतु बड़े राज्यों को केरल और तमिलनाडु जैसे राज्यों के अनुरूप कार्य करना होगा, तभी हम 2045 के लक्ष्य को प्राप्त कर सकते हैं।

मुख्य शब्दावली (Keywords) : साक्षरता, विकास दर, सकल घरेलू उत्पाद, प्रति व्यक्ति आय, महान विभाजक वर्ष।

परिचय (Introduction)

किसी भी देश की जनसंख्या वृद्धि को चार महत्वपूर्ण कारक प्रभावित करते हैं। ये कारक देश की जनसंख्या के जीवन स्तर को स्पष्ट करने के साथ ही राष्ट्रीय जनसंख्या नीति– क्रियान्वयन को भी स्पष्ट करते हैं। जनसंख्या वृद्धि को प्रभावित करने वाले प्रमुख कारकों में पहला कारक साक्षरता है, जो किसी भी देश के जनसंख्या विकास का बुनियादी आधार है। दूसरा कारक उच्च सकल घरेलू उत्पादन है, अर्थात जनसंख्या का अधिकांश भाग विविध उत्पादन प्रक्रियाओं में संलग्न होने से है। तीसरा कारक देश के सभी राज्यों में प्रति व्यक्ति आय से संबंधित है। अंतिम कारक विकास दर है जो क्षेत्र/प्रदेश के विकास स्तर को प्रकट करता है। भारत में पिछले दशक (2011) में जनसंख्या वृद्धि दर 17.64 प्रतिशत आंकी गई, जबकि इससे पूर्ववर्ती दशकों (1991 व 2001) में जनसंख्या वृद्धि दर क्रमशः 23.86 व 21.34 प्रतिशत थी। सन् 1991 के पश्चात विगत दोनों दशकों (2001 व 2011) की जनसंख्या वृद्धि दर में गिरावट आयी है, किन्तु इतनी कमी आने पर भी विश्व में जनसंख्या की दृष्टि से भारत का दूसरा स्थान कायम है। आज विश्व की कुल जनसंख्या में 17.5 प्रतिशत जनसंख्या भारत की है। विश्व में भारत जिस

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प्रकार आर्थिक विकास के क्षेत्र में अग्रसर हुआ है उसका प्रभाव जनसंख्या नियंत्रण पर तुलनात्मक दृष्टि से कम दिखाई देता है।

अध्ययन का उद्देश्य

किसी भी शोध प्रपत्र का एक निश्चित उद्देश्य होता है और उस उद्देश्य की प्राप्ति हेतु अध्ययन विधि–तंत्र का निर्धारण किया जाता है। वर्तमान शोध प्रपत्र का मूल उद्देश्य है कि हम भारत की जनसंख्या वृद्धि के कारकों की पहचान कर सकें तथा महत्वपूर्ण कारकों की पहचान कर जनसंख्या वृद्धि पर उनके सामयिक–स्थानिक (Spatio-Temporal) प्रभावों का विश्लेषण करें। निश्चित उद्देश्य के परिप्रेक्ष्य में तथ्यों के विश्लेषण हेतु शोधकर्त्ता द्वारा मूलतः द्वितीयक आंकड़ों का संग्रह किया गया है। सामान्य सांख्यिकी विश्लेषण विधि का प्रयोग करते हुए संग्रहित आंकड़ों का वर्णन किया गया है। इस क्रम में अनुभवाश्रित विधि तंत्र (Empirical Methodology) का भी प्रयोग किया गया है। जनसंख्या संबंधी अधिकतर आंकड़े 1981, 1991, 2001 एवं 2011 की जनगणना से लिये गये हैं। कुछ आंकड़े समाचार पत्रों के स्त्रोत से भी एकत्रित किये गये हैं।

भारतीय जनसंख्या

वर्तमान भारत में करीब 140 करोड़ जनसंख्या अधिवासित है। चीन के बाद यह विश्व की दूसरी सबसे बड़ी जनसंख्या है। भारत में विश्व की 17.5 प्रतिशत जनसंख्या 2.4 प्रतिशत वैश्विक भूमि पर अधिवासित है। विश्व में प्रतिदिन सर्वाधिक जनसंख्या वृद्धि भारत में हो रही है। अगले ही वर्ष भारत की कुल जनसंख्या चीन से अधिक हो जायगी। नीचे की तालिका में कुछ देशों में जनसंख्या वृद्धि की दैनिक प्रवृत्ति को दिखाया गया है:

तालिका-1

चयनचित देशों में प्रतिदिन जनसंख्या वृद्धि

क्रम संख्या	देश	प्रतिदिन जनसंख्या वृद्धि (2012)
1.	भारत	45,552
2.	चीन	15,139
3.	नाइजेरिया	11,553
4.	पाकिस्तान	8,721
5.	यू.एस.ए.	7,371

स्त्रोत : हिन्दुस्तान टाइम्स – 22/01/2013, पटना

भारत की जनसंख्या 1901 ई. में मात्र 23.8 करोड़ थी जो 2011 ई. में 121.02 करोड़ और 2023 (अनुमानित) में 140 करोड़ हो चुकी है। भारतीय राज्यों में सर्वाधिक जनसंख्या (करीब 22 करोड़ सिर्फ उत्तर प्रदेश में है) महाराष्ट्र और बिहार अन्य वृहद् जनसंख्या वाले राज्य हैं। वस्तुतः विध्यांचल पर्वत के

उत्तर और तटीय भारत में देश की 80 प्रतिशत से अधिक जनसंख्या अधिवासित है। इसकी वृद्धि दर, साक्षरता, पुरूष– महिला अनुपात, प्रति व्यक्ति आय, कार्यिक संरचना और संसाधनात्मक महत्त्व में बड़े स्तर पर प्रादेशिक विषमता देखने को मिलती है। यद्यपि तीव्र वृद्धि एक समस्या है लेकिन यही समस्या भारत को सबसे बड़ा श्रमिकों का (कुशल/अनुशल) बाजार भी बनाता है।

भारत में जनसंख्या वृद्धि का बदलता स्वरूप

विश्व के सबसे बड़े गणतंत्र की पिछली जनगणना के सकारात्मक परिणमों का अध्ययन करने पर ऐसा प्रतीत होता है कि देश का जनमानस भारी जनसंख्या दबाव के प्रति सजग होने लगा है। देश के तीन राज्यों को छोड़ कर शेष सभी राज्यों में जनसंख्या वृद्धि दर में गिरावट आई है। इस आधार पर आगामी दशकों में आशातीत परिणाम मिलने की प्रबल सम्भावनाएँ हैं। देश का विकास मात्र मानव संसाधन पर निर्भर नहीं करता और न धार्मिक भावनाएँ देश के विकास में सार्थक हो सकती है, बल्कि देश का विकास देश में निवास कर रहे सभी जनसमुदायों में समान राष्ट्रीय अवधारणाओं पर निर्भर करता है। वैश्विक परिदृश्य के आधार पर विश्व के लगभग सभी विकसित राष्ट्रों ने जनसंख्या वृद्धि को नियंत्रित करने में बहुत बड़ी सफलता प्राप्त की है। अनेक विकासशील राष्ट्र भी जनसंख्या वृद्धि को नियंत्रित करने पर लगे हैं। चीन जैसे विशाल जनाधिक्य राष्ट्र ने जनसंख्या को नियंत्रित करने हेतु कठोर नियम बनाकर जनसंख्या वृद्धि को रोकने में सफलता प्राप्त की है। भारत में सन् 1951 के पश्चात सन् 1981 तक जनसंख्या में अत्यधिक वृद्धि होती रही, जिसका प्रभाव भारतीय जनमानस पर लम्बे समय तक देखने को मिला। सन् 1921 ई॰ से सन् 1981 तक देश में अकाल एवं महामारियों पर नियंत्रण होने लगा। फलस्वरूप मृत्यु दर में कमी आने लगी और जनसंख्या वृद्धि तीव्र गति पकड़ने लगी। इसीलिए भारत में सन् 1921 को ''महान विभाजक वर्ष'' (Great Divide Year) के नाम से जाना जाता है।

सन् 1951 से सन् 1981 के मध्य देश में विकास की लहरों के साथ–साथ जनसंख्या वृद्धि दर भी अधिक था, क्योंकि सन् 1981 तक देश में चिकित्सा सेवाओं का उच्च स्तरीय विकास एवं चिकित्सा के प्रति जनजागरूकता बढ़ने से मृत्यु दर लगातार घटती रही। सन् 1981 के पश्चात देश में साक्षरता का प्रतिशत तीव्र गति से बढ़ने लगा, इससे अधिकांश शिक्षित लोग सरकारी व गैर–सरकारी क्षेत्रों में रोजगार पाने के साथ ही भारतीय जनमानस में छोटे परिवार की अवधारण प्रवेश करने लगी। फलस्वरूप देश में एक दशक के बाद सन् 1991ई॰ में जनसंख्या वृद्धि दर में लगभग एक प्रतिशत की गिरावट आई। सन् 1991 ई॰ के बाद शिक्षित वर्ग का झुकाव शिक्षा की गुणवता के प्रति एवं देश में नियोजन परिवार के प्रति जागरूकता के कारण जनसंख्या वृद्धि दर में कमी आने लगी। फलस्वरूप सन् 2011 में जनसंख्या की वृद्धि दर 17.64 प्रतिशत आंकी गयी। वर्तमान परिस्थितियों के आधार पर भारत में पश्चिमी संस्कृति का तीव्र समावेश एवं सीमित परिवार के प्रति जागरूकता, कोविड महामारी आदि आगामी दशकों में जनसंख्या वृद्धि दर पुनः कमी की संभावना है। विशेषकर निर्वतमान दशक के जनगणना का कार्य भले ही कोविड–19 के कारण समय पर नहीं हो पाया किन्तु कोविड महामारी के कारण भारत के जनमानस को जिन परिस्थितियों का सामना करना पड़ा उससे प्रतीत होता है कि भारत में जनसंख्या वृद्धि का परिदृश्य आगामी दशकों में क्रमशः कम होता जाएगा। तालिका–2 में भारत की जनसंख्या वृद्धि की प्रवृत्तियों को तीन दशकों के संदर्भ में दिखाया गया है।

तालिका-2
भारत में जनसंख्या वृद्धि दर

क्र0सं0	राज्य/के0शा0प्रदेश का नाम	1981से1991(%)	1991से2001 (%)	2001से2011(%)
1.	जम्मू और कश्मीर	30.34	29.04	23.70
2.	हिमाचल	20.79	17.53	12.80
3.	पंजाब	20.81	19.76.	13.70
4.	उत्तराखण्ड	24.23	19.20	19.20
5.	हरियाणा	27.41	28.06	19.90
6.	राजस्थान	28.44	28.33	21.40
7.	उत्तर प्रदेश	25.55	25.80	20.10
8.	बिहार	23.38	28.43	25.10
9.	सिक्किम	28.47	32.98	12.40
10.	अरुणाचल प्रदेश	36.83	26.21	25.90
11.	नागालैण्ड	56.08	64.41	–0.50
12.	मणिपुर	29.29	30.02	18.70
13.	मिजोरम	39.70	29.18	22.80
14.	त्रिपुरा	34.30	15.74	14.70
15.	मेघालय	32.86	29.94	27.80
16.	असम	24.44	18.85	16.90
17.	पश्चिमी बंगाल	24.73	17.84	13.90
18.	झारखण्ड	24.03	23.19	22.30
19.	उड़ीसा	20.06	15.94	14.00
20.	छत्तीसगढ़	25.73	18.06	22.60
21.	मध्य प्रदेश	27.24	24.34	20.30
22.	गुजरात	21.19	22.48	19.20
23.	महाराष्ट्र	25.73	22.57	16.00
24.	आन्ध्र प्रदेश	24.20	13.86	11.10
25.	कर्नाटक	21.12	17.25	15.70
26.	गोवा	16.08	14.89	8.20
27.	केरल	14.32	9.42	4.90
28.	तमिलनाडु	15.39	11.19	15.60
29.	चण्डीगढ़	42.16	40.33	17.10
30.	दिल्ली	51.45	46.31	21.00
31.	दमण –दीव	28.46	55.59	53.50
32.	दादर, नगर हवेली	33.57	59.20	55.50
33.	लक्ष्यद्वीप	28.47	17.19	6.20
34.	पांडिचेरी	33.64	20.58	27.70
35.	अण्डमान निकोबार द्वीप समूह	48.70	26.94	6.70
	भारत	23.86	21.34	17.64

स्त्रोतः शोध लेखक द्वारा स्वयं विविध स्त्रोतों से मूल आंकड़ा संग्रहित कर उसे परीष्कृत किया गया है।

उपरोक्त तालिका में देश में सभी राज्य/केन्द्र शासित प्रदेशों के विगत तीन दशकों की जनसंख्या वृद्धि दर को दर्शाया गया है। देश के अधिकांश राज्य/केन्द्र शासित प्रदेशों की जनसंख्या वृद्धि दर में गत तीन दशकों से लगातार गिरावट आ रही है। सन् 1991 की जनगणना में भारत के राज्यों में वृद्धि दर 14.32 प्रतिशत से 39.70 प्रतिशत तक थी। नागालैण्ड राज्य 56.08 प्रतिशत को अपवाद स्वरूप माना जा सकता है। एक दशक बाद सन् 2001 में नागालैण्ड राज्य (64.41प्रतिशत) को पुनः अपवाद स्वरूप मानने पर देश के सभी राज्यों में वृद्धि दर घटकर 9.42 प्रतिशत से 32.98 प्रतिशत तक रही। सन् 2011 में जनगणना के परिणाम और भी सार्थक रहे। अर्थात जनसंख्या वृद्धि दर 4.90 से 27.80 प्रतिशत तक रही, किन्तु राज्यों के मध्य लगभग 23 प्रतिशत वृद्धि दर का अन्तर जनसंख्या नियंत्रण सम्बन्धी नीतियों की कमियों को उजागर करता है। देश की जनसंख्या वृद्धि दर में भले ही कमी आई है, किन्तु देश की कुल आबादी बढ़ रही है, जो राज्यों में असमान जनसंख्या वृद्धि दर का प्रतिफल है।

यद्यपि जनसंख्या वृद्धि दर में कमी आयी है लेकिन कुल जनसंख्या में लगातार वृद्धि हो रही है। इसके तीन प्रमुख कारण हैं :

1. 15 वर्ष से 59 वर्ष की आयु प्रजनन क्षमता की आयु है। इस वर्ग में मात्र भारत की करीब 68 प्रतिशत जनसंख्या है। अतः औसतन दो बच्चे प्रति परिवार के बावजूद कुल वृद्धि अत्यधिक होती है।
2. औसत जीवन प्रत्याशा 1901 ई॰ में मात्र 23 वर्ष था जो वर्त्तमान में 69 वर्ष हो चुका है। वृद्धि के कारण लम्बी जीवन प्रत्याशा वास्तविक जनसंख्या वृद्धि का कारण बन चुका है।
3. तथाकथित बिमारू (BIMARU) राज्यों में अभी भी प्रजनन् दर अधिक होने से सकल संख्या दक्षिण भारत के राज्यों की तुलना में अधिक है। बिहार और उत्तर प्रदेश जैसे राज्यों में नियंत्रण के बावजूद प्रति माँ बच्चों की संख्या 2.5 से अधिक है।

देश के सभी राज्य/केन्द्र शासित प्रदेशों के क्षेत्रफल में अत्यधिक अन्तर है। इसका प्रभाव राज्यों के जनसंख्या आंकड़ों पर स्पष्ट दिखाई देता है। उत्तर प्रदेश राज्य में जहाँ जनसंख्या 22 करोड़ के आंकड़े को पार कर गई है वहीं सिक्किम जैसे छोटे राज्य में कुल जनसंख्या 8 लाख से भी कम है। अर्थात देश में जहाँ कुछ राज्यों की जनसंख्या करोड़ों में है वहीं कुछ राज्यों की जनसंख्या लाखों में होने से सभी राज्यों का विकास भी एक समान नहीं हो पा रहा है। इसलिए भारत में अधिक जनसंख्या युक्त राज्यों की विकास दर छोटे राज्यों की अपेक्षा कम है। आज, बिहार, उत्तरप्रदेश व मध्य प्रदेश जैसे राज्यों में जनसंख्या वृद्धि दर 20 प्रतिशत से अधिक है किन्तु इनकी विकास दर 15 प्रतिशत से कम है, जबकि कम जनसंख्या वृद्धि दर युक्त राज्य सिक्किम, हिमाचल प्रदेश, केरल एवं गोवा राज्य में विकास दर 15 प्रतिशत से अधिक है। देश के उत्तरी भाग मं स्थित बड़े राजयों की जनसंख्या वृद्धि दर में गिरावट आई है, किन्तु देश के दक्षिणी राज्यों की तुलना में इनमें जनसंख्या प्रतिशत अधिक है। जनसंख्या के प्रारम्भिक आकड़ों के आधार पर देश के उत्तरी बड़े राज्यों में आज भी प्रत्येक महिला औसतन 2.5 से अधिक बच्चों को जन्म दे रही है। अर्थात देश की आबादी बढ़ाने में देश के उत्तरी राज्यों का सहयोग अधिक है। इससे देश में जनसंख्या असन्तुलन बढ़ता जा रहा है और इस असन्तुलन के कारण भारत में अनेक क्षेत्रीय समस्याऐं राष्ट्रीय समस्याऐं बनती जा रही हैं।

भारत में वृहद धरातलीय विषमताओं के साथ–साथ अनेक प्रकार की धार्मिक, सामाजिक, आर्थिक और राजनीतिक वैचारिक विषमताएँ जनसंख्या नियंत्रण/विकास में अवरोध पैदा करती रहती हैं। देश के

सभी राज्यों में भिन्न–भिन्न सामाजिक–आर्थिक स्वरुप होने से जनसंख्या वृद्धि दर के आंकड़े भी अत्यधिक विषमता युक्त हैं। देश के कुल 18 राज्य /केन्द्र शासित प्रदेशों में जनसंख्या वृद्धि दर राष्ट्रीय कुल वृद्धि दर से अधिक है, जबकि 17 राज्य/केन्द्र शासित प्रदेशों में राष्ट्रीय वृद्धि दर से कम है। देश के 6 राज्य/केन्द्र शासित प्रदेशों में जनसंख्या वृद्धि दर 25 प्रतिशत से अधिक है, जबकि 5 राज्य/केन्द्र शासित प्रदेशों में यह वृद्धि दर 10 प्रतिशत से कम है। देश के कुछ राज्यों की जनसंख्या वृद्धि दर में तीव्रता के साथ कुछ राज्यों में कमी भी आ रही है, जैसे– नागालैण्ड में एक दशक के अन्तर्गत जनसंख्या वृद्धि दर 64.41 प्रतिशत से गिर कर –0.50 प्रतिशत तथा केरल राज्य में यह वृद्धि दर 4.86 प्रतिशत पर पहुँच गयी है। अतः भारत में जिस द्रीव गति के साथ प्रत्येक क्षेत्र में विकास और परिवर्तन हो रहा है, उसका प्रभाव जनसंख्या नियत्रंण के क्षेत्र में भी कुछ राज्यों में देखने को मिल रहा है। भारत के जिन राज्यों में साक्षरता प्रतिशत निम्न, विकास का अत्यधिक अभाव, औद्योगिक व कृषि उत्पादन में भारी कमी, प्रति व्यक्ति आय का निम्न स्तर तथा धर्मान्धतायुक्त जनसमुदयों की अधिकता है। ऐसे राज्यों में जनसंख्या वृद्धि अपेक्षाकृत अधिक पायी जाती है। भारत में बिहार एवं अरूणाचल प्रदेश राज्यों में जनसंख्या की वृद्धि दर सर्वाधिक रही, जबकि भारत में सर्वोच्च साक्षरता प्रतिशत (93.9) का प्रभाव केरल राज्य में मात्र 4.90 प्रतिशत जनसंख्या वृद्धि के साथ रहा। आन्ध्र प्रदेश, सिक्किम व हिमाचल प्रदेश में उच्च विकास दर के प्रतिफल जनसंख्या वृद्धि दर कम रही। इसी प्रकार भारत में जिन राज्यों का सकल घरेलू उत्पादन 5.0 प्रतिशत से अधिक था। उनमें प्रति व्यक्ति आय औसतन रू. 60000 से अधिक थी। अतः उक्त कारकों द्वारा प्रत्यक्ष अथवा अप्रत्यक्ष रूप से जनसंख्या वृद्धि दर प्रभावित होती रही है।

उत्तर प्रदेश व बिहार जैसे जनाधिक्य राज्यों की जनसंख्या देश के अधिकांश राज्य/केन्द्र शासित प्रदेशों के अन्तर्गत देखने को मिलती है, जबकि देश के अन्य राज्यों से जनसंख्या स्थानान्तरण उक्त राज्यों के अनुरुप नहीं है। इसके बाद भी उत्तर प्रदेश एवं बिहार में जनसंख्या 19.95 व 10.38 करोड़ के आंकड़ों को पार कर गयी थी। देश में जहाँ कुछ राज्यों की जनसंख्या करोड़ों के आंकड़ों को पार करती जा रही है, वहीं पाँच छोटे राज्यों में जनसंख्या औसतन 20 लाख से कम है। देश में राज्यों के मध्य जनसंख्या आंकड़ों में अत्यधिक अन्तर होने से छोटे राज्यों के विकास की तुलना बड़े राज्यों से करना सार्थक नहीं है। उत्तराखण्ड राज्य दो दशक पूर्व 84.79 लाख जनसंख्या के साथ उत्तर प्रदेश राज्य से अलग हुआ था। सीमित क्षेत्रफल के फलस्वरुप इसका दो दशक में चहुमुखी विकास हुआ और सन् 2011 के आर्थिक सर्वे में इसकी विकास दर (24.70 प्रतिशत) देश में सर्वाधिक तथा प्रति व्यक्ति आय देश के 28 राज्यों में से पाँचवें स्थान पर थी, जबकि उत्तर प्रदेश की विकास दर (13.42 प्रतिशत) उत्तराखण्ड से आधा एवं प्रति व्यक्ति आय सबसे निम्न थी।

भारत में जनसंख्या नियंत्रण संबधी नीतियाँ/कार्यक्रम गत तीन दशकों में मात्र 7.02 प्रतिशत जनसंख्या वृद्धि दर को कम कर पाई है। इससे देश में सन् 2045 तक जनसंख्या वृद्धि दर को स्थिर कर पाना कठिन ही नहीं बल्कि चुनौती पूर्ण कार्य हैं। जनसंख्या आंकड़ों के आधार पर भारत के जिन राज्यों में 5 करोड़ से अधिक जनसंख्या है उनमें जनसंख्या वृद्धि दर 20 प्रतिशत से अधिक है, क्योंकि उन राज्यों में जनसंख्या के मध्य अनेक सामाजिक एवं आर्थिक विषमतायें हैं। इसलिए बिहार एवं उत्तर प्रदेश जैसे राज्यों में आज भी प्रत्येक महिला औसतन 2.5–4 बच्चों को जन्म दे रही है। इस स्थिति के आधार पर भारत में आगामी 35 वर्षों में जनसंख्या वृद्धि दर को स्थिर कर पाना कठिन है। यह माना जाता है कि

मुस्लिम समुदाय में धार्मिकता के आधार पर अधिक जन्म दर पाई जाती है। किन्तु विगत जनगणना आंकड़ों के आधार पर बिहार के अतिरिक्त प्रायः सभी राज्यों की जनसंख्या वृद्धि दर में संतोषजनक गिरावट आई है।

जनसंख्या वृद्धि दर पर साक्षरता वृद्धि, विकास दर, सकल घरेलू उत्पादन एवं प्रति व्यक्ति आय का प्रभाव

भारत में अत्यधिक जनसंख्या वृद्धि से पूर्व प्रधानमंत्री स्व0 श्रीमती इंदिरा गाँधी इस देश के भविष्य को देखते हुए अत्यधिक चिन्तित थी, इसलिए उन्होनें देश में आपातकाल के समय परिवार नियोजन कार्यक्रम को प्रभावी बनाया। यह कार्यक्रम देश में धीरे–धीरे आम जन–मानस के लिए प्रेरणा का मार्ग बनता रहा और आज भारत में प्रायः सभी परिवार इस कार्यक्रम को अति आवश्यक समझने लगे हैं। देश के सभी राज्य/केन्द्र शासित प्रदेशों में लगातार साक्षरता प्रतिशत बढ़ रहा है। आर्थिक स्तर में तीव्र गति से सुधार होने के साथ ही विकास दर व प्रति व्यक्ति आय में तीव्र वृद्धि हो गई है। देश के एक राज्य केरल में जहाँ जनसंख्या वृद्धि दर 4.90 प्रतिशत थी, वहीं दूसरे राज्य मेघालय में यह वृद्धि दर 27.30 प्रतिशत थी। अतः इतना बड़ा अन्तर उभरने का तात्पर्य यह है कि हमारे देश के जनसंख्या विकास की सोच में अत्यधिक असमानता के साथ ही क्षेत्रीय विकास में अत्यधिक असमानताएँ भी हैं।

तालिका-3

साक्षरता वृद्धि, विकास दर, सकल घरेलू उत्पादन एवं प्रति व्यक्ति आय

क्रम सं0	राज्य/केन्द्र शासित प्रदेश	2011 साक्षरता प्रतिशत(%)	2011 विकास दर(%)	2011 सकल घरेलू उत्पाद(%)	2012 प्रति व्यक्ति आय(रू0 में)
1	नागालैण्ड	80.1	7.02	0.15	21434
2	केरल	93.9	16.44	3.67	59179
3	लक्ष्यद्वीप	92.3	9.35	0.01	51320
4	अ0नि0 द्वीप समूह	86.3	12.55	0.06	74340
5	गोवा	87.4	15.42	0.41	132719
6	आन्ध्र प्रदेश	67.7	19.44	7.77	60458
7	सिक्किम	42.2	19.29	0.08	48937
8	हिमाचल प्रदेश	83.8	21.13	0.72	58493
9	पंजाब	76.7	10.97	3.03	67473
10	पश्चिम बंगाल	77.1	10.76	6.07	41469
11	उड़ीसा	73.5	14.80	2.55	36923

12	त्रिपुरा	87.8	11.80	0.22	38493
13	तमिलनाडु	80.3	17.94	7.49	72993
14	कर्नाटक	75.6	15.73	5.46	59763
15	महाराष्ट्र	82.9	14.23	14.09	83471
16	असम	73.2	12.70	1.43	30413
17	चण्डीगढ़	86.4	16.54	0.28	120912
18	मणिपुर	79.8	5.88	0.13	29684
19	उत्तराखण्ड	79.6	24.70	1.06	68292
20	गुजरात	79.3	12.21	6.59	63961
21	हरियाणा	73.6	19.19	3.53	92327
22	उत्तर प्रदेश	69.7	13.42	8.05	26051
23	मध्य प्रदेश	70.6	10.73	3.29	27250
24	दिल्ली	86.3	18.80	3.54	116885
25	राजस्थान	67.1	10.76	1.46	29786
26	झारखण्ड	67.6	10.76	1.46	29786
27	छत्तीसगढ़	71.0	18.12	1.78	44097
28	मिजोरम	91.6	9.69	0.08	45982
29	जम्मू और कश्मीर	68.7	10.35	0.65	33056
30	बिहार	63.8	21.59	2.92	20069
31	अरूणाचल प्रदेश	67.0	6.12	0.10	51644
32	पाण्डेचेरी	86.5	13.97	0.18	82767
33	मेघालय	75.5	17.14	0.20	48383
34	दमन और दीव	87.1	13.60	0.02	39970
35	दादर नगर हवेली	77.7	16.20	3.03	51364

स्त्रोत - शोध लेखक द्वारा विविध स्त्रोतों से संग्रहण

किसी भी क्षेत्र में सामाजिक आर्थिक परिवर्तन मुख्य रुप से उस क्षेत्र में विद्यमान सकल घरेलू उत्पादन, प्रति व्यक्ति आय, उस क्षेत्र की विकास दर एवं साक्षरता प्रतिशत पर निर्भर करता है। भारत एक विकासशील राष्ट्र है। इसकी अधिकांश जनसंख्या गाँवों में निवास करती है, जिसका मुख्य व्यवसाय कृषि एवं पशुपालन है। इसके साथ ही भारत के सभी राज्यों एवं केन्द्र शासित प्रदेशों के भू–भाग व क्षेत्रफल में अत्यधिक विषमताएँ हैं। भौगोलिक आधार पर भारत में पर्वतीय, मैदानी, पठारीय एवं समुद्र तटवर्ती चार प्रकार के भू–भाग युक्त राज्य हैं, जिनमें एक पैमाने के आधार पर न विकास कार्य किया जा सकता है और न ही एक समान विकास को मापा जा सकता है। महाराष्ट्र एवं तमिलनाडु राज्य समुद्री तट पर स्थित हैं। ये औद्योगिक एवं कृषि उत्पादन में अग्रणी राज्य हैं, किन्तु महाराष्ट्र में सकल घरेलू उत्पादन 14.9 प्रतिशत था और तमिलनाडु में यह 7.49 प्रतिशत था। इसके साथ ही दोनों राज्यों में प्रति व्यक्ति आय, विकास दर, साक्षरता प्रतिशत आदि में अन्तर दिखाई देता है, किन्तु यह एक संयोग है कि दोनों राज्यों की जनसंख्या वृद्धि दर में अत्यधिक समानता रही। इसी प्रकार देश के अन्य समान भू–भाग युक्त राज्यों में अनेक प्रकार की असमानताएँ देखने को मिलती हैं। भारत में जनसंख्या वृद्धि दर को सबसे अधिक प्रभावित करने वाले दो कारक–साक्षरता और गरीबी हैं, जिन राज्यों में साक्षरता का प्रतिशत अधिक है उनमें जनसंख्या वृद्धि दर कम एवं जिन राज्यों में प्रति व्यक्ति आय कम हैं उनमें जनसंख्या वृद्धि दर अधिक रही । जनसंख्या वृद्धि दर के आधार पर भारत के सभी राज्य/केन्द्र शासित प्रदेशों को पाँच वर्गों में बाँट कर उनके सम्मुख साक्षरता, विकास दर, सकल घरेलू उत्पादन को प्रतिशत में तथा प्रति व्यक्ति आय को रूपयों में दर्शाया गया है।

तालिका-4

निम्न जनसंख्या वृद्धि दर (10 प्रतिशत से कम), 2011

क्र0सं0	राज्य/के0शा0प्र0	ज0सं0वृ0दर %	साक्षरता %	विकास दर %	सकल घरेलू उत्पाद %	प्रति व्यक्ति आय (रु0 में)
1.	नागालैण्ड	–0.50	80.1	7.02	0.15	21434
2.	केरल	4.90	93.9	16.44	3.67	59179
3.	लक्ष्यद्वीप	6.20	92.3	9.35	0.01	51320
4.	अ0नि0द्वी0समूह	6.70	86.3	12.55	0.06	74340
5.	गोवा	8.20	87.4	15.42	0.41	132719

स्त्रोत – शोध लेखक द्वारा मूल आकड़ों को परिष्कृत किया गया है।

उपरोक्त तालिका के अनुसार भारत के निम्न जनसंख्या वृद्धि दर युक्त पाँच राज्य हैं, किन्तु यही राज्य भारत के सर्वाधिक साक्षरता प्रतिशत एवं प्रति व्यक्ति आय वाले राज्य भी हैं। इन राज्यों में जनसंख्या वृद्धि दर के आंकड़ों का अध्ययन करने से स्पष्ट होता है कि इन राज्यों में (नागालैंड राज्य को छोड़कर) जनसंख्या वृद्धि दर पर उच्च साक्षरता प्रतिशत एवं प्रति व्यक्ति उच्च आय का प्रभाव स्पष्ट रूप से

दिखाई देता है। इससे प्रतीत होता है कि भविष्य में साक्षरता प्रतिशत एवं प्रति व्यक्ति आय बढ़ने के साथ इन राज्यों में जनसंख्या वृद्धि दर में कमी आती रहेगी। नागालैंड एक ऐसा राज्य है जहाँ साक्षरता दर अधिक है किन्तु विकास दर एवं सकल घरेलू उत्पाद दर कम है। नागालैंड की साक्षर जनजातीय जनसंख्या का दूसरे राज्यों में जाना, तथा बाहरी जनसंख्या के बसने पर प्रतिबंध के कारण यहाँ की जनसंख्या वृद्धि दर कम हो गयाी है।

तालिका-5

कम जनसंख्या वृद्धि दर (10-15 प्रतिशत), 2011

क्र0सं0	राज्य/के0शा0प्र0	ज0सं0वृ0दर %	साक्षरता %	विकास दर %	सकल घरेलू उत्पाद %	प्रति व्यक्ति आय (रु0 में)
1	आन्ध्र प्रदेश	11.10	67.7	19.44	7.77	60458
2	सिक्किम	12.40	82.2	19.29	0.08	48937
3	हिमाचल प्रदेश	12.80	83.8	21.13	0.72	58493
4	पंजाब	13.70	76.7	10.97	3.03	67473
5	पं0 बंगाल	13.90	77.1	10.76	6.07	41469
6	उड़ीसा	14.00	73.5	14.80	2.55	36923
7	त्रिपुरा	14.70	87.8	11.80	0.22	38493

स्त्रोत - शोध लेखक द्वारा मूल आकड़ों को परिष्कृत किया गया है।

कम जनसंख्या वृद्धि दर के अंतर्गत देश के 7 राज्य हैं, जिनमें सबसे कम वृद्धि दर (11.10 प्रतिशत) आन्ध्रप्रदेश में तथा सबसे अधिक (14.70 प्रतिशत) त्रिपुरा राज्य में है। इस वर्ग में प्रति व्यक्ति आय का प्रभाव जनसंख्या वृद्धि दर पर स्पष्ट रुप से दिखाई देता है। आंध्र प्रदेश, हिमाचल प्रदेश एवं पंजाब में प्रति व्यक्ति आय रु॰ 58 हजार से अधिक है, जबकि सिक्किम, पं॰ बंगाल, उड़ीसा एवं त्रिपुरा में प्रति व्यक्ति आय उक्त राज्यों की अपेक्षा कम है। इस वर्ग में तीन पर्वतीय राज्यों की तुलना अन्य राज्यों से नहीं की जा सकती है, क्योंकि पर्वतीय राज्यों में औद्योगिक क्षेत्रों के अभाव में सकल घरेलू उत्पादन एवं प्रति व्यक्ति आय का प्रतिशत अन्य राज्यों की अपेक्षा निम्न रहता है, जो उपरोक्त तालिका से भी स्पष्ट होता है।

तालिका-6

मध्यम जनसंख्या वृद्धि दर (15-20 प्रतिशत), 2011

क्र0सं0	राज्य / के0शा0प्र0	ज0सं0वृ0दर %	साक्षरता %	विकास दर %	सकल घरेलू उत्पाद %	प्रति व्यक्ति आय (रु0 में)
1	तमिलनाडु	15.60	80.3	17.94	7.49	72993
2	कर्नाटक	15.70	75.6	15.73	5.46	59763
3	महाराष्ट्र	16.00	82.9	14.23	14.09	83471
4	असम	16.90	73.2	12.70	1.43	30413
5	चण्डीगढ़	17.10	86.4	16.54	0.28	120912
6	मणिपुर	18.70	79.8	5.88	0.13	29684
7	उत्तराखण्ड	19.20	79.6	24.70	1.06	68292
8	गुजरात	19.20	79.3	12.21	6.59	63961
9	हरियाणा	19.90	76.6	19.19	3.53	92327

स्त्रोत- शोध लेखक द्वारा मूल आकड़ों को परिष्कृत किया गया है।

मध्यम जनसंख्या वृद्धि (15–20 प्रतिशत) के अन्तर्गत देश के आठ राज्य एवं एक केन्द्र शासित प्रदेश हैं। चण्डीगढ़ एक सुनियोजित नगर क्षेत्र है, किन्तु एक केन्द्र शासित प्रदेश के रुप में व्यवस्थित है। इसके जनसंख्या संबंधी आंकड़ों की तुलना अन्य राज्यों से करना सार्थक नहीं है। इस वर्ग के तीन राज्यों (असम, मणिपुर एवं उत्तराखण्ड) में औद्योगिक क्षेत्रों की कमी है। उत्तराखण्ड के तराई–मैदानी क्षेत्र में औद्योगिक क्षेत्रों का धीरे–धीरे विकास हो रहा है। शेष राज्यों में औद्योगिक क्षेत्रों का विकास अधिक है। देश में सर्वाधिक सकल घरेलू उत्पादन का प्रतिशत (14.09) महाराष्ट्र राज्य में रहा, जबकि हरियाणा को छोड़कर अन्य राज्यों में सकल घरेलू उत्पादन 5.46 प्रतिशत से अधिक था। हरियाणा में कृषि विकास अन्य राज्यों की अपेक्षा अधिक है। इस वर्ग के सभी राज्यों (चण्डीगढ़ को छोड़कर) में कम साक्षरता प्रतिशत जनसंख्या वृद्धि दर को अधिक प्रभावित करता हुआ दिखाई देता है, जबकि असम एवं मणिपुर राज्यों में मध्यम जनसंख्या वृद्धि दर के लिए प्रति व्यक्ति निम्न आय तथा सकल घरेलू उत्पादन का न्यून प्रतिशत होना प्रमुख कारक है।

तालिका-7

उच्च जनसंख्या वृद्धि दर (20-25 प्रतिशत), 2011

क्र0सं0	राज्य / के0शा0प्र0	ज0सं0वृ0दर %	साक्षरता %	विकास दर %	सकल घरेलू उत्पाद %	प्रति व्यक्ति आय (रु0 में)
1	उत्तर प्रदेश	20.10	69.7	13.42	8.05	26051
2	मध्य प्रदेश	20.30	70.6	10.73	3.29	27250
3	दिल्ली	21.00	86.3	18.80	3.54	116885
4	राजस्थान	21.40	67.1	18.76	4.15	39967
5	झारखण्ड	22.30	67.6.	10.76	1.46	29786
6	छत्तीसगढ़	22.60	71.0	18.12	1.78	44097
7	मिजोरम	22.80	91.6	9.69	0.08	45982
8	जम्मू और कश्मीर	23.70	68.7	10.35	0.65	33056

स्त्रोत- शोध लेखक द्वारा मूल आकड़ों को परिष्कृत किया गया है।

केन्द्र शासित प्रदेश दिल्ली को राष्ट्रीय राजधानी प्रदेश भी कहा जाता है। प्रायः सभी राज्यों की राजधानियाँ जन स्थानान्तरण के प्रमुख केन्द्र बिन्दु होते हैं। राष्ट्रीय राजधानी क्षेत्र दिल्ली में देश के अनेक प्रान्तों से लगातार स्थानान्तर होते रहने से उच्च जनसंख्या वृद्धि दर का होना स्वाभाविक है। अर्थात दिल्ली में आन्तरिक जनसंख्या वृद्धि की अपेक्षा स्थानान्तरित जनसंख्या की वृद्धि अधिक है। इस वर्ग के अन्तर्गत उत्तर भारत के पाँच हिन्दी भाषा राज्यों (उत्तर प्रदेश, मध्य प्रदेश, राजस्थान, झारखण्ड एवं छत्तीसगढ़) में साक्षरता प्रतिशत राष्ट्रीय औसत (74.94 प्रतिशत) से लगभग 6 प्रतिशत कम है। इसका प्रत्यक्ष प्रभाव अधिक जनसंख्या वृद्धि पर देखा जा सकता है एवं उक्त राज्यों में प्रति व्यक्ति आय अन्य राज्यों की अपेक्षा निम्न रही है एवं विकास दर औसतन सामान्य रही है। जम्मू और कश्मीर मुस्लिम जनसंख्या (66.97 प्रतिशत) बाहुल्य राज्य है। इस राज्य में आतंकवाद का प्रभाव प्रायः सभी विकासात्मक कार्यों पर देखा जा सकता है किन्तु धार्मिक अंधविश्वास के कारण जनसंख्या वृद्धि दर तीव्र था लेकिन हाल के वर्षों में इस केन्द्रशासित प्रदेश की जनसंख्या वृद्धि दर तथाकथित बिमारू (BIMARU) राज्यों से कम हो चुकी है। मिजोरम एक जनजाति बाहुल्य राज्य है, जहाँ साक्षरता प्रतिशत उच्च रही है, किन्तु इसका प्रभाव जनसंख्या वृद्धि दर के नियंत्रण पर नहीं दिखाई देता है क्योंकि जनजातीय अवधारणाओं के कारण वे जनसंख्या नियोजन में रूचि नहीं लेते हैं।

तालिका-8

उच्चतम जनसंख्या वृद्धि दर (25 प्रतिशत से अधिक)

क्र0सं0	राज्य / के0शा0प्र0	ज0सं0वृ0दर %	साक्षरता %	विकास दर %	सकल घरेलू उत्पाद %	प्रति व्यक्ति आय (रु0 में)
1	बिहार	25.10	63.8	21.59	2.92	20069
2	अरुणाचल प्रदेश	25.90	67.0	6.12	0.10	51644
3	पांडिचेरी	27.70	86.5	13.97	0.18	82767
4	मेघालय	27.80	75.5	17.14	0.20	48383
5	दमण और दीव	53.50	87.1	13.60	0.02	39970
6	दादर, नगर हवेली	55.50	77.7	16.20	0.03	51364

स्त्रोत- शोध लेखक द्वारा मूल आकड़ों को परिष्कृत किया गया है।

उपरोक्त तालिका के अनुसार देश के तीन राज्यों एवं तीन केन्द्र शासित प्रदेशों में जनसंख्या वृद्धि दर (25 प्रतिशत से अधिक) है। पाण्डिचेरी, दमन–दीव व दादर–नगर हवेली केन्द्र शासित प्रदेशों का नगरीय स्वरुप इनमें अधिक जनसंख्या वृद्धि का मूल कारण है। इनमें पिछले दशकों में भी जनसंख्या वृद्धिदर अन्य राज्य / केन्द्र शासित प्रदेशों की अपेक्षा अधिक रही है, क्योंकि इन प्रदेशों में सम्पूर्ण भारत से ग्रामीण जनसंख्या का लगातार स्थानान्तरण हो रहा है। इन प्रदेशों की सम्पूर्ण व्यवस्था केन्द्र आधारित है, इसलिए इन प्रदेशों में मध्यम विकास दर के साथ ही प्रति व्यक्ति आय का स्तर एवं साक्षरता का प्रतिशत भी सामान्य रहा है। बिहार की स्थिति अन्य राज्यों की अपेक्षा भिन्न है। बिहार में जनसंख्या वृद्धि दर उच्च है। इसी के साथ विकास दर भी उच्च है। ये एक दूसरे के विरोधी कारक हैं। लेकिन बिहार में विकास दर (प्रतिशत) अधिक होने के बावजूद आय में संतोषजनक वृद्धि (वास्तविक) नहीं है। अतः यह परिस्थिति जनसंख्या वृद्धि पर नियंत्रण कायम नहीं करता है। अरूणाचल प्रदेश और मेघालय में पर्वतीय परिस्थितियाँ उच्च जनसंख्या वृद्धि का मूल कारण है। यहाँ जन्म दर भी अधिक है।

भारत में समान जनसंख्या वृद्धि दर हेतु प्रभावी कदम

देश में जनसंख्या वृद्धि दर को कम करने हेतु प्रमुख रुप से दो सुझाव हैं। प्रथम सुझाव यह है कि अप्रत्यक्ष नियंत्रण कारकों को राष्ट्रीय स्तर पर कार्यिक प्राथमिकता दी जाय। इसके अन्तर्गत महिलाओं को शिक्षा एवं रोजगार के अवसर में पर्याप्त वृद्धि आवश्यक है। विवाह की वर्त्तमान आयु में भी वृद्धि की

जा सकती है। महिलाओं के लिए 18 से बढ़ाकर 20 तथा पुरूषों के लिए 21 से 23 की जा सकती है। इससे तीव्र प्रजनन् आयु काल (age period) से बचा जा सकता है। द्वितीयक एवं तृतीयक क्षेत्र के रोजगार में भी भारी वृद्धि की आवश्यकता है। सुरक्षित मातृत्व भी महिलाओं में अधिक बच्चे की रूचि में कमी लायेगी। पुरूष बच्चे की चाह के बदले समाज में यह अवधारणा विकसित करनी होगी कि लड़का हो या लड़की, सबकी कार्यिक क्षमता और गुणवत्ता एक है। उपरोक्त अप्रत्यक्ष कारण स्वतः छोटे परिवार के प्रति आकर्षण उत्पन्न करने में सक्षम होगा।

देश में जनसंख्या वृद्धि दर को एक समान करने हेतु दूसरा सुझाव कानून होना चाहिए। यह सत्य है कि हमारा देश धर्मनिरपेक्ष है। यहाँ धार्मिक स्वतंत्रताएं हैं, किन्तु इसका तात्पर्य यह नहीं होना चाहिए कि धर्म की आड़ में आप देश की ज्वलन्त समस्याओं से मुँह मोड़ लें। इसलिए देश के सभी राज्यों को जनसंख्या नियंत्रण हेतु अपने सर्वोच्च साक्षर राज्य केरल के समान वुमेन कोड विल 2011" का प्रारुप तैयार कर कानूनन अपनाना चाहिए। प्रमोद भार्गव के अनुसार उक्त मसौदे में प्रावधान है कि किसी नागरिक को धर्म, जाति, क्षेत्र और भाषा के आधार पर परिवार नियोजन से बचने की सुविधा नहीं होगी। साथ ही गर्भ निरोधक समस्त सुविधाएं सरकार निःशुल्क उपलब्ध करायेगी। यदि देश के सभी राज्य/केन्द्र शासित प्रदेशों में जनसंख्या नियंत्रण से सम्बन्धित धर्म, जाति और क्षेत्र निरपेक्ष कानून प्रचलन में आता है तब देश में अधिक प्रभावकारी रुप में जनसंख्या वृद्धि दर नियंत्रित हो पायेगी।

भारत में अब जनसंख्या की अधिक वृद्धि दर के लिए क्षेत्रीय विकास का अभाव कारण स्वरूप नहीं रह गया। वह समय तब था जब लगभग सपूर्ण भारत गाँवों में बसता था। आज का भारत नगरीय स्वरूप धारण करता जा रहा है। भारत के अधिकांश गाँव विकास की किरणों से जुड़ चुके हैं। पंचायती राज ने ग्रामीण महिलाओं के सपनों को पंख लगा दिये है, दूरसंचार, दूरभाष, कम्प्यूटर आदि की दुनिया ने ग्रामीण भारत के जनजीवन को नगरीय सुविधाएं प्रदान कर दी हैं, किन्तु निवर्तमान दशक के अन्तिम चरण में अन्तर्राष्ट्रीय स्तर पर फैली हुई कोविड –19 बीमारी ने अनेक राष्ट्रों में जनसंख्या वृद्धि के परिदृश्य को अनेक आधारों पर प्रभावित कर दिया है, भारत इससे अछूता नहीं है, विगत तीन वर्षों में शिक्षा ऑनलाइन होने से बच्चों के शैक्षिक स्तर में गिरावट भी देखी गयी है। बच्चे स्कूलों में होने वाली शिक्षणेत्तर गतिविधियों को लगभग भूल चुके है। भारत में सकल घरेलू उत्पाद एवं प्रति व्यक्ति आय में अत्याधिक परिर्वतन आ गया है, प्रत्येक राज्य में विकास दर पहले की अपेक्षा अधिक होना स्वाभाविक है। देश में संभावित जनगणना के आंकड़े प्रकाशित होने पर पुनः जनगणना परिदृश्य पर उपरोक्त कारकों का तुलनात्मक अध्ययन किया जा सकता है।

निष्कर्ष

भारत अनेक प्रकार की विभिन्नताओं का देश है। यहाँ राज्यों के क्षेत्रफल एवं उनकी जनसंख्या आकार एवं वृद्धि दर में भी अन्तर है। पिछले दशक में नागालैण्ड एवं केरल जैसे राज्यों में जनसंख्या वृद्धि दर 5 प्रतिशत से कम रही, वहीं बिहार, मेघालय, अरुणाचल प्रदेश जैसे राज्यों में यह वृद्धि दर 25 प्रतिशत से अधिक रही। भारत के प्रायः सभी राज्यों के विकास स्तर में पहले की अपेक्षा वृद्धि हुई है। इसलिए साक्षरता प्रतिशत एवं प्रति व्यक्ति आय में भी सकारात्मक वृद्धि हो रही है। इसी का प्रतिफल है कि भारत में भले ही जनसंख्या बढ़ रही है, किन्तु वृद्धि दर में गिरावट आ रही है। जनसंख्या वृद्धि दर को समान स्तर पर लाने के लिए देश के सभी राज्य/केन्द्र शासित प्रदेशों को केरल के समान (वुमेन कोड

विल–2011) को लागू करना होगा। राष्ट्र हित में हमें धर्म, जाति और क्षेत्र रहित कानून को अपनाना होगा। तभी समृद्ध राष्ट्र की कल्पना साकार हो पायेगी। यह अति आवश्यक है कि वर्त्तमान वृहद् कार्यिक एवं संभावित कार्यिक जनसंख्या को कुशल बनाकर संसाधन का स्वरूप प्रदान करें।

भारत विश्व का पहला राष्ट्र था जहाँ 1948 ई॰ में ही परिवार नियोजन को राष्ट्रीय कार्यक्रम का दर्जा दिया गया है। 1977 ई॰ में प्रथम अन्तराष्ट्रीय जनसंख्या सम्मेलन का आयोजन यू.एन.ओ. द्वारा बुडापेस्ट में किया गया था। भारत उन देशों में था जिन्होंने जनसंख्या नियंत्रण का जबरदस्त समर्थन किया था। यद्यपि भारत में चीन की भांति एक बच्चे की अनिवार्यता सम्बंधी कानून नहीं बनाये गये लेकिन स्वैच्छिक कानून और साक्षरता से उत्पन्न स्वविवेक के कारण भारत 2001 ई॰ तक करीब 13 करोड़ अतिरिक्त जनसंख्या वृद्धि को रोकने में सफल रहा।

भारत सरकार की राष्ट्रीय जनसंख्या नीति के तहत देश में सन् 2045 तक जनसंख्या वृद्धि को स्थिर करने की योजना है, किन्तु सन् 2011 की जनगणना के आधार पर देश में दशकीय जनसंख्या वृद्धि दर 6 राज्यों में 25 प्रतिशत से अधिक, 8 राज्यों में 20–25 प्रतिशत व 9 राज्यों में 15–20 प्रतिशत रही है, अर्थात भारत में जनसंख्या नियंत्रण संबन्धी समस्त कार्यक्रमों का संचालन होने पर भी भारत के सर्वाधिक 23 राज्य/केन्द्र शासित प्रदेशों में जनसंख्या वृद्धि दर 15 प्रतिशत से अधिक रही। इस आधार पर भारत सरकार की सन् 2045 तक जनसंख्या वृद्धि को स्थिर करने की नीति सफल हो पायेगी, ऐसा संभव नहीं प्रतीत होता है। देश में गत तीन दशकों के जनसंख्या आंकड़ों से स्पष्ट है कि देश के 23 राज्य/केन्द्र शासित प्रदेशों की जनसंख्या वृद्धि दर में लगातार गिरावट आ रही है, जबकि शेष 12 राज्यों की जनसंख्या वृद्धि दर में अस्थिरता अधिक है। विगत जनगणना आंकड़ों के आधार पर देश के 35 राज्य/केन्द्र शासित प्रदेशों में से 32 राज्य / केन्द्र शासित प्रदेशों की जनसंख्या वृद्धि दर में गिरावट आई है, जबकि शेष तीन राज्यों (छत्तीसगढ, तमिलनाडु एवं पाण्डिचेरी) की जनसंख्या वृद्धि दर में पूर्व दशक की अपेक्षा अधिक वृद्धि रही है। भारत में जनसंख्या की दृष्टि से उत्तर प्रदेश सबसे बड़ा राज्य है और विगत दशक में भी इस राज्य में सबसे अधिक जनसंख्या (198436415) थी और युवा वर्ग में अधिक जनसंख्या होने के कारण जनसंख्या वृद्धि दर भी अधिक थी। कुल मिलाकर छोटे परिवार के प्रति जागरूकता, साक्षरता में वृद्धि, महिलाओं के लिए रोजगार अवसरों में वृद्धि जैसे कारकों के आधार पर माना जा सकता है कि भारत 2045 तक स्थिर जनसंख्या के लक्ष्य को प्राप्त कर सकता है।

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BOOK -REVIEW

Title of the Book	:	Tourism in Bihar
Name of the Author	:	Arti Kumari
No. of Chapters	:	11
No. of Pages	:	256
Publisher	:	Rajesh Publication New Delhi - 110002
Year of Publication	:	2022
Price	:	Rs. 800/-

The author of the book 'Tourism in Bihar' has done a commendable work by giving a systematic account of the growth, spatial pattern, richness and emerging challenges before the tourism in Bihar. Modern tourism has emerged as an industry and it provides job directly and indirectly to a large size of working population in Bihar. In fact, present Bihar is endowed with four important resources. They are land, water, population and tourism. Tourism of Bihar needs effective attention. Once it is properly developed on the principles of eco-tourism, geo tourism and sustainable tourism, it may bring Bihar on global connectivity map and may be pivotal in the socio- economic transformation of the state.

The book is divided into eleven chapters. Chapter one is on the definition, typology, history and importance of tourism in general. Chapter two gives an account of tourism in India, While chapter three is on tourism in Bihar. In fact, this chapter is synanomous to the title of the book. Early two chapters are conceptual and general. The author's only contribution is to present the prevailing facts in order to give a sequential linkage with the global and Indian tourism. Chapter three to ten are on different types of tourism in Bihar. Although no internationally standarised classification scheme is used, the author herself has developed a scheme of classification which seems justifiable and impressive. Bihar has been rich in religious and heritage sites. There are large number of such sites which have potential to attract global tourists. considering significance. The author has written two chapters on religious and heritage sites separately. The scholar has further covered eco-tourism, natural sites, Water sites and even rural sites having potential significance in the toursim economy of Bihar. Astro-tourism has also been taken into account. However, sites like Khagaul, Taregana and Taregana Top are not internationally recognised centers of astronomical significance due to lack of adequate evidences.

Simply on the basis of nomenclature, there may not be possible to attract tourists on large scale. Chapter eleven and chapter three are identical so far as the title of the chapters are concerned. Chapter eleven adds a term 'An overview'. Its contents however, hardly gives an overview. It would have been better to give a chapter on problems, prospects and suggestions for the

development of tourism in Bihar. Chapter three also would have been more enriched by providing a classification of tourist centres of Bihar into centres of global, national, regional and local importance. There are also some factual errors. There is a photograph of Mandhar Parvat in Page 226 mentioning its location in Jammui district while this Parvat (Hill) is situated in Banka district. Glossary of words is the collection of such words which are not in common use and may also be local nomenclature. If the author uses such types of nomenclature/words then the glossary is needed to facilitate the global readers. Here, the author has presented abbreviation instead of uncommon/local words under the heading of glossary of words. In fact, the author would have created two separate pages giving respectively to glossary of words and abbreviations.

However, the young and promising author (Dr. Arti Kumari) has done hard work in presenting this book before us. She herself has written that this is her maidan effort. I am sure that she will bring necessary changes in the next edition of the book. The book is readable and very informative on the tourism of Bihar. The author of the book definitely commands our appreciation and good wishes.

Rash Bihari Pd. Singh
Professor of Geography (Retd.)

GENERAL SECRETARY REPORT

On the Auspicious Occasion of the XXIII Annual Conference and National Seminar of The Association of Geographers, Bihar and Jharkhand October 15-16, 2022 S.B. College, Ara (VKS University), Bihar (India)

Hon'ble Chief Guest and Guest of Honour of today's inaugural session of 23rd Annual Conference cum National Seminar, Chief Patron, Patron, President, Past Presidents, President Elect of the AGBJ, Convener, Other dignitaries on the dais, Fellow delegates, Life Members of the Association, Invited Guests, Students, Media Persons, Ladies and Gentlemen.

I am standing before you to present my first General Secretary report of the overall activities of the association. It is a matter of great privilege and honour for me to present this report on the occasion of the 23rd Annual Conference cum National Seminar under the auspices of the Association of Geographers, Bihar and Jharkhand, which is being attended by a large number of distinguished scholars and researchers, not only from different parts of the states of Bihar and Jharkhand but also from other Indian states and again not only from geography fraternity but also from several other branches of knowledge.

Friends! Our association has now become more than twenty years old. During these years, the Association has strengthened, united and organised the geographers of Bihar and Jharkhand. The association itself has been strengthened in respct of life members, financial position and infrastructure facilities. These have been possible due to the active participation by the P.G. Departments and College Departments of Geography of different Universities to give an active support in the functioning of the association. These activities helped in increasing the number of life members to 1258. There has been an increase of about 100 life members in less than one year. There has also been an increase in the number of institutional members and annual members.

I am happy to inform the AGBJ family that our financial position is also considerably sound. This year also the statement of account of the Association has been certified by the Chartered Accountant and the treasurer will present the balance sheet in the General Body Meeting. Our fixed deposit is Rs. 12,83,205/- till 31st March 2022.

The infrastructural facilities of the Association has also improved much during the last few years. Website has been launched and email address created. We are communicating well with such a large number of members through the website of the association launched in 2016. All relevant informations are now available on the website and one can click www.agbj.in for getting any information. Besides that, you may interact with the association office bearers through the email- agbj2003@gmail.com and Whatsapp social media. The PAN Card of the association has been made in 2019 to facilitate fixed deposit account.

It is my pleasure to inform you that Prof. D.P. Singh, our past President has launched an academic programme under the name of 'Founders and Makers of Modern Geography in

India'. It is an online lecture series whose 28 episodes are completed recently. This programme has received tremendous response across the country.

Bihar geography has also achieved a destination where State Government funded for the establishment of Centre for Geographical Studies in the Aryabhatt Knowledge University, Patna. This centre also organised a lecture series during the Corona period and that has already been published as a book named **'Contemporary Inquiry in Geography'**.

The centre has also entered into an international collaboration with the University of Wolverhampton, United Kingdom. The Centre has launched Ph.D. programme and is in the process of launching MA/MSc in Remote Sensing and GIS. It is also recognised as a Training and Counselling Centre for the students of Amanat course, launched by BBOSE, Patna.

There is also a good news for geography fellows that BBOSE (Bihar Board of Open Schooling and Examination) has launched a Programme for the Amanat/ Amin certificate. Its certified geographers will get immense job opportunities. Prof. R.B.P Singh Patron of the Association is appointed as the Advisor to the BBOSE for this programme. Prof. Singh is also appointed as a member of the Governing Body of BBOSE.

Prof. R.B.P. Singh is nominated by the Ministry of Education, Govt. of India as a member of a committee for co-operation to UNESCO on Social Sciences. He is also appointed as a chairman, Advisory Committee to Shri Krishna Science Centre, Patna by the Ministry of Culture, Govt. of India. Dr. Singh is also nominated as a member of the Governing Bodies of Shri Gopal Narayan Singh University, Sasaram and Mahavir Arogya Sansthan, Patna.

Various Departments of Geography of the Universities of Bihar and Jharkhand are promoting the subjects by organising Seminars, extra mural lectures, workshop and other academic activities throughout the years. Department of Geography, Patna University organized a special lecture on 'Spatial Science Demystifying Research' delivered by Dr. Rajiv Thakur, Associate Professor of Geography, Missouri State University, USA. Department of Geography, College of Commerce, Arts and Sciene, Patna, a constituent unit of Patliputra University became the first GIS and Remote Sensing Centre among all Colleges of Bihar. The Department of Geography L.N. Mithila University, Darbhanga has successfully organized various IIRS-ISRO outreach Programme during 2021-22 and become the first University in the state of Bihar to initiate IIRS-ISRO outreach programme. Dr. Gaurav Sikka was co-investigator on cross country international survey project funded by Norweigian University of Science and Technology, Trondheim, Norway. Dr. Ram Pravesh Yadav, H.o.D. of Geography, BRA Bihar University, Muzaffarpur was awarded Dr. Sarwapalli Radha Krishnan National Teacher's Award on Teachers Day, 2022 by Didiji Foundation, Patna. Dr. Pintu Kumar, Assistant Professor, Department of Geography, Magadh University, Bodh-Gaya convened the online National Seminar in association with Prof. Rob Linrothe, Northwestern University USA. Post-graduate Department of Geography, B.N. Mandal University, Madhepura has organized a special lecture delivered by Prof. Kameshwar Nath Singh, Vice-Chancellor of Central University of South Bihar, Gaya. An alumnai meet was organized in the University Department of Geography, Vinoba Bhave University, Hazaribag. Post-graduate teaching in Geography has been started in Ramchandra Chandravansi University, Bishrampur, Palamu, a private University in Jharkhand. Dr. Jitendra Shukla joined as Professor of Geography in Nilamber Pitamber University, Daltonganj now Medininagar (Palamu) and appointed as Dean

faculty of Social Sciences, Education and Medical. Dr. Swati Yadav and Dr. Prashant Kumar, Assistant Professors of Geography, T.M. Bhagalpur University have participated in an online course of Remote Sensing in IIRS, Dehradun.

Since our last annual conference in September 2021, geography departments of different universities organised several academic activities both off-line as well as on-line. Several guest faculties and regular teachers have also joined respective geography departments of Bihar and Jharkhand. We seize this occasion to congratulate them and also request them to associate themselvese with the Association to carry it forward and to make it an association of new generation geographers. I am sorry to state that due to shortage of time, achievements of several geographers of Bihar and Jharkhand in the fields of book writing, receiving awards, attending national and international seminars, getting promotion, etc. are not being presented here. I on behalf of the association congratulate them and wish to have a bright future.

I, as a General Secretary of the Association request all those life members who have not furnished their email to kindly submit the same to the office of the Association. You are also requested to be a regular follower of our website for any kind of information. All newly recruited teachers in geography are specially requested to come forward to become actively associated with the Association. Your association will give a new generational move to the Association.

At the end I once again express my sincere thanks to all of you for your kind co-operation and support in running the Association. I am sure that our bond to work together will promote the cause of geography and we shall succeed in establishing geography as an indispensable subject in coming years. We need to work academically on challenging issues in a systematic and scientific way so that stake holders in the field of planning and development may not be able to ignore the importance of Geography.

I hope that your two-day stay at Ara will be academically very fruitful. At the end, I owe deep sense of gratitude to the organizers of this Conference who have provided all kinds of facilities satisfactorily.

Thanking you all once again.

(Dr. Manoj Kumar Sinha)
General Secretary, AGBJ
email: agbj2003@gmail.com

THE ASSOCIATION OF GEOGRAPHERS BIHAR & JHARKHAND

DEPARTMENTAL NEWS

PATNA UNIVERSITY, PATNA

1. Bhoogol Vachaspati Award, 2021

Prof. (Dr.) Sudeepta Adhikari was awarded with Bhoogol Vachaspati Award posthumously in 43rd Indian Geography Congress, NAGI held in Department of Geography, Institute of Science, Banaras Hindu University, Varanasi on October 28-30, 2021.

2. National Unity Pledge

National Unity Pledge (Rastriya Ekta Diwas) to commemorate the birth anniversary of Sardar Vallabh Bhai Patel was held on 31.10.2021 in which all teachers, research scholars and office staff of the Geography Department took part. It was addressed by Head of the Department, Prof (Dr.) Anuradha Sahay, Prof (Dr.) Md. Nazim, Dr. Supriya and Miss. Niharika Narayan.

3. Jal-Jeevan-Hariyali Celebration

Jal-Jeevan-Hariyali Diwas was celebrated in the department on 07.12.2021. The topic of discussion was "Paudhshala Shrijan". Head of the Department Dr. Anuradha Sahay discussed about the importance of plants for our environment and encouraged the students for planting more trees. Students and teachers took part actively in the event and plantation was done.

4. Human Rights Day Celebration

The celebration was held on 15.12.2021 at 11.00 a.m. in the Department of Geography, Patna University. The teachers and students took active participation and discussed various aspects of human rights. The major topics discussed were: i. Minority Rights, ii. Rights against child abuse, iii. Human Rights in Indian Perspective iv. Harassment of Women in work place. The program was very successful as it was meant to make the students aware of various dimensions of human rights.

5. Conservation of Environment: Sustaining People and Planet

A lecture was held on 16.12.2021 on the topic "Conservation of Environment: Sustaining People and Planet". Chief speaker was Prof. Birendra Prasad, Director, IQAC, P.U. The lecture was very enriching and informative. All the teachers and students actively participated in the lecture.

6. Induction Meet of M.A. Semester-I of batch 2021-2023

The New Year 2022 ushered the beginning of New Semester Classes of MA Semester-I (2021-2023). **"Welcome Address"** was held in the Department for students of MA Geography Semester-I on 14.02.2022 at 11:00 am. It was addressed by Head of the

Department, Prof. (Dr.) Anuradha Sahay, Prof. (Dr.) Md. Nazim, Rahul Kumar Tiwari and Prity Rani. The students of MA Semester-I were acquainted with the new course curricular under CBCS which they have to pursue.

7. Special Lecture by Prof. Abha Laxmi Singh

A special lecture on "An Analysis of Urban Rural Relations and Environmental Issues" was held on 26.04.2022 in the Seminar Hall of the Department. The speaker was Prof. Abha Laxmi Singh, Professor and former Chairperson, Department of Geography, A.M.U., Aligarh. She discussed about the relationship between urban and rural areas and the issues related to environment. The lecture was very enriching and informative.

8. Poster Making Competition

A Poster Making Competition was held in the Department of Geography, P.U. on 25.05.2022. The students actively participated in the competition by exhibiting posters related to the Environment.

9. World Environment Day Celebration

World Environment Day was celebrated in the Department of Geography, Patna University on 5th June 2022. The Head, Department of Geography Dr. Anuradha Sahay, Prof. (Dr.) Md. Nazim, Dr. Manoj Kumar Sinha and research scholars, students and non-teaching staff took active participation in tree plantaion drive on this occasion . Saplings of rare and medicinal herbal plants were also planted.

10. Appointment and Joining of Assistant Professor (Guest Faculties)

Patna University appointed Guest Faculty in the month of July, 2022. Four Guest Faculties joined in the P. G. Department of Geography- Dr. Uday Kumar, Dr. Vivek Kumar, Dr. Arti Kumari and Dr. Monika Kumari. Six Guest Faculties joined in the Under Graduate Department of Geography, Patna College. They are Dr. Munna Manish Kumar, Dr. Nirupma Surabhi Lakra, Dr. Bhubneshwar Kumar Mandal, Dr. Ashok Sahani, Dr. Babita Sharma and Dr. Vikash Mahto. Four Guest Faculties joined in B.N.College are Dr. Abid Ali Akhtar, Dr. Ram Naresh Prasad, Dr. Pramod Kumar Pandey and Dr. Babita Kumari.

11. Dr. Uday Kumar Published an article in an International Peer Reviewed (Referred) Journal 'JOURNAL OF ACADEMIC RESEARCH' Vol. 12, Dec. 2021, EISSN: 2395-1311 entitled "Geography in the changing India of Higher Education: Opportunities and Challenges".

12. Induction Meet (B.A. Semester-I, CBCS)

An Induction meet of B.A. Semester-I was held in the Department of Geography on 1st September 2022. Welcome address was given by Prof. Anuradha Sahay and Prof. Md. Nazim. Dr. Manoj Kumar Sinha, Guest Faculties and Research Scholars. Prof. Md. Nazim made the students aware of CBCS rules and regulations and discussed the new syllabus as it was 1st introduced in Bihar.

L.N. MITHILA UNIVERSITY, DARBHANGA

1. L.N. Mithila University, Darbhanga has estabilished a new advance laboratory for the students of geography for G.I.S. & Remote sensing.
2. An excursion tour was organised by the University department of Geography for partial fulfillment of syllabus of IIIrd Semester. Students in the year 2022 under the leadership of Dr. Anurajan as well as Dr. Rashmi Shikha for one day at Rajgir.
3. Dr. Rashmi Shikha, Asst. Professor of Geography, K.S. College has been transferred to University, Dept. of Geography, L.N.M.U. Darbhanga in the month of Sept. 2022.
5. A team of Geography students participated three days work show organished by meteorological department of Bihar at Patna under leadership of Dr. Manu Raj Sharma & Sonu Kumar.

B.R.A. BIHAR UNIVERSITY, MUZAFFARPUR

1. Dr. Ram Pravesh Yadav, the Head of the University P.G. Department of Geography, B.R.A. Bihar University, Muzaffarpur was awarded Dr.Sarwapalli Radha Krishnan National Teachers Award on 05.09.2022 by DidiJi Foundation.
2. Dr. Ram PraveshYadav, the Head, completed his tenure as a member of Syndicate, and Senate of the BRA Bihar University, Muzaffarpur in the month of July and September, 2022 respectively.
3. Three Guest Faculty joined in the University Department of Geography- Dr. Alpna Jyoti (July, 2021), Dr. Neelambari Gupta (Aug., 2021) and Dr. Rajeshwar Rai (Sept. 2021).
4. Dr.Alpna Jyoti published her book on Geomorphology entitled “Quantitative Geomorphology”
5. Dr. Ram PraveshYadav, Head, University Department of Geography, BRABU, Muzaffarpur delivered his speech on the topic 'Earth Day' in the RDS College, Muzzaffarpur on 22ndApril, 2022. Simultaneously, on the same day, he also delivered his lecture as the chief speaker at the local Langat Singh College on the topic 'Earth Day'.
6. In the national webinar on the focal theme “Only One Earth” on the eve of World Environment Day held on 5thMay, 2022 organized by 'The Institution of Engineers (India), Muzaffarpur Local Centre, Dr. Ram PraveshYadav delivered his lecture as the 'Chief Guest' and was felicitated with the 'Certificate of Appreciation'.
7. Lecture in Integrated Social Science Refresher Course, organized by HRDC: Dr. Ram Pravesh Yadav delivered his lecture on the topic “Holistic Model of Development: An Emerging Concept' in the integrated Refresher Course of Social Science. He also delivered his second lecture in the Orientation Course organised by HRDC, Muzaffarpur.

CENTRE FOR GEOGRAPHICAL STUDIES
(ARYABHATTA KNOWLEDGE UNIVERSITY, PATNA)

The Centre for Geographical Studies conducted various types of academic activities during the period of October 2021 to September 2022. Some important activities were as follows:

1. XVI DGSI International Online Conference was held at the Centre on September 10-12, 2021. Altogether 558 participants were registered. Participants were from 27 States and 4 union territories. This was the first International Conference hosted by the Centre.
2. The Centre launched Ph.D. programme and in the first admission test 8 students were declared qualified for admission in this programme.
3. As many as three extra-mural lectures were organised in the centre. They were delivered by Prof. Abha Lakshmi Singh of Aligarh Muslim University on 'Geological Research and Use of Methodology'; Dr. Pradhan Parthsarthi of South Bihar Central University on 'Climate Change over the Eastern Gangetic Plain of India', and by Akhouri Bishwapriya, Director of Geological survey of India, Patna on 'Ground Water Scenario of Patna District, Bihar'.
4. Post Graduate (M.A./M.Sc.) Programme in Geography has been started for the session 2022-2024 under choice based credit system (CBCS).
5. The Centre has now launched its website (cgspatna.ac.in) Facebook Account, Twitter Account and E-mail address.
6. The Centre organised one day programme on April 2, 2022 as 'Austism Awareness Day' in Collaborate with Utkarsh Seva Sansthan.
7. World Earth Day, 2022 was celebrated on 22.4.2022. The Centre organised plantation of 22 Neem trees and 11 Arjuna trees on this occasion. A discussion was also organised on "Ecological Processes Involved in the Soil System and Relationship with Human Being".
8. The Centre organised 5 days workship on "Geospatial Analytics and Post Covid-19 Urban Developemnt for early career researchers under urban studies foundation. It was organised in collaboration with the University of Wolverhampton, U.K. The workshop dates were Sept. 17 to Sept. 21, 2022.
9. One day seminar was organised on May 9, 2022 on the eve of National Technology date. The Centre also organised National Technology Day on 11.05.2022.

Ph. D. Degree Awarded

(October, 2021 to September, 2022)

Patna University

Sl. No	Name of Scholar	Titles of Thesis	Name of Supervisor
1.	Rahul Kumar Tiwari	Trends and Patterns of Urbanization in Rohtas District (1981-2011): A Geographical Study	Prof. Ravi Kiran Sharma
2.	Shanti Bhushan Kumari	Levels of Human Resource Development Associated Problems and Prospects in Kaimur District: A Geographical Study	Prof. R.B.P. Singh
3.	Manish Kumar	The Status of Agriculture in Saharsa District: A Geographical Study	Prof. Md. Nazim
4.	Preeti Priya	Role of Mukhyamantri Balika Cycle Yojna and Poshak Yojna on the educational development of girls in Purba Champaran District of Bihar: A Geographical Analysis	Dr. M. K. Sinha
5.	Ritesh Kumar	Spatial Pattern of Informal Economic Activities in Patna Municipal Corporation: A Geographical Study	Prof. Anuradha Sahay
6.	Chandan Kumar	Integrated Area Development Programme:A Case Study of Hulasganj and Ghosi Anchals, District Jehanabad, Bihar	Dr. Debjani Sarkar Ghose
7.	Rakesh Kumar Singh	Spatial Pattern of Agro-Based Industries and Its Role in Rural Development: A Case Study of Bhojpur District, Bihar	Prof. Anuradha Sahay
8.	Neeta Kumari Jha	पटना महानगर में आवासीय क्षेत्र के लम्बवत विकास के विशेष संदर्भ में भूमि- उपयोग की गतिशीलता: एक भौगोलिक विश्लेषण	Prof. M.M.P. Sinha
9.	Sunil Kumar Saw	झारखंड के गिरिडीह जिला में खनन क्रियाओं का पर्यावरण पर प्रभाव: एक भौगोलिक विश्लेषण (1991-2011)	Prof. Anuradha Sahay
10.	Jay Shankar Kumar Singh	बिहार के भोजपुर जिला में जनसंख्या वृद्धि का भूमि उपयोग एवं कृषि प्रारूप पर प्रभाव: एक भौगोलिक विश्लेषण (1981-2011)	Prof. Anuradha Sahay
11.	Rita Kumari	कैमूर जिला में महिला साक्षरता का बदलता स्वरूप (1981-2011) : एक भौगोलिक अध्ययन)	Prof. Anuradha Sahay

Ranchi University

Sl. No	Name of Scholar	Titles of Thesis	Name of Supervisor
1.	Raj Kamal Tiwari	Changing Pattern of Agriculture in Jharkhand : A Geographical Analyis	Dr. Lal G.S.N. Shahdeo
2.	Arpana Premi Lina Oraon	Problems and Prospects of Regional Development in Kolhan Division Jharkhand	Dr. Jayshree Shahdeo
3.	Gawritti Mariyam Ekka	Problems and Prospects of Agricultural Landuse in Panch Pargana Plain-Jharkhand	Dr. Jayshree Shahdeo
4.	Mithilesh Ranjan	Integrated watershed management of Swarnrekha River Basin, Jharkhand	Dr. Jayshree Shahdeo
5.	Karri Tarkeshwar Rao	Spatio-temporal Variation of Urbanization in North Coastal Region Andhara Pradesh	Dr. G.K. Singh
6.	Moushami	Environmental Impact of Coal Mining in North Karanpura Coalfield Project (NKP) Area : Jharkhand	Dr. Jitendra Sukhla
7.	Rajshree Das	Urbanization and its Temporal Pressure Land Resources (A case study of Ranchi City)	Dr. Rajeev Ranjan Srivastava
8.	Holy Archana Kachhap	"Socio-Economic Development of Urban Tribal Population in Jharkhand : A Comparable Study of Ranchi and Jamshedpur City, 1981-2011	Dr. Abhay Krishna Singh
9.	Madhumita Kumari	Functions of Urban Fringe of Ranchi City	Dr. Shiv Kumar
10.	Sweta Mahto	ओरमाँझी प्रखंड के भूमि का मूल्याकंन : कृषि के विकास में इसका अनुप्रयोग– एक भौगोलिक अध्ययन।	Dr. Ram Kumar Tiwari
11.	Jyoti Kumari	राँची महानगर की जनसंख्या के बदलते प्रतिरूप – एक भौगोलिक अध्ययन।	Dr. Gyanendra Kumar Singh
12.	Priyanka Singh	झारखंड में कृषि गत्यात्मकता : एक भौगोलिक अध्ययन।	Dr. Ram Kumar Tiwari
13.	Anjali Sinha	पश्चिमी सिंहभूमि जिला में कृषि उपयोग की समस्याएँ, संभावनाएँ एवं विकास की दशा।	Dr. Jayshree Shadeo
14.	Sujata Kumari	झारखंड के दशलक्षीय नगरः जनसंख्या भूगोल में एक अध्ययन।	Dr. Ram Kumar Tiwari
15.	Pratibha Singh	कैमूर जिला में कृषि भूमि उपयोग की समस्याएँ एवं समाधान	Dr. Jayshree Shahdeo
16.	Dinesh Kumar Murmu	देवघर जिला में संथाल जनजातियों पर नगरीकरण का प्रभाव	Dr. Shiv Kumar
17.	Tabassum	राँची जिला में जनसंख्या : एक भौगोलिक अध्ययन।	Dr. (Mrs.) Anita Sinha
18.	Indra Bhushan Pandey	राँची नगरीय क्षेत्र की वर्तमान जनसंख्या एवं आदिवासीय समस्याएँ।	Dr. Gyanendra Kumar Singh
19.	Sushma Soren	खूँटी जिला की जनजातिय समस्याएँ तथा नियोजन : एक भौगोलिक अध्ययन।	Dr. Ram Kumar Tiwari

B.R.A. Bihar University, Muzaffarpur

Sl. No	Name of Scholar	Titles of Thesis	Name of Supervisor
1.	Manoj Kumar	A Study of Water Resource Appraisal, Utilization Management and Planning of Paschim Champaran District.	Dr. Vijay Kumar Verma,
2.	Shirin Hayat	Integrated Area Development of Vaishali District : A Geographical Analysis.	Dr. Ram Pravesh Yadav
3.	Sushil Kumar Singh	Spatio - Temporal Analysis of Population Dynamics in Vaishali District : A Geographical Study	Prof. (Dr.) Surendra Prasad
4.	Rajan Kumar	A Geographical Study of Population Dynamics in Sitamarhi District.	Dr. Ram Naresh Sharan
5.	Ram Ekbal Singh	Migration of Population and its Impact on Socio - Economic Conditions : A Case Study of Saran District.	Dr. Ram Naresh Sharan
6.	Soni Kumari	A Geographical Analysis of Terrain Evaluation for the Development of Muzaffarpur District.	Dr. Ram Pravesh Yadav,
7.	Sunil Kumar	Urban Development: A Case Study of Sitamarhi District.	Dr. Pramod Kumar,
8.	Smt. Priyanka Kumari	Geographical Study of Population Dynamics in Khagaria District.	Dr. Umashankar Singh,
9.	Sushil Kumar Singh	A Geographical Study of Problems and Prospects of Urbanization in Samastipur District of Bihar.	Dr. K.L. Manjhi,
10.	Ida Ella Seema Karketta	दक्षिण छोटानागपुर प्रमंडल में बिरहोर आदिम जनजाति के सामाजिक, आर्थिक एवं सांस्कृतिक जीवन शैली की वर्त्तमान दशा एवं भविष्य की दिशा : एक भौगोलिक अध्ययन	: Dr. Rupa Kumari
11.	Ambrish Kumar	चंपारण क्षेत्र में अनुसूचित जाति का आर्थिक क्रियाकलाप : एक भौगोलिक विश्लेषण	: Dr. Pramod Kumar

JOURNEY OF THE ASSOCIATION OF GEOGRAPHERS, BIHAR & JHARKHAND

Sl. No.	Venue	President	Presided over	Convener	General Secretary	Treasurer	Date	Remarks
1.	Patna University Patna	Prof. P. Dayal	Prof. P. Dayal	Prof. R. B. P. Singh			25-04-1999	Foundation Meeting
2.	Patna University Patna	Prof. L. N. Ram	Prof. L. N. Ram	Prof. G. P. Jha	Prof. R. B. P. Singh	Prof. D. P. Singh	23-24 Nov., 1999	1st Annual Conference
3.	B. R. A. Bihar Univ. Muzaffarpur	Prof. L.C.C.N. Sahdeo	Prof. L. N. Ram	Prof. B. P. Mishra	Prof. R. B. P. Singh	Prof. D. P. Singh	17-18 March, 2001	2nd Annual Conference
4.	Magadh Univ. Bodh Gaya	Prof. L. N. Ram	Prof. L. N. Ram	Prof. M. Prasad	Prof. R. B. P. Singh	Prof. D. P. Singh	16-17 March, 2002	3rd Annual Conference
5.	Rajendra College, Chapra (J. P. Unit)	Prof. R. N. P. Sinha	Prof. R. N. P. Sinha	Prof. B. L. Sinha	Prof. R. B. P. Singh	Prof. D. P. Singh	4-5 Dec., 2003	4th Annual Conference
6.	T. M. Bhagalpur Univ., Bhagalpur	Prof. V. N. P. Sinha	Prof. V. N. P. Sinha	Prof. R. B. Mandal	Prof. R. B. P. Singh	Prof. D. P. Singh	18-19 Oct., 2004	5th Annual Conference
7.	Vinoba Bhave Univ., Hazaribag	Prof. R. Gauntia	Prof. R. Gauntia	Dr. Kamla Prasad	Prof. R. B. P. Singh	Prof. D. P. Singh	9-10 Oct., 2005	6th Annual Conference
8.	V. K. S. University Ara	Prof. S. N. Prasad	Prof. S. N. Prasad	Prof. B. K. Singh	Prof. K. N. Paswan	Prof. Md. Ataullah	27-28 Dec., 2006	7th Annual Conference

9.	M. J. K. College, Bettiah (BRA Bihar)	Prof. Bahura Ekka	Prof. Rana Pratap	Dr. B. N. Choubey	Prof. K. N. Paswan	Dr. Md. Ataullah	3 - 4 Feb., 2007	8thAnnual Conference
10.	Nalanda Open Univ., Patna	Prof. Rana Pratap	Prof. Rana Pratap	Prof. R. B. P. Singh	Prof. K. N. Paswan	Dr. Md. Ataullah	9 - 10 Dec., 2007	9th Annual Conference
11.	Magadh University Bodh Gaya	Prof. N. Sharma	Prof. N. Sharma	Prof. Rana Pratap	Prof. K. N. Paswan	Dr. Md. Ataullah	6 - 7 Dec., 2008	10th Annual Conference
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