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A Study on Mango Economy of Malda District, West Bengal

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Mango is called "the king of all fruits" on account of its nutritive value, taste, attractive fragrance and health promoting qualities. Malda, district of West Bengal, popularly known as 'Mango city' not only in the State but all over India due to its varieties. The present study is deals with two parts. First part deals with the block-wise growth pattern in terms of area, production and yield of mango which increased during 1990-91 to 2010-11. The compound annual growth rate of area, production and yield of mango is 1.18 %, 5.92 % and 4.69 % respectively. The second part is an attempt to understand the inter-linkages between the stakeholders and the role of aratdars (middlemen) in marketing channels where all the profits consumed by the aratdars (middlemen) or traders than the growers. Therefore, the farmers did not get the actual value of mango. Mechanization, diversification and commercialization of agriculture resulted in shifting of cropping pattern from traditional crops to new crops, which had contributed to the increased area and production under mango in the study region. Changing demand pattern also contributed significantly to shifting of more area under production of mango.

Keywords : The king of all fruits, Growth Pattern, Inter-Linkages, Stakeholders, Malda.

Introduction

The Mango, Mangifera indica L, which belongs to the family of Anacardiaceae, is one of the most important tropical and subtropical fruits of the world and is popular both in fresh and processed forms. It is called as the king of fruits on account of its nutritive value, taste, attractive fragrance and health promoting qualities. It is a delicious, exotic and nutritional fruit giving vitamins A and B to the human beings. In many languages it is called the mother of all tropical fruits and is the national fruit of India. It is general concern among the people that mango is a fruit for all, everybody consuming this fruit either a poor or a rich community. Mango has been in cultivation in Indian subcontinent for well over 4,000 years and has been the most favorite fruit since ages.

Mango is nutritious and an excellent source of carotene as compared to other fruits. A 100 gram of edible portion of the mango contains about 1,990 mcg of beta-carotene (vitamin A), which is much higher than the same in other fruits. Eating mangoes in the season

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may provide a store of vitamin A in the liver, sufficient to last for the rest of the year and highly beneficial for the prevention of vitamin A deficient disorders, like night blindness. Mangoes, both ripe and unripe, are good source of vitamin C. About 16 mg of vitamin C is present in 100 gram of mango. Ripe mango provides a good source of calories and supplies 74 kcal per 100 gram.

Mechanization, diversification and commercialization of agriculture resulted in shifting of cropping pattern from traditional crops to new crops, which had contributed to the increased area and production under mango. Changing demand pattern also contributed significantly to shifting of more area under production of mango. However, marketing and processing of mango have not picked up proportionate with the level of production. Further, supportive mechanism in the form of agriculture inputs, post-harvest infrastructure set up, such as packaging, pre cooling, cold storage, pack houses, marketing system, and institutional credit have not come up in proportion to the increase in production of fruit.

The various commonly grown commercial varieties are Rani Pasand, Bombai, Bimli, Biara, Bhababi, Bariha, Fazli, Golapkhas, Golapbhog, Anaras, Champa, Molaemjam, Himsagar, Sadoulla, Nabab Pasand, Mohanbhog, Langra, Surma Fazli, Chausa, Kalapahar, Kohitoor, Neelam, Dashehari etc. Recently introduced varieties are Mallika and AmraPalli.

The mango tree is a large branched perennial tree with height of 30-40 m and a crown radius spreading about 10 m. The flowers are produced in terminal panicles of 10-40 cm long and each flower has 5 petals of 5-10 mm long. After flowering, the fruit, which is a drupe, takes three to six months to ripe. The Mango fruit varies considerably in size, shape, color, presence of fiber, flavor, taste and several other characters. The shape of the fruit varies from round to ovate-oblong or longish, with the length ranging from 2.5 to 30 cm in different varieties. The weight of mango goes up to 2.5 kg for some varieties. However, the average size of mango available in India marked weighs about 200-350 grams. The ripe fruit is yellow, orange or red in color; usually reddish on the side facing the sun. Mango is well adapted to tropical and sub-tropical climates. The ideal temperature ranged for mango is 24^0C to 30^0C during the growing season, along with high humidity. A rainfall ranging from 890 mm to 1015 mm in a year is considered to be ideal for growing mangoes. Dry weather before blossoming is conducive to profuse flowering. Mangoes, ripe or unripe, are widely used as a fresh fruit. It is also used to make juice, milk shake, pulp, jam, jelly, pickle and chatni. Ripe mango is often cut into thin layers, desiccated, folded and then cut and sold as mango chewy bars. Pieces of the fruit can be mashed and used in ice-cream. Dried unripe mango, mainly amchur is used as a spice in India.

Literature Review

Sundaresan and Thanesekaran (1984) in their study on production and marketing of grapes identified severity of diseases, pest attack, lack of adequate capital facilities to meet the initial establishment costs and high cost of inputs as the major production problem, while unorganized market structure, high marketing costs unnecessary deductions and lack of finance facilities rank as the important marketing problems.

Patil et al., (1988) analyzed the marketing

costs and price-spread for mangoes in four marketing channels. Among the four channels, direct sale from producer to consumer was found to be the most profitable, while the one through pre-harvest contractor was the least profitable.

N. Srinivasan (1990) in his paper on "Competitive Agricultural Marketing System Prospects in 21st Century" explain that in the northern districts of Tamil Nadu like Cuddalore and Villupuram, Regulated Markets have a record of good performance whereas in the southern districts like Tirunelveli and Virudhunagar, their performance is very poor. Though a very large number of farmers are aware of the existence of regulated markets, only a few of them avail of the marketing facilities offered by the regulated markets.

Ram Prakash Srivastava (1998) has studied the mango cultivation it includes the cultivation practices from planting to till marketing of mango and also his studied history, origin and nomenclatures of mango, disease affected to the mango.

Kusum Budhwar (2002) studied the Romance of mango, which includes a detailed description of mango by a history and lore, botany of the mango plant and using the mango. It is a complete study of the king of fruits.

Krisagar, et. al., (2003) analyzed the Marketing of Mango in South Konkan Region of Maharastra State. The farmers reported that in Vashi market mangoes are not having healthy competition among traders while purchasing mango, also reported by the farmers that price received from wholesaler of Vashi market less than their expectation. The traders decide the price secretly. The farmers faced problems of skilled labour at the time of harvesting of mangoes and have to pay heavy transport cost.

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Objectives

1. To analyze the growth patterns in area, production and productivity of mango in Malda District during 1990-91 to 2010-11.

2. To study the cultivation practices of mango as also the adoption of modern technology, along with the economics of mango orchards.

3. To describe the aspects relating to export of mango, price spread, various channels, their efficiency, etc.

4. To analyze the marketing problems of mango cultivation of Malda District.

5. To offer suitable suggestions for the improvement of production and marketing of mangoes in Malda District.

Data base and Methodology

The study is based on secondary sources of data as well as interviewed in course of field survey from the growers. Secondary data was collected mainly from published sources of State Governments, District Horticulture Department and others many governmental agencies.

Study Area:

For the present study Malda district of the state of West Bengal has been taken which lies between latitudinal and longitudinal figures of 24^0 40´20½ N to 25^0 32´08½ N and $87^0$45´50½ E to $88^0$28´10½E respectively and surrounded by Bangladesh and Dakhsin Dinajpur in East, Santhal Parganas of State of Jharkhand in West, Uttar Dinajpur in North and Murshidabad in South. The district of Malda has total area of 3733 sq.km (census 2011) and the total population of Malda district is 39, 88,845 (census 2011). For administrative purpose the district has been divided into fifteen Blocks. The region of mature alluvium that had given

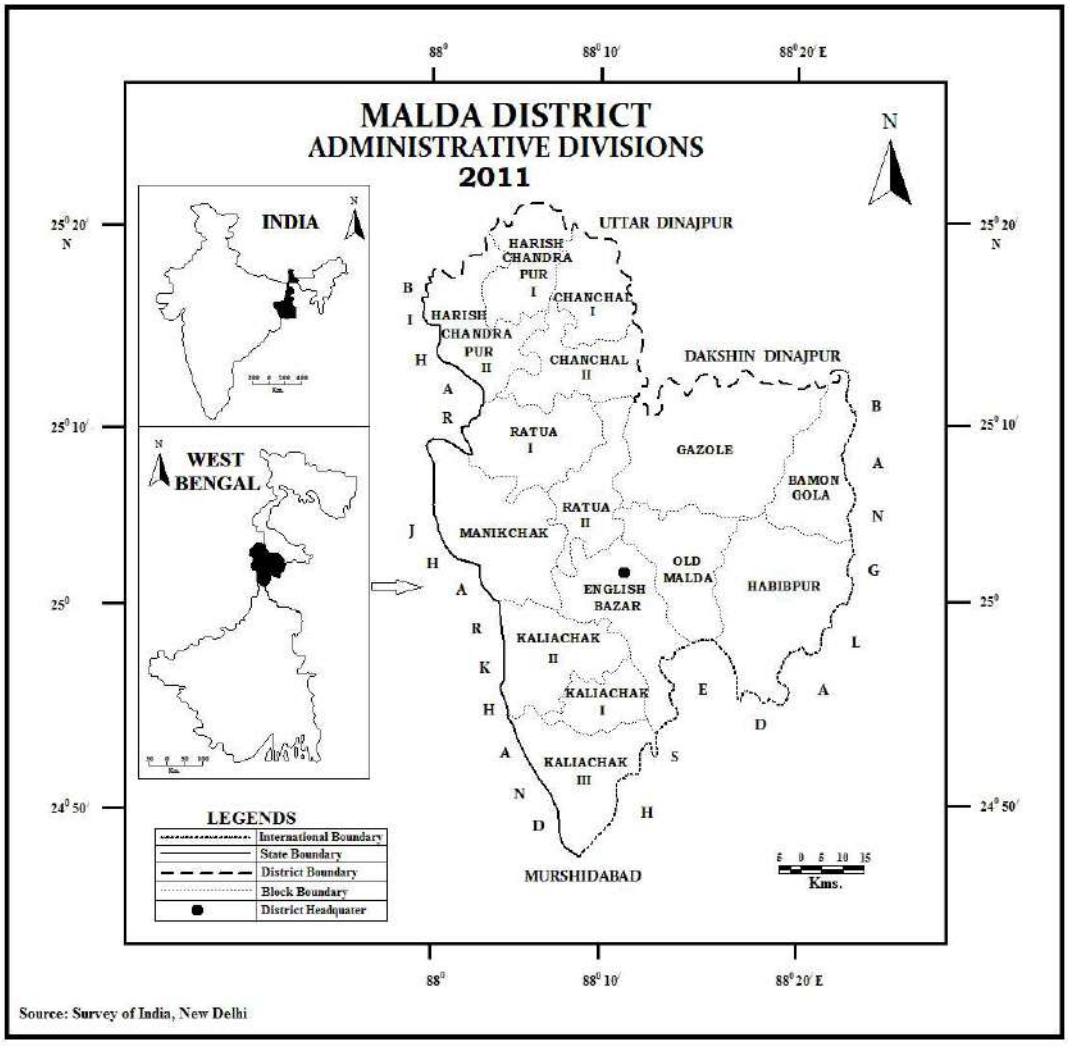

Fig.1

North Bengal its old historical name of *Varendri* or *Barendri* is known today as the Barind. This region is made up of the ancient alluvial humps that are remnants of old riverine floodplains that remained unaffected subsequently by inundation and renewed silting. Besides the eastern and northeastern fringes of the district, the Barind tract also extends into parts of Uttar and Dakshin Dinajpur and adjoining areas within Bangladesh, forming an upland rising to elevations of over 37 m above the mean sea level in its highest portion. The cumulative area of the Barind spanning Uttar & Dakshin Dinajpur and Malda districts in North Bengal is 1621sq.km.

Cultivation of Mango in Malda District

Malda, being the area with the highest production of mango in the state and also in

Table 1: Area, Production and Yield of Mango in Malda District of West Bengal during 1990-2010

Year	Area ('000 ha.)	Production ('000 MT)	Yield (kg/ha)
1990-91	21.68	62.00	2860
1991-92	21.80	205.00	9400
1992-93	21.90	55.00	2510
1993-94	21.91	175.20	8000
1994-95	22.00	21.00	950
1995-96	22.20	260.00	11700
1996-97	22.40	22.00	980
1997-98	22.42	220.00	9810
1998-99	23.20	65.00	2820
1999-00	24.08	270.00	11210
2000-01	24.15	105.00	4350
2001-02	24.25	253.87	10450
2002-03	24.50	63.67	2600
2003-04	24.55	86.00	3500
2004-05	24.85	135.00	5430
2005-06	25.25	150.00	5940
2006-07	25.50	180.00	7060
2007-08	25.90	175.00	6760
2008-09	26.30	190.00	7220
2009-10	27.00	180.00	6666
2010-11	27.40	196.00	7153
CAGR (%)	1.18	5.92	4.69

Source: District Horticulture Office, Malda

India, with the largest area dedicated to mango cultivation, was the most obvious choice for the study. Mango is one of the most popular fruits of Malda district. About 250 varieties of mango are grown in the district, in comparison to 1100-1200 varieties in the country. Area, Production and productivity related data of mango during 1990-91 – 2010-11 are depicted in Table 1.

Area under cultivation of Mango in Malda district:

It is identified that the area under mango cultivation in Malda district considerably increased from 21.68 thousand hectares in 1990-91 to 27.40 thousand hectares in 2010-11. Malda district is the largest producer of mango not only in West Bengal but in India also. The highest area under cultivation of mango was recorded in 2010-11 and lowest in 1990-91. The Compound Annual Growth Rate of expansion of land under mango cultivation was positive resulting in 1.18 per cent per annum.

Mango production in Malda district

It is observed that the overall level performance of production of mango in the study area from the year 1990-91 to 2010-11. The highest production of mango was 270 thousand metric tonnes in 1999-2000 and lowest production of mango was 21 thousand metric tonnes in 1994-95. In the year 1993-94, 1995-96, 1997-98, 1999-2000, 2001-02, 2008-09 and 2010-11 there was a notable increase over the previous year. There was decreasing trend during 1192-93, 1994-95, 1996-97, 1998-99, 2002-03 and 2007-08 over the respective previous years. The production of mango highly depends on the climatic and natural conditions. This is the reason for the sudden increase or decrease of mango in the study area. The Compound Annual Growth Rate was 5.92 per cent per annum.

Productivity of Mango in Malda district

It is very interesting to note from the study that the maximum yield of mango per hectare, over the study period in Malda district was 11700 kg/hectares in 1995-96 and lowest yield

Table 2: Area, Production and Yield of Mango Growing Blocks of Malda District of West Bengal in 2010-11

Blocks	Area (Ha.)	Share (%)	Production (MT)	Share (%)	Yield (kg/ha)
English Bazar	9156	34.68	46335	24.36	5060
Ratua-II	2542	9.63	28986	15.24	11403
Ratua-I	2540	9.62	25845	13.59	10175
Manikchak	3793	14.37	27412	14.41	7226
Old Malda	2122	8.04	21895	11.51	10318
Kaliachak-II	1892	7.17	15425	8.11	8152
Kaliachak-I	1596	6.05	7273	3.82	4795
Chanchal-II	1624	6.15	7673	4.03	4479
Harishchandrapur-II	1135	4.30	7156	3.76	6030
Total	26400	100	190200	100	7273

Source: District Horticulture Office, Malda, West Bengal

980 kg/hectares in 1996-97. From 1990-91 to 2010-11, in the year 1995-96, 1997-98, 1999-2000 and 2001-02, there was notable increase over the previous year whereas during the other years it was reasonable. There was decreasing trend during 1994-95, 1996-97, 1998-99 and 2000-01, over the respective previous year. The Compound Annual Growth Rate of expansion of productivity was 4.69 per cent per annum.

There are 9 mango growing blocks in Malda district. Out of this English Bazar

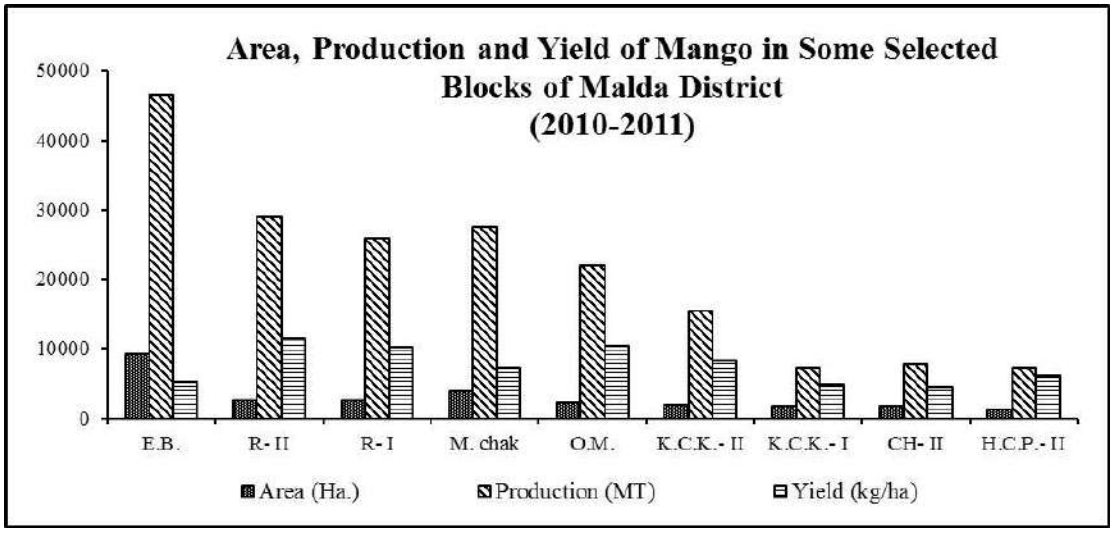

Fig. 2

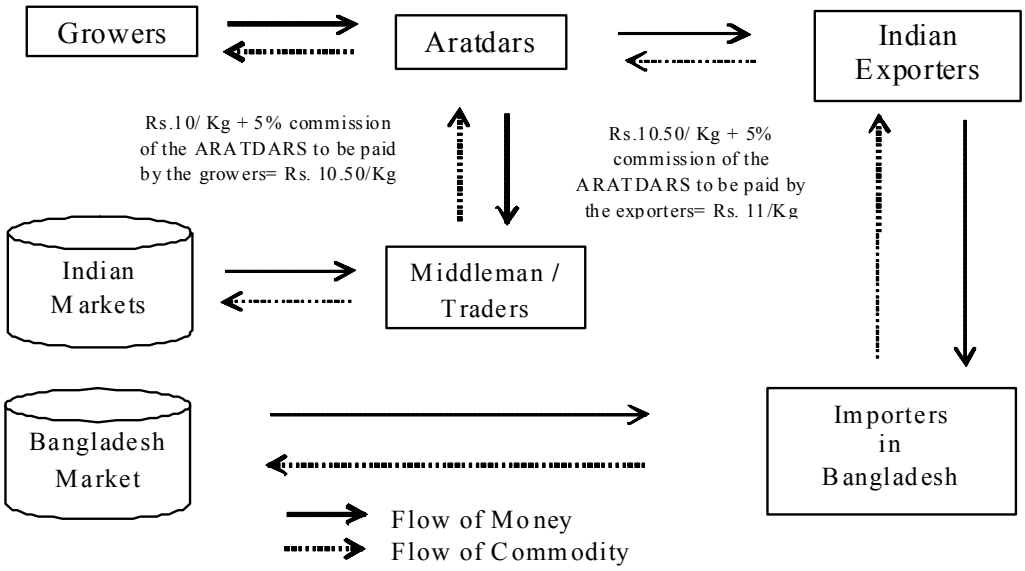

Fig.3: Mango Supply Chain without Mango Merchants

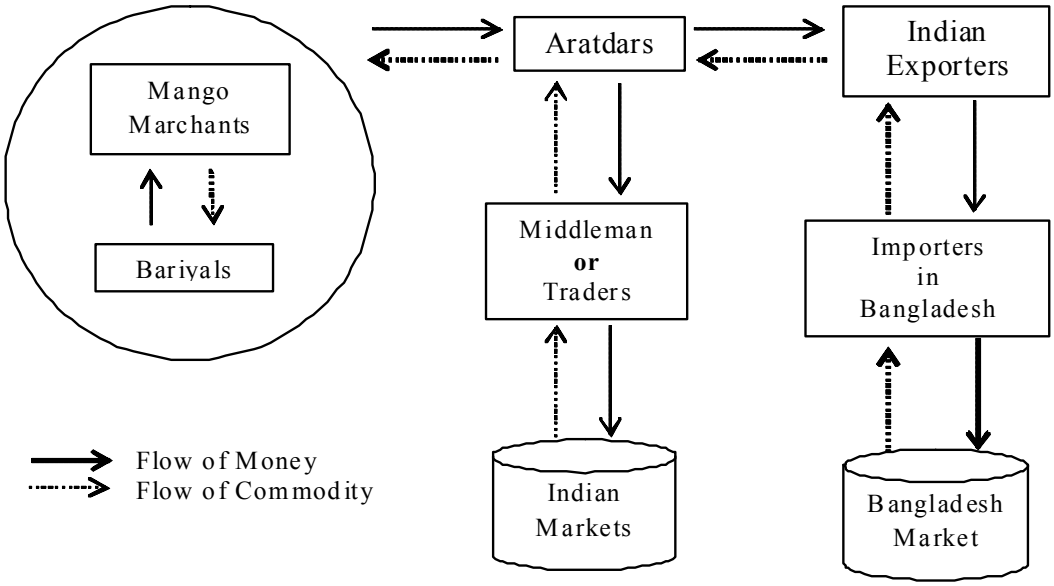

Fig.4: Mango Supply Chain with Mango Merchants

devoted 9156 hectare, accounting for 34.56 per cent of total area under mango followed by Manikchak (3793 hectare) and Ratua-II (2542 hectare). In terms of production, English Bazar block ranks first (46335 MT), Ratua-II stood second (28986 MT) and Manikchak recorded third (27412 MT). In terms of yield of mango, Ratua-II ranks first (11403 kg/ha.), Old Malda stood second (10318 kg/ha.) and Ratua-I ranks third (10175 kg.ha.). The information of mango growing blocks of Malda district is given in Table 2.

Inter-linkage among various Stake-holders in the Mango Economy of Malda

Flow of Commodity

Figure 3 and 4 explain the inter-linkage between the various stakeholders in the mango economy of Malda. It is evident from Figure 2 that as mango moves from one stakeholder to the other, its price increases steeply due to the profit percentage charged by each one of the stakeholders. While the farm get price for mango is Rs. 10.50/ kg, it is sold to the Bangladeshi importers at approximately Rs. 24/ kg. The growers sell the produce directly to the *aratdars*. The *aratdars* then sell it off either to the exporters or traders in other states. The *aratdars* charge a commission of five percent from the growers as well as from the exporters/ traders. Thus, they make a total profit of ten percent on each consignment of mango that they trade in. The exporters then sell the produce to importers in Bangladesh, which forms the bulk of fruits exported from Malda. The exporters enjoy incentives/duty rebates approximately amounting to 7.5 percent of the total export value under different schemes of the government aimed at export promotion. In addition to this, they charge a commission of 2.5-5 percent from the importers in Bangladesh. Thus, they are earning around 10-12 percent profit (including the export incentives from the government) by

exporting fruits to Bangladesh. As expressed by a majority of the exporters in Malda, they are not faced with any serious problems while getting the incentives from the Directorate General of Foreign Trade (DGFT) office. Figure 3 depicts the role of mango merchants and garden contractors *bariyals* in the mango economy. Mango merchants are businessmen who are interested in investing their money (mostly profits earned from their businesses) in the mango economy. These mango merchants lease in mango orchards and employ *bariyals* to take care of those. The *bariyals,* as facilitators, employ and manage whatever resources are required for ensuring a healthy harvest. The profit, earned after selling the produce, is shared between the mango merchants and the *bariyals* in a 50:50 or 75:25 basis. It is to be noted that mango merchants bear the cost of all the resources employed for growing the orchard. The produce is sold to the *aratdars* and is then either sold to the Indian markets or exported to Bangladesh. Some of the mango merchants have well-established marketing channels in Bangladesh and deal directly with the Bangladeshi importers to sell their produce. The latter then designate an exporter, having Import-Export Code (IEC), in Malda to take delivery of the consignment. A majority of the exporters in Malda are of this type. They charge a commission from the merchants and send their consignments to Bangladesh. The increase in the price of mango from mango merchants to the Bangladesh market is more or less the same as discussed with the help of Figure 4.

Flow of Money

Inter-linkage among different stakeholders in terms of flow of commodity has been discussed in the previous section. This section traces the flow of money in the mango economy of Malda. An important feature of the mango economy in Malda is that the entire flow of commodity from farm gate to the import market takes place on informal credit terms, i.e. on word of mouth basis and no formal agreements/ contracts are effected between the parties, neither do the growers and *aratdars* take any advance from the exporters or traders before delivering their consignment (Figure.4) for all the exports that happen, the *aratdar* receives his commission only after the exporter has received his payment from the importer. The grower will receive his payment only after the *aratdar* has received his payment from the exporter. This process and steps of payment/ money flow are the same for the mango merchants as well. They give out the *bariyal's* share in the profit after receiving their payments from the exporter/trader. Thus, the role the Bangladeshi importer plays is an extremely crucial one considering the fact that the sustenance of the entire chain hinges on when and whether or not he pays for the consignment imported from India. It is only expected that such trade without any formal terms would involve high default risks for the stakeholders involved. Almost all the growers, mango merchants and *bariyals* cited more than one instance where their share of income was wrongly appropriated by the importers in Bangladesh. One obvious question which arises here is w*hy then do the mango growers, merchants and exporters prefer trading with Bangladeshi importers?*

Significant Changes in the Mango Economy:

There is a significant change in the mango economy that occurs at present time in the district. These changes are as follows:

1. Increase in the area and production of mango : Since 1990-91, there has been a marked increase in the area dedicated to mango cultivation. A number of paddy fields are being rapidly converted to mango orchards, partly in search of greater profitability and partly because cultivation of food crops could not be carried out within close proximity of well-grown mango orchards. Good agricultural practices, as disseminated by the DoFPI&H officials, have helped ease out the fluctuations in mango production to a large extent.

2. Improvement in the quality of mango orchards : The DoFPI&H, through its various schemes and training and outreach programmes, has been able to influence a large number of mango growers to stop using chemical fertilizers in their orchards. As a result, area under organic cultivation of mango is increasing every year. Almost all the growers interviewed in course of the field survey agreed that the quality of mango is improving and that not only do they look better but also taste better than before.

3. Increase in daily wage of the labourers : With a gradual expansion in the area under cultivation of mango, there has been a corresponding increase in the demand for labourers in the orchards for various works, viz., spraying pesticides and other medicines, plucking mangoes, loading or unloading them for transportation, etc. This increase in demand has been further compounded by two important factors – firstly, the increase in employment

options and opportunities under the National Rural Employment Guarantee Scheme (NREGS) and, secondly, the increasing out-migration of labourers due to better work opportunities and higher wages outside the state. Together, these factors had led to a labour shortage during mango harvesting season and a corresponding increase in the daily wage for labourers.

4. Increased employment in supporting sectors : Expansion of the mango economy has led to creation of employment opportunities in supporting sectors like the packaging industry. There are a number of wooden box manufacturing units in and around the mango growing hubs of Englishbazar, Ratua, Milky, etc. These units manufacture the wooden boxes used for packing the mangoes. These units continue production throughout the year to avoid shortage situations during peak seasons. Production during lean season is principally a part-time activity carried out by employing part-time labourers, who are often students earning for their education. There is also a category of labourers which is specifically engaged in the job of packing the mangoes and loading and unloading of the packed boxes for transportation. In a nut shell, as pointed out by all the respondents that during mango harvesting season, there is no dearth of employment in Malda.

5. Exporters able to access various government schemes : The exporters have pointed out that NFTP has been beneficial for them to a great extent. Exporters of fresh fruits are getting a number of benefits like Vishesh Krishi and Gram Upaj Yojna, Duty Entitlement Pass Book, Duty Drawback schemes, etc. The exporters were of the opinion that the overall export from Malda to Bangladesh had increased to a great extent.

6. Women more involved in the mango-economy : The mango economy in Malda has been witnessing a marked increase in the number of women working in the processing units. Women have little or no role in the preharvest mango season, but during the harvest season, they hardly find time for their regular household chores, the work pressure at the processing units being at its peak. In recent years, the Horticulture Department has been distributing organic cultivation kits among the women self help groups (SHGs) to encourage a more substantial involvement of women in the mango economy. The Department is also arranging for training sessions for women.

Conclusion and Recommendations:

Diversified topography offers the potential for the production of a wide variety of agriculture, horticulture and sericulture produces. The study shows that the area, production and yield of mango have been increased during the study period. The district has 15 blocks out of which 9 blocks are the mango growing. English Bazar, Manikchak and Ratua II are the three leading mango producing blocks of Malda district.

In the present study an attempt has been made to explore the dynamics of mango economy and inter-linkage among various stakeholders. The growers sell the produce directly to the aratdars or middlemen. The aratdars or middlemen sell it off either to exporters or traders in other states. It means the growers do not sell their produce directly to the exporters. Therefore, the middlemen play a crucial role in the marketing channels. Marketing Information plays an important role

in the Marketing of Mango. The prices of mango are dependent on the market situation. If the growers do not have proper information regarding the market, they cannot take advantages of high prices mango. Problems in this regard have been classified into different components like late information, limited information, inadequate information and misleading information and the like. There are two regulated markets namely, English Bazar regulated market and Samsi regulated market in the district. Among these two markets, the English Bazar regulated market is famous for mango and litchi.

This present study is not only an attempt to explore the dynamics of the mango economy and inter-linkages among various stakeholders, but also to identify specific bottlenecks and put forward some realistic recommendation that can address these obstacles. Some recommendations are as follows:

a) Promoting mangoes as a brand in international markets

b) Orientation programmes should be arranged for the local growers and exporters

c) The development of adequate cold storage capacity with latest technology

d) Developing a market intelligence-cum-marketing network

e) Representation of all stakeholders in the Board of Trade

f) Providing necessary infrastructural support

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Carrying Capacity and Population Food Balance of District Bulandshahr, Uttar Pradesh

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The study of carrying capacity of land and population food balance in district Bulandshahr is an attempt to understand the man and land relationship. It helps in finding out the relative population pressure on the available arable land in different blocks of the district. In the contemporary world, where the problems of food crisis and over population are real; an analysis of the carrying capacity of land is of great importance. The increasing pressure of population on the available resources is a matter of great concern to the present day academicians, planners and policy makers. Geographers are spatially concerned with deteriorating man and land relationship (Gharge, 2011). The idea of carrying capacity relates closely to that of sustainable development, because both refer to the need of survival rather than capital. However, in future it is recommended to bring down the population pressure so as to avoid any decline in the carrying capacity of the land.

There is a close relationship between numbers of heads of persons and the carrying capacity of the land, particularly in an agrarian society where land is almost the sole support of the growing population. The supply of agricultural land is almost fixed in aerial extent while population is increasing rapidly.

Estimation of carrying capacity using food production is carried out by dividing total food production by the standard level of food consumption of the area. The result is a population that can be supported at a given level of subsistence assuming that food is equitably distributed. In simplest words carrying capacity of land is about food production and population.

Keywords : Carrying capacity, population food balance, food crop density, surplus and deficit population food balance.

Introduction

Agricultural land is the most important resource for food production. Early civilizations started in deltas and valleys endowed with rich and fertile soils that enabled agriculture development and food production. Thus agriculture has been the mainstay of livelihood for thousands of years. The rapid increase in population mainly after industrial revolution put pressure on the land resources for continuously increasing food production. The continuous cultivation of crops promoted land degradation consequently carrying capacity of agricultural land has been affected. In India green revolution was started with an aim of increasing food production with the help of technological improvements and advancements of scientific knowledge.

In India since the inception of the Green Revolution the cereal production increased only

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five fold, while fertilizer consumption increased 322 times between 1950–51 and 2007–08 (Prasad, 2009). The carrying capacity of agricultural land is now dependent on the use of chemical fertilizers, HYV of seeds and timely irrigations. The use of fertilizer for improvements in soil productivity is one of the widely used practices worldwide. Use of fertilizers has no doubt increased the carrying capacity of land; but, at the same time it has also created serious environmental problems. Large scale applications of fertilizers specially nitrogen (N) have shown harmful effects on groundwater quality and is therefore deleterious to environmental health. After the constant use of chemical fertilizers over the decades the present situation has arrived where even the additional doses of chemicals and high level of mechanisation have failed to produce corresponding levels of crop production. This has put a serious problem before the governments, planners and scientists to feed more than 1200 million people of India. It is, therefore, necessary to take all measures to ensure that the carrying capacity of land does not get depleted and enough is produced to feed the teeming millions and to keep a safe buffer stock.

Hence, the present study is intended to measure the carrying capacity of land and population food balance in Bulandshahr district.

Carrying capacity is a concept which can be defined as 'how many people can the earth support?' (Cohen and Joel, 1995). The finding of its answer is very difficult and complex task, for there can be no single and definitive answer. It is a realistic concept concerned with the maximum potential or the optimum level of food production.

Carrying capacity may be defined as the maximum number of individuals that can be supported sustainably within a given environment. For studying the carrying capacity of agricultural land, the food production always remains under consideration. It is basically the potentiality of the agricultural land supporting the number of people. Nayak, (2009:52) defined carrying capacity of land as the number of people that a unit area of land can support at a given level of technology and the system of land use. Allan (1972) has defined the carrying capacity of land as "the number of people and the level of their activities which a region can sustain in perpetuity at an acceptable quality of life and without land deterioration." According to Nayak 2009, The carrying capacity of land in terms of human biomass can be taken as the standard employed to measure the agricultural efficiency in Asian society, since major share of agricultural land is occupied by food crops. Stamp (1958) believe that carrying capacity in a sense is a measure of farming efficiency. The concept of carrying capacity of land was suggested by Stamp in his presidential address to the International Geographical Congress at Rio de Janerio in 1956. The Biologist and ecologist frequently apply the concept of carrying capacity to measure population pressure on the environment. The idea of carrying capacity relates closely to that of sustainable development, because both refer to the need of survival rather than capital. However, for future it is always recommended to bring down the population pressure so as to avoid any decline in the carrying capacity of the land.

To study the carrying capacity of Bulandshahr district is an attempt to understand the men land relationship. It would help in finding out the relative population pressure on

the available arable land in different blocks of the district. In the contemporary world, where the problems of food crisis and over population are real; an analysis of the carrying capacity of land is of great importance. The increasing pressure of population on the available resources is a matter of great concern to the present day academicians, planners and policy makers. Geographers are spatially concerned with deteriorating man and land relationship (Gharge, 2011).

As stated earlier there is a close relationship between the number of heads of persons and the carrying capacity of the land, particularly in an agrarian society where land is almost the sole support of the growing population. The availability of agricultural land is almost fixed in aerial extent while population is increasing rapidly.

To maintain or improve the carrying capacity of agricultural land to feed the fast growing population, there is a need to develop a system that would be sustainable in nature, able to feed the fast growing population and simultaneously maintain the natural health of the soil and should be economically viable and environmentally safe. This would pave the way for sustainable agricultural land development.

Objective

The objective of this study is to measure the carrying capacity of agricultural land in relation to population pressure and to find out the present and projected surplus/deficit population food balance.

Study Area

Bulandshahr District is a part of the Ganga Yamuna *Doab* of western Uttar Pradesh. It lies between 28º 04' N and 28º45' N latitudes and 77º 35' E and 78º 30' E longitudes. It is bounded by the districts of Hapur and Ghaziabad in the north, Aligarh in the south, Amroha and Badaun in the east, and Gautam Budh Nagar in the west. River Ganga forms a natural boundary between Bulandshahr as well as Badaun and Amroha districts. It covers a total area of 3,719 km^2 (Fig. 1.1).

The district is a level plain with variations of some uneven lands on the banks of rivers. River Ganga is the architect of this plain. The whole area is covered by alluvial deposits of Quaternary age. The only mineral of any importance in the district is *kankar*. It experiences the sub-humid monsoon climate (Singh, 1971), that is why the district is rich in agricultural land, and produces many crops; fruits and vegetables. There are three harvests, viz. the *kharif,* the *rabi* and the *zaid*. The *zaid* is relatively of small significance. The important crops which are produced in the study area and which occupy more than one percent of the cultivated area are rice, wheat, maize, barley, pearl millet (Bajra), Pulses, mustard, sugarcane and potatoes.

Methodology

The spatial patterns of carrying capacity of agricultural land is worked out by applying Jasbir Singh, (1972) formula. Nine major food crops which are produced in the study area and which cover more than one percent of the cultivated area have been taken for the present study for the estimation of carrying capacity. These are rice, wheat, maize, barley, pearl millet (Bajra), Pulses, mustard, sugarcane and potatoes. However, the fruits and vegetables are excluded. Further, triennium averages of the data for the years 2006-07, 2007-08 and 2008-09 are taken to study carrying capacity in different parts of the district. For the

Location of Bulandshahr District

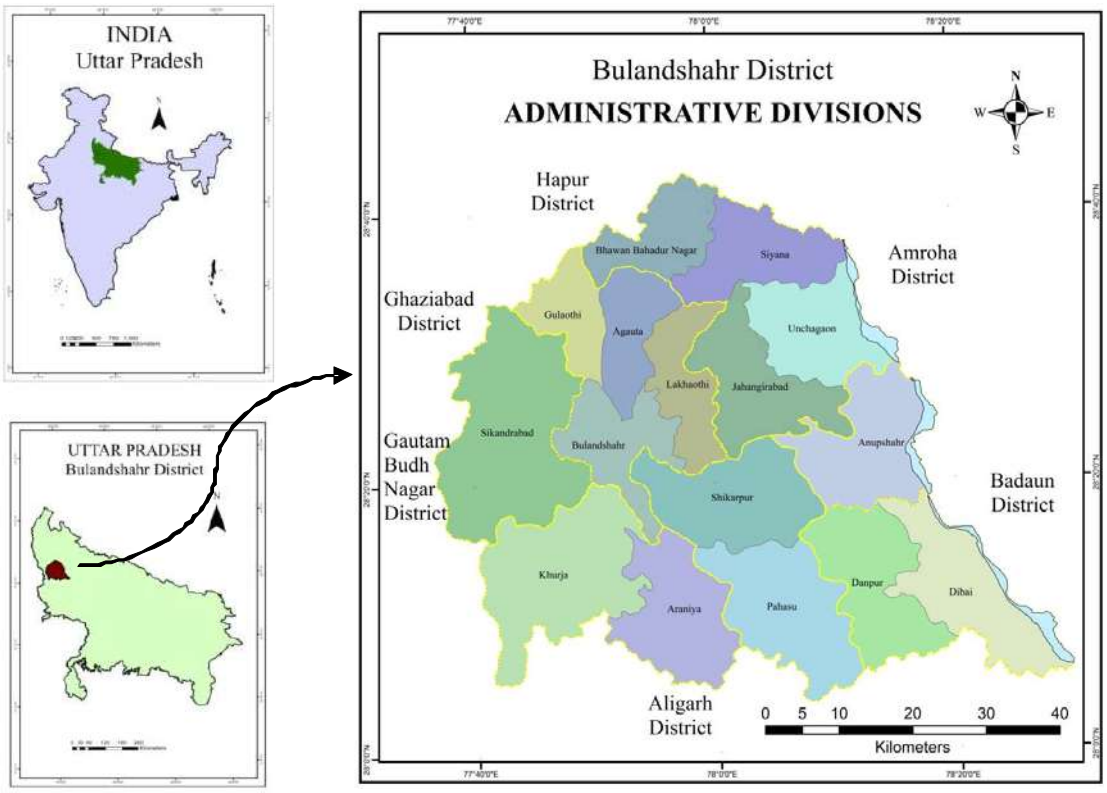

Fig. 1.1

calculation of carrying capacity of agricultural land the caloric values were worked out for all the selected crops using Indian Council of Medical Research (ICMR) tables (ICMR, 2011) and the area under food crops. Similarly weighted average standard nutrition unit for ingestion in calories/person/annum for all the blocks of Bulandshahr district was calculated on the basis of scale recommended by ICMR, Hyderabad.

The carrying capacity (C_p) is calculated using the following expression:

$$Cp = \frac{Co}{Sn}$$

Where:

C_p = Carrying capacity

Co = Caloric output available for ingestion per unit area for the selected crops.

S_n = Weighted average standard nutrition for ingestion in calories/person/annum

Food Crop Density (FCD) is defined as the density of population per unit area under food crop. The pressure of population on land is generally measured on the basis of the density of population. In the present study block wise population projected on 2001 census data for 2008 was divided by the area under food crops in the respective blocks and the values so obtained were used for the block wise

analysis of spatial pattern of food crop density (FCD) in Bulandshahr district. The algorithm used for the calculation of FCD is:

$$\text{Food Crop Density} = \frac{\text{Population of the Block}}{\text{Area under food crops in the block}}$$

Population- Food Balance is worked out on block level in order to identify the areas of surplus and deficit carrying capacity using the following formulae.

Population Food Balance = Carrying Capacity - Food Crop Density

Projected Population Food Balance is calculated by considering the present population growth rate projected over the period of 32 years from 2008 to 2040 while the carrying capacity is considered as constant at the current level of agricultural productivity and present status of technology. It is calculated by using the formula given below:

Projected Population Food Balance = Carrying Capacity – Projected Food crop Density

Patterns of carrying capacity

The average carrying capacity of agricultural land in Bulandshahr district for 2007-08 has been calculated as 1181.36 persons per square km. While at the block level it shows a great variation. Some blocks have recorded a very high carrying capacity while others have shown a very low carrying capacity.

The spatial pattern of carrying capacity of agricultural land of Bulandshahr district has been analysed by categorising all the C.D. blocks of the district Bulandshahr into five categories viz. very low, low, medium, high and very high. Table 1.1 and Figure 1.2 show block wise distribution pattern of carrying capacity of land in study area.

Very low carrying capacity

The category of very low carrying capacity is defined by less than 1104 persons/ sq.km. It is found only in Khurja block with a value of 1053.23 persons/sq.km. Khurja block lies in the south western part of the district. It covers only 25% area under Land Capability Class (LCC) I which is very less in comparison to other blocks and it has 46% area under LCC II, 13% area under LCC III and 16% area under LCC IV. 32.51% area of the blockis covered by Aulera soil series which has a high level of alkalinity.The Khurja block also has a low FYM consumption and very less area under FYM and green manure crops which are translated into very low carrying capacity of Khurja block.

Low carrying capacity

The low category of carrying capacity is recorded within the range of 1104 to 1156 persons/sq.km. This category covers eight blocks of the district namely Pahasu with a carrying capacity of (1109.68), Araniya (1113.29), Danpur (1118.54), Lakhaothi (1126.97), Bulandshahr (1128.42), Shikarpur (1129.28), Sikandrabad (1129.63) and Dibai with a carrying capacity of 1137.01 persons/ sq.km. These blocks combinedly covers 58.88% area under Land Capability Class I, 25% area under LCC II, 11.38% area under LCC III and 4.75% area under LCC IV. It is mainly due to the low FYM consumption and low area under FYM and green manure crops and low fertile soils which seems to be responsible for low carrying capacity.

Medium carrying capacity

The category of medium carrying capacity 1157 to 1207 persons/sq.km has been recorded in Jahangirabad block only with a carrying capacity of 1192.56 persons/sq.km. The block has moderate FYM consumption. It covers 64% area under LCC I, 18% under LCC II, 16% under LCC III and 2% under LCC IV.

High carrying capacity

This category has been defined having a carrying capacity ranging between 1208 and 1258 persons/sq.km. It includes only two blocks of the district namely Anupshahr and Gulaothi with a carrying capacity of 1250.79 and 1252.45 persons/sq.km respectively. These blocks have rich fertile land and most of the area of these blocks fall in the Land Capability Class I and very less area falls under LCC III and IV. Around 76% area of these blocks is covered by LCC I, 19.5% by LCC II, 3% by LCC III and only 1.5% area of these blocks comes under LCC IV. These blocks have very high level of agricultural mechanization and FYM consumption as well as noticeable area under FYM and green manure crops seems to be the drivers of high carrying capacity of the block.

Very high carrying capacity

The category of very high carrying capacity is defined to be recorded with more than 1259 persons/sq.km. Four blocks Unchagaon (1265.80), Agauta (1280.29), Siyana (1304.69) and Bhawan Bahadur Nagar (1309.14) fall into this catagory. These blocks lie within the northern part of the district. These blocks have a high fertility and most of the area falls in the Land Capability Class I while a very small area falls under LCC IV. Around 80% area of these blocks is covered by LCC I, 15.5% by LCC II, 2.75% by LCC III and only 1.75% area of these blocks comes under LCC IV. These blocks have very high levels of agricultural mechanization and FYM consumption as well as very large area under FYM and green manure crops and very fertile soils. These are the plausible causes for very high carrying capacity of these blocks.

From the above analysis it has been found that southwestern part of the district Bulandshahr has a very low carrying capacity (1181.36 persons/sq.km) and as one moves upwards it increases. The highest carrying capacity is found in northern blocks of the district like Bhawan Bahadur Nagar, Siyana, Unchagaon and Agauta blocks. Nine blocks namely Sikandrabad, Lakhaothi, Bulandshahr, Shikarpur, Khurja, Araniya, Pahasu, Danpur and Dibai have a carrying capacity less than the district average of 1181.36 persons/sq.km. The remaining seven blocks, Bhawan Bahadur Nagar, Siyana, Agauta, Gulaothi, Unchagaon, Anupshahr and Jahangirabad have a more carrying capacity than the district average. It is found that the blocks which have maximum FYM consumption and have sufficient acreage under FYM and green manure crops has maximum carrying capacity while the blocks that have low FYM consumption as well as less acreage under FYM and green manure crops have very low carrying capacity.

In order to increase the carrying capacity of agricultural land and to maintain the fertility of the soils cropping intensity and irrigation intensity as well as agricultural mechanization, FYM consumption and area under FYM and

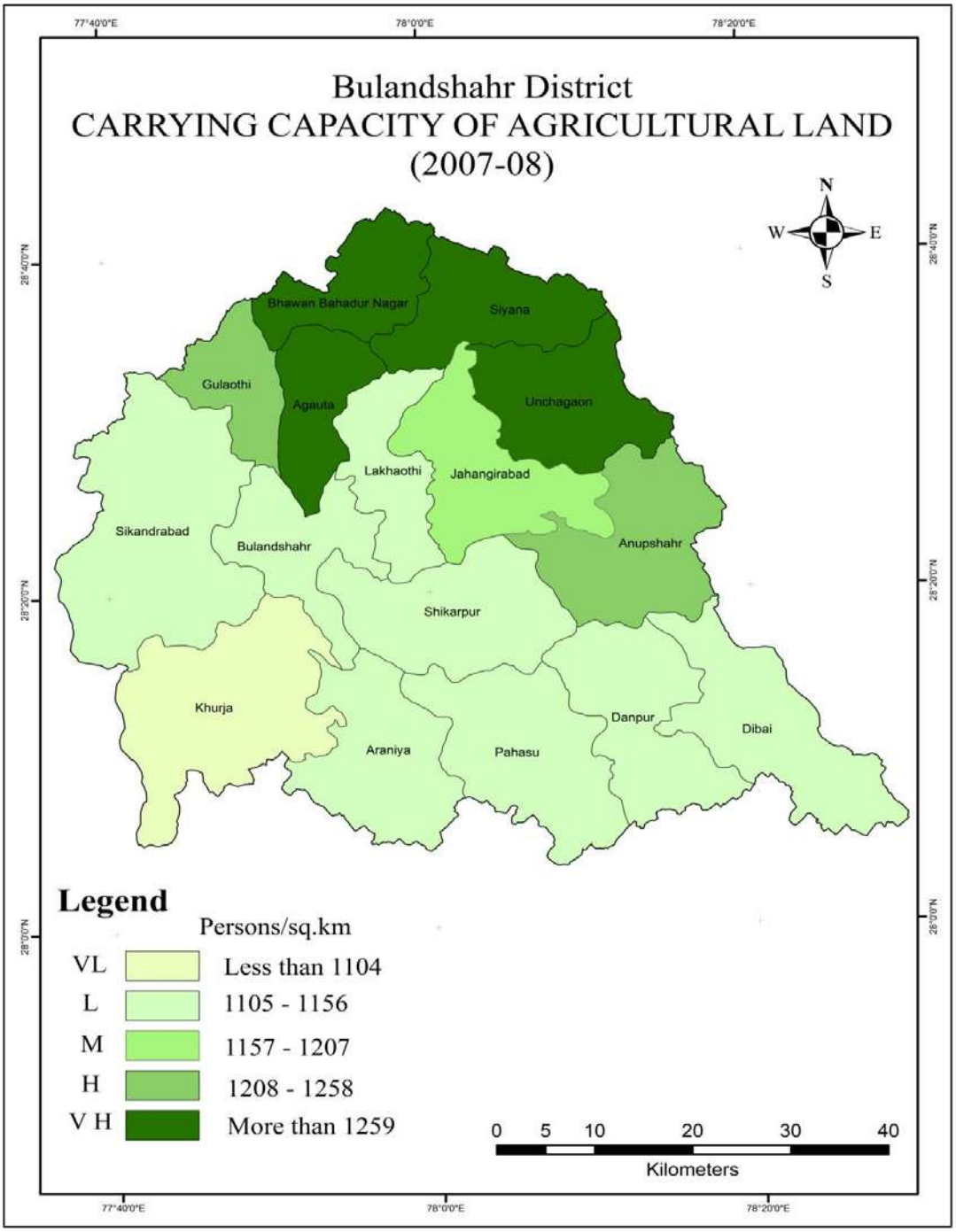
77°40'0"E
78°0'0"E
78°20'0"E
Bulandshahr District
CARRYING CAPACITY OF AGRICULTURAL LAND
(2007-08)
N
W
E
S
Bhawan Bahadur Nagar
Siyana
Gulaothi
Agauta
Unchagaon
Lakhaothi
Jahangirabad
Sikandrabad
Bulandshahr
Anupshahr
Shikarpur
Khurja
Danpur
Dibai
Araniya
Pahasu
Legend
Persons/sq.km
VL Less than 1104
L 1105 - 1156
M 1157 - 1207
H 1208 - 1258
V H More than 1259
0 5 10 20 30 40
Kilometers

Fig. 1.2

Table 1.1 : Bulandshahr District Carrying Capacity and Population Food Balance (2007-08)

S. No.	C.D. Blocks	Carrying Capacity (Person/ Sq.km)	Population	Area under Food Crops (Sq. Km's)	Food Crop Density (Persons/ Sq. Km)	Population Food Balance (Persons/ Sq. Km)
1	Sikandrabad	1129.63	339497	441.74	768.54	361.09
2	Gulaothi	1252.45	156045	119.05	1310.79	-58.34
3	Lakhaothi	1126.97	139271	173.39	803.21	323.76
4	Bulandshahr	1128.42	392978	161.49	2433.5	-1305.09
5	Shikarpur	1129.28	201051	312.2	643.97	485.3
6	Bhawan Bahadur Nagar	1309.14	121249	171.22	708.16	600.98
7	Siyana	1304.69	172795	150.4	1148.91	155.79
8	Jahangirabad	1192.56	216203	270.18	800.21	392.35
9	Khurja	1053.23	336641	408.21	824.68	228.56
10	Araniya	1113.29	144667	313.9	460.87	652.43
11	Pahasu	1109.68	222378	384.49	578.37	531.32
12	Unchagaon	1265.80	164917	206.07	800.28	465.52
13	Danpur	1118.54	179837	301.14	597.19	521.35
14	Dibai	1137.01	241521	246.38	980.26	156.75
15	Anupshahr	1250.79	199821	288.87	691.72	559.06
16	Agauta	1280.29	120900	166.8	724.8	555.49
	Bulandshahr District	1181.36	3349771	4115.55	813.93	367.43

green manure crops should be further increased. It is also of great significance that judicious crop selection and crop rotation should be practiced so that the goal of increasing carrying capacity and sustainable development of agricultural land can be achieved.

Food Crop Density

The pressure of population on land is generally measured in terms of the density of population. In this study only the area under the major selected crops is considered to measure the population pressure i.e. population burden on agricultural land. So the food crop density is defined as the density of population per unit area under food crops (Nayak, 2009). Hence, Men-land ratio is an important element in studying the population pressure.

The food crop density has been measured to study the sustainability of agricultural land and it has been found that food crop density of district Bulandshahr as a whole is 813.93 persons/sq.km. The total population of the

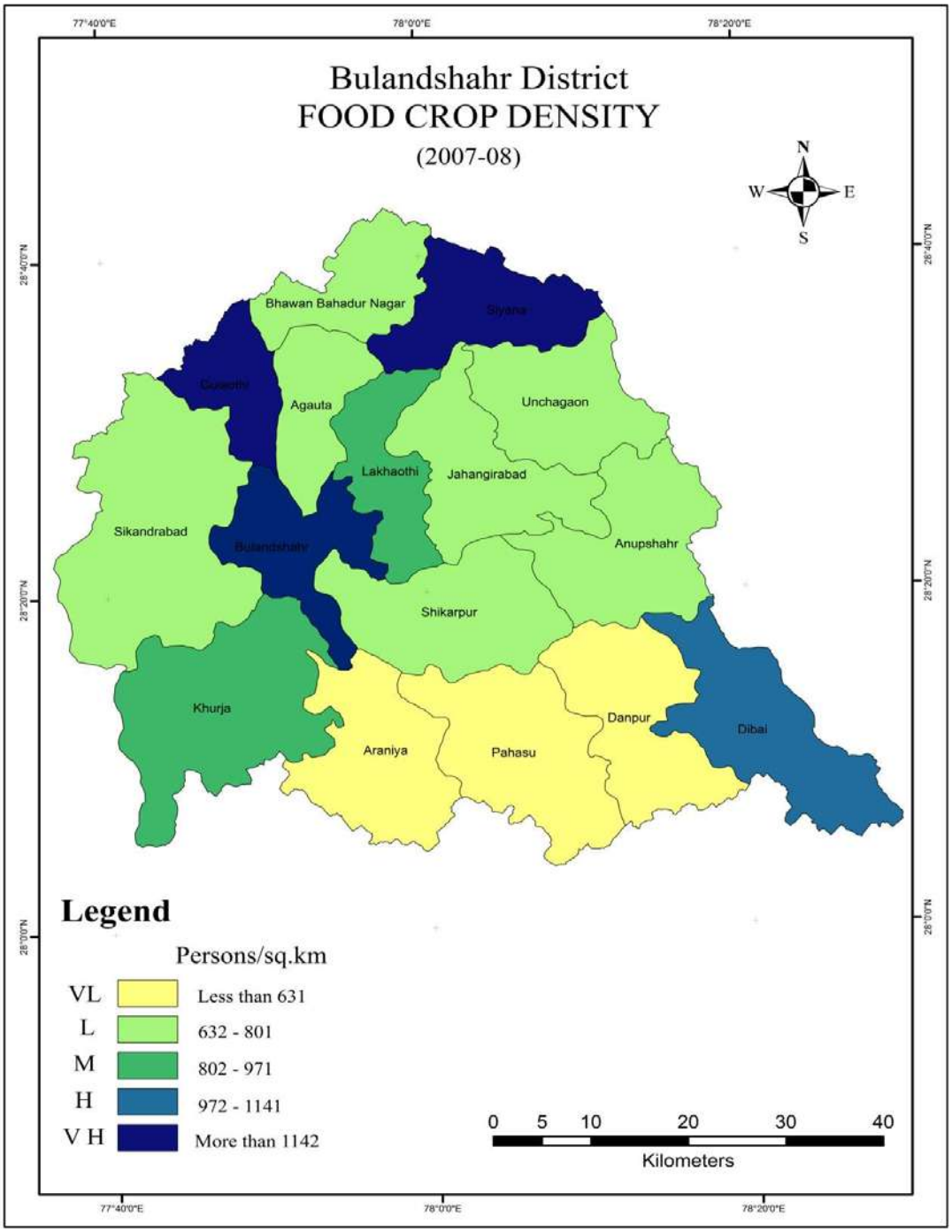
Bulandshahr District
FOOD CROP DENSITY
(2007-08)
N
W
E
S
77°40'0"E
78°0'0"E
78°20'0"E
28°40'0"N
28°20'0"N
28°0'0"N
Bhawan Bahadur Nagar
Siyana
Gulaothi
Agauta
Unchagaon
Lakhaothi
Jahangirabad
Sikandrabad
Bulandshahr
Anupshahr
Shikarpur
Khurja
Danpur
Dibai
Araniya
Pahasu
Legend
Persons/sq.km
VL Less than 631
L 632 - 801
M 802 - 971
H 972 - 1141
V H More than 1142
0 5 10 20 30 40
Kilometers

Fig. 1.3

district in the year 2007-08 was 3349771 persons and the total area under the major selected crop was 4115.55 sq.km. Significant variations have been observed in food crop density at block level. Table 1.1 and Figure 1.3 show block wise distribution of the food crop density in 2007-08. It has been recorded to be high in the blocks of Siyana (1148.91), Gulaothi (1310.79) and Bulandshahr (2433.5) due to high population concentration in these blocks. The very low food crop density is recorded in the blocks of Araniya (460.87), Pahasu (578.37), and Danpur (597.19). Low population concentrations and large area under food crops in these blocks have resulted in very low food crop density.

Population Food Balance

Ecologists and population biologists have long used the logistic model of population dynamics as a way to understand the cause and effect relationship between carrying capacity and population size (Wilson & Bossert, 1971; Gotelli, 1998). There is a deep relationship between carrying capacity and population. If an area has the highest carrying capacity and at the same time it also has a high pressure of population than its carrying capacity then the food balance would decline. It helps in identifying the areas with surplus and deficit carrying capacity.

The Table 1.1 shows that in 2007-08 the carrying capacity of the Bulandshahr district was 1181.36 persons/sq.km while the average food crop density was 813.93 persons/sq.km. Therefore the average population food balance of the district as calculated was 367.43 persons/ sq.km. It shows that the district was enjoying surplus carrying capacity of 367.43 persons/ sq.km. Figure 1.4 shows the block levels variations in food balance where out of the 16 blocks two suffer from food deficit also.

The carrying capacity of the cultivated land at the present level of technology as reported in 2007-08 in Bulandshahr and Gulaothi blocks was experiencing population pressure more than its potential. The Bulandshahr block is experiencing an extra pressure of 1305.09 persons/sq.km while in the case of Gulaothi it is 58.34 persons/sq.km of cultivated land.

The remaining blocks of the district are in comfortable position and are experiencing lesser population pressure on the existing cultivated lands. It means that per square km cultivated land in these blocks can support the food requirements of some more persons which vary between 156 persons to 652 persons/ sq.km. The block wise food balance status of all the blocks of the district are presented in Table 1.1. These variations have been measured into very low, low, medium, high and very high categories.

The very low population-food balance is defined by less than 84 persons/sq.km. It is found in Gulaothi and Bulandshahr blocks. The population food balance is recorded least in Bulandshahr block where its value is -1305.09 persons/sq.km. Gulaothi follows Bulandshahr block and suffers from food deficiency to an extent of -58.34 persons/sq.km. The carrying capacity of the Bulandshahr block was 1128.42 persons/sq.km in 2007-08 while the food crop density was very high i.e. 2433.50 persons/ sq.km that is why the population food balance was recorded very low. It shows that this block is experiencing a deficit in population food balance in the district. Bulandshahr is also the

district headquarter which attracts migrants from the nearby small towns and villages. The carrying capacity of the Gulaothi block was 1252.45persons/sq.km in 2007-08 while the food crop density was very high i.e. 1310.79 persons/sq.km that is why in Gulaothi block the population food balance was also recorded very low. Being within the bounds of NCR of Delhi and its industrialization has promoted immigration and therefore the food crop density of Bulandshahr and Gulaothi blocks has increased significantly.

The category of low population food balance is bounded by the values lying between 85 to 226 persons/sq.km which is found only in two blocks of the district namely Siyana and Dibai. They have the population food balance of 155.79 and 156.75 persons/sq.km respectively. Siyana block has the carrying capacity of 1304.69 persons/sq.km and has a food crop density of 1148.91 persons/sq.km. While Dibai block has the carrying capacity of 1137.01 persons/sq.km and food crop density of 980.26 persons/sq.km. These blocks having high population concentration presently are self sufficient and can feed extra 155.79 to 156.75 persons/sq.km respectively.

The medium category of population food balance is found between 227 to 368 persons/sq.km. It is appearing in the blocks of Khurja, Lakhaoti and Sikandrabad with an additional population that can be feeded as 228.56, 323.76 and 361.09 persons/sq.km respectively. All these blocks together have an average carrying capacity of 1103.27 persons/sq.km and the average food crop density of 798.71 persons/sq.km. These blocks are presently self sufficient and have a surplus carrying capacity. Sikandrabad and Khurja which being industrial town also have relatively high population concentration which perhaps define medium carrying capacity of these blocks.

The category of high population food balance has been recorded within the range of 369 to 510 persons/sq.km. It is appearing in the blocks of Jahangirabad, Unchagaon and Shikarpur with a surplus population food balance of 392.35, 465.52 and 485.30 persons/sq.km respectively. All these blocks together with have an average carrying capacity of 1195.88 persons/sq.km and the average food crop density of 748.16 persons/sq.km. These blocks also have low food crop density and therefore presently are self sufficient in food availability with a surplus carrying capacity.

The very high population food balance is defined by more than 511 persons/sq.km. This category includes six blocks namely Danpur (521.35), Pahasu (531.32), Agauta (555.49), Anupshahr (559.06), Bhawan Bahadur Nagar (600.98) and Araniya 652.43 persons/sq.km. The average carrying capacity of this category is 1196.96 persons/sq.km. The average food crop density for this category is measured as 626.85 persons/sq.km. The average population food balance for this category has been estimated at 570.10 persons/sq.km which is very high. So all these blocks being having low concentration of population are comfortably self sufficient to feed their population.

Projected Surplus and Deficit Population Food Balance

From the above discussions it is clear that the carrying capacity of agricultural land of Bulandshahr district as a whole can feed its present population. The present level of

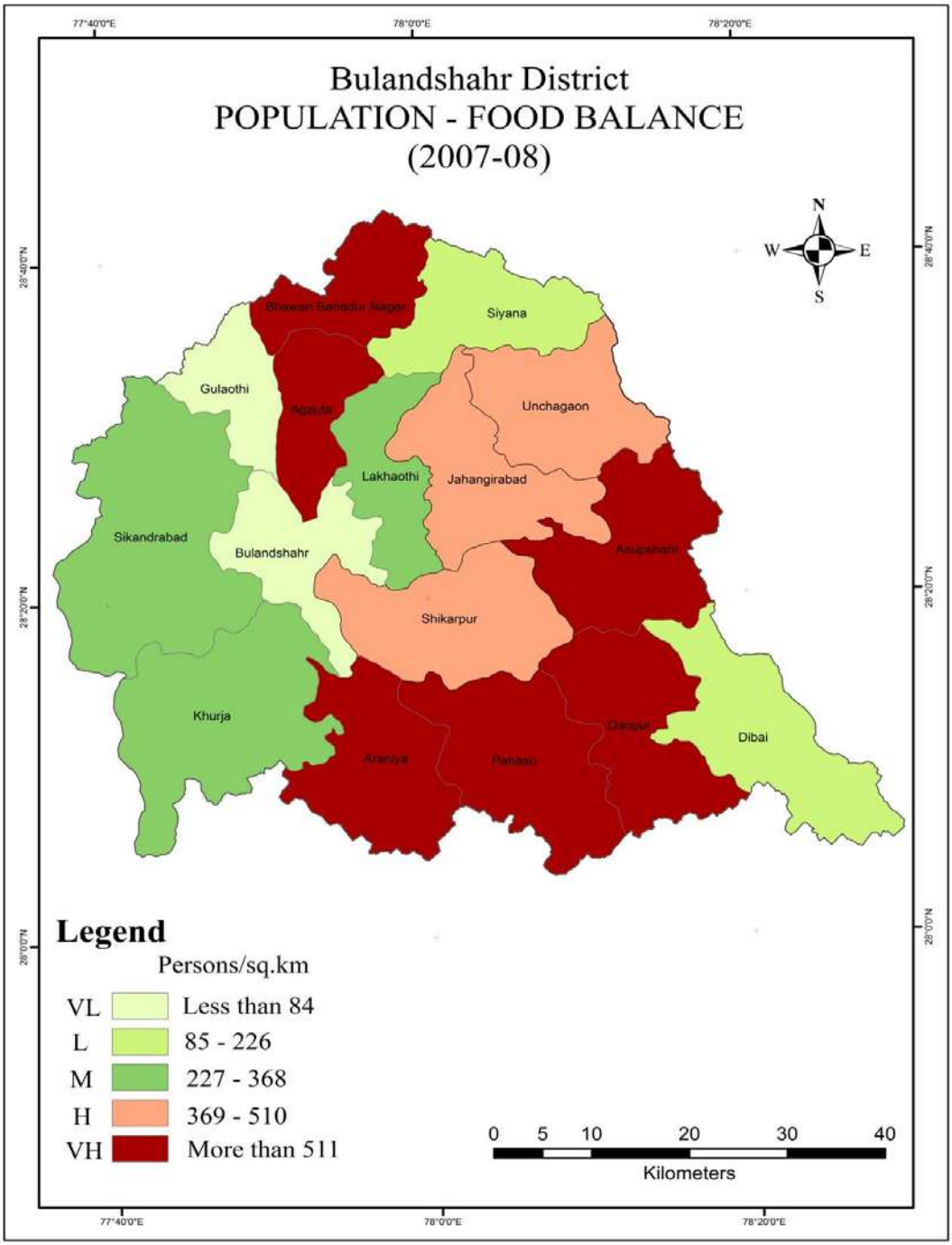
Bulandshahr District
POPULATION - FOOD BALANCE
(2007-08)
77°40'0"E
78°0'0"E
78°20'0"E
28°40'0"N
28°20'0"N
28°0'0"N
N
W
E
S
Bhawan Bahadur Nagar
Siyana
Gulaothi
Agauta
Unchagaon
Lakhaothi
Jahangirabad
Sikandrabad
Bulandshahr
Anupshahr
Shikarpur
Khurja
Dibai
Aranlya
Pahasu
Dangur
Legend
Persons/sq.km
VL Less than 84
L 85 - 226
M 227 - 368
H 369 - 510
VH More than 511
0 5 10 20 30 40
Kilometers

Fig. 1.4

carrying capacity of the agricultural land of the district is sufficiently high. However, there is a need to compute, that the present level of carrying capacity is how long sustainable for the growing population of the district.

For finding out the projected population figures the growth rate of population has been computed for the period lying between 2001 to 2040. At the current level of agricultural technology and carrying capacity of agricultural land it has been found that the food crop density would continuously increase due to increasing population resulting in a declining level of Population Food Balance. It is needed to be stressed here that the population of the district in 2001 was 3002721 persons which increased to 3498507 persons in 2011 with a growth rate of 1.65% per year. The projected figure of population for 2040 at the current growth rate has been estimated as 4936285 persons. Hence, the food crop density of the district is expected to reach at 1175.33 persons/sq.km. Therefore, in a period of 32 years population food balance is expected to decline by -18.06 persons/sq.km resulting in an overall deficit population food balance.

Figure 1.5 and Table 1.2 depicts a block wise declining population food balance in the district. The carrying capacity of agricultural land is taken as constant at the present level of technology and the food crop density is increasing due to fast growing population. Where the graph lines of these two variables intersect each other ahead of it the population-food balance is registered in negative. In other words at that point of time the district would reach its maximum food crop density balancing carrying capacity and beyond which the district would be unable to feed additional population.

The population food balance of the district Bulandshahr in 2008 was 367.43 persons/ sq.km. For 2038 the projected population food balance of the district has been estimated at only 6.03 persons/sq.km. It means that by 2038,

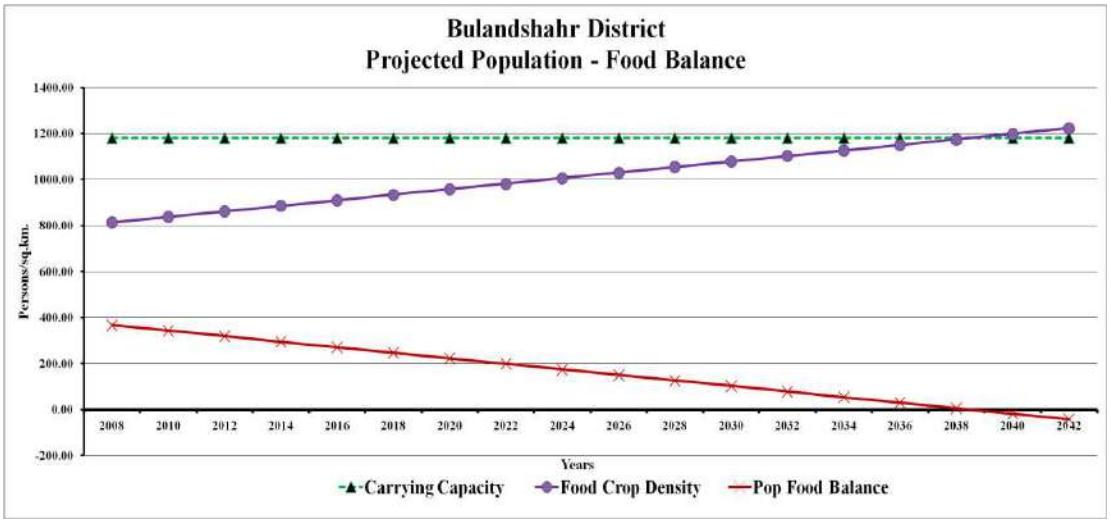

Fig. 1.5

Table 1.2 : Bulandshahr District Projected Population-Food Balance (2008-2040)

Years	Carrying Capacity	Population	Food Crop Density	Population Food Balance
2008	1181.36	3349771	813.93	367.43
2010	1181.36	3448928	838.02	343.34
2012	1181.36	3548085	862.12	319.24
2014	1181.36	3647242	886.21	295.15
2016	1181.36	3746400	910.30	271.06
2018	1181.36	3845557	934.40	246.96
2020	1181.36	3944714	958.49	222.87
2022	1181.36	4043871	982.58	198.78
2024	1181.36	4143028	1006.68	174.68
2026	1181.36	4242185	1030.77	150.59
2028	1181.36	4341342	1054.86	126.50
2030	1181.36	4440500	1078.96	102.40
2032	1181.36	4539657	1103.05	78.31
2034	1181.36	4638814	1127.14	54.22
2036	1181.36	4737971	1151.24	30.12
2038	1181.36	4837128	1175.33	6.03
2040	1181.36	4936285	1199.42	-18.06

if the carrying capacity of the district remains constant and the food crop density continue to increase in situ of current rate of population growth the district will be able just to feed its population. Then after 2038 the population food balance scores would be recorded in minus figures and an alarming declining trend would be registered. In 2040 the population food balance would be -18.06 persons/sq.km. Hence, a district which presently is a food surplus would turn into a food deficit district after 2038. So, it can be stated that Bulandshahr district would be self sufficient to feed its population only till 2038.

The spatial pattern of projected population food balance has been worked out for each block also in order to identify spatial variations in population food balance within the study area.

This exercise has been conducted in order to isolate those blocks which are showing a serious projected deficit food balance figures like Bulandshahr Gulaothi, Siyana and Dibai. These blocks should be taken care of right now and a proper planning strategy be designed in advance so that their declining food balance can be arrested. Separate strategies would also be refined for those blocks which are not showing deficit food balance even by 2038, so that such blocks can become in a comfortable position to feed the population of other blocks which would be unable to feed themselves by 2038. The block wise projected population food balance is presented in Table 1.3 and Figure 1.6. It has been found that by 2040, out of

Table 1.3 : Bulandshahr District Projected Population Food Balance (2008-2040)

Blocks	Carrying Capacity (2008)	Food Crop Density (2040)	Population Food Balance (2040)
Sikandrabad	1129.63	1132.02	-2.39
Gulaothi	1252.45	1915.73	-663.29
Lakhaothi	1126.97	1191.19	-64.22
Bulandshahr	1128.42	3486.41	-2357.99
Shikarpur	1129.28	952.85	176.43
Bhawan Bahadur Nagar	1309.14	1058.12	251.01
Siyana	1304.69	1674.31	-369.62
Jahangirabad	1192.56	1174.34	18.21
Khurja	1053.23	1202.80	-149.56
Araniya	1113.29	694.51	418.79
Pahasu	1109.68	859.51	250.17
Unchagaon	1265.80	1194.83	70.98
Danpur	1118.54	899.87	218.66
Dibai	1137.01	1440.09	-303.08
Anupshahr	1250.79	1028.71	222.08
Agauta	1280.29	1092.20	188.09
Bulandshahr District	1181.36	1199.42	-18.06

sixteen blocks seven blocks would suffer from food deficit.

The blocks which would suffer from declining population food balance are Bulandshahr, Gulaothi, Siyana, Dibai, Khurja Lakhaothi and Sikandrabad . The blocks of Bulandshahr and Gulaothi which are still food deficit blocks with a population food balance of -1305.09 and -58.34 persons/sq.km respectively in 2007-08 would be experiencing declining population food balance to the tune of -2357.99 and -663.29 persons/sq.km respectively in 2040. The food crop density of Bulandshahr block would reach from 2433.50 to 3486.41 persons/sq.km from 2007-08 to 2040, likewise food crop density of Gulaothi block would also reach from 1310.79 to 1915.73 persons/sq.km. The blocks of Siyana, Dibai, Khurja Lakhaothi and Sikandrabad which are presently food surplus blocks would also become food deficit blocks by 2040 to the extent of -369.62, -303.08, -149.56, -64.22 and -2.39 respectively. So with the current population growth and a constant carrying capacity the food crop density is bound to increase and consequently the population food balance would decline resulting in a deficit carrying capacity.

The remaining nine blocks Jahangirabad, Unchagaon, Shikarpur, Agauta, Danpur, Anupshahr, Pahasu, Bhawan Bahadur Nagar and Araniya are supposed to remain within the positive population food balance category. These blocks would experience surplus

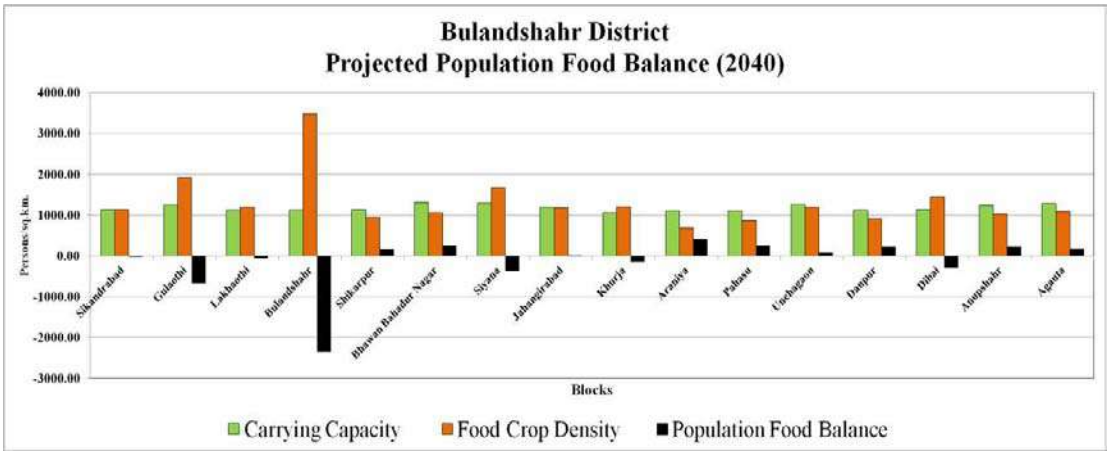

Fig. 1.6

carrying capacity of 418.79 persons/sq.km for Araniya followed by Bhawan Bahadur Nagar 251.01, Pahasu 250.17, Anupshahr 222.08, Danpur 218.66, Agauta 188.09, Shikarpur 176.43, Unchagaon 70.98 and Jahangirabad 18.21persons/sq.km in 2040.

Conclusion

It is therefore concluded that at the present level of agricultural technology the present carrying capacity of the district is sufficiently high and it may feed it present population. However, the population of the district is continuously increasing while the carrying capacity of agricultural land would remain constant at the current level of agricultural technology. Hence, the food crop density would continuously increase on account of continuously increasing population resulting in the declining levels of population food balance.

For maintaining the carrying capacity and sustainable development of agricultural land it is suggested to increase the agricultural efficiency using sustainable agricultural practices like cropping in parity with the land suitability classes as well as by reducing on the population growth. Special attention is required in the blocks of Bulandshahr and Gulaothi which are already recording a negative trend of carrying capacity.

The study on the projected food balance at the present level of agricultural technology as well as a constant carrying capacity and at the present pace of population growth shows that by the year 2040 the food crop density of the district is expected to reach at the level of 1199.42 persons/sq.km. Hence, in a period of 32 years from 2008 onward population food balance of the district as a whole is expected to reach -18.06 persons/sq.km i.e. a deficit population food balance. The calculated population food balance of the district in 2008 was 367.43 persons/sq.km the projected value of which for 2038 is estimated to be only 6.03 persons/sq.km. It means that if the carrying capacity of agricultural land remains constant and the food crop density continue to increase at the same pace the district would be able to

feed a surplus population only 6.03 persons/ sq.km. After 2038, the population food balance would read minus figures and would represent the beginning of a negative trend. By 2040 the population food balance would be -18.06 persons/sq.km to be declined further onward with the passage of time.

Hence, it is suggested to :

a) Lay down strategies to enhance the carrying capacity of all the blocks of the district with an urgent note for the blocks of Bulandshahr, Gulaothi, Siyana, Dibai, Khurja and Sikandrabad.

b) Long term strategies are needed to enhance the carrying capacity of all other remaining blocks which at present are in a comfortable position and which are having a strong likelihood of falling into the category of deficit food balance by 2040.

c) Equally important are the strategies to be laid down for all the blocks of the district in order to minimise the stress of population on their agricultural land resources i.e, to decrease their food crop density.

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Nature of Migration in Upper Kosi Watershed of Kumaon Himalaya, Almora District, Uttarakhand

Ashutosh Singh and S.B. Singh

Man is not only the beneficiary of the resource development and utilization but also the most potent and dynamic agent of production. Human resource as an active and important resource has significant role to adjust himself with the environment and then adjusts the environment too. There is a direct relationship between population, environment and economic development. Present paper tries to explain the general demographic condition and nature of migration in Upper Kosi watershed of Kumaon Himalaya, Uttarakhand.

Keywords : Economic Development, Resource Utilization, Resource Development, Demographic Condition, Migration.

Introduction

Population is one of those various groups of elements that causes the different regions of earth to differ and in real sense it is the human occupancy of land that gives character and significance to a geographic area, more than any other factor. In Geography, the central theme is areal differentiation of which the population of human life forms the dynamic element. Population is a point of reference from which all the other elements are observed and from which they all, singly or collectively, derive significance and meaning. It is population, which furnishes the focus (Trewartha, 1953). The pattern of population in any area depend upon a numbers of factors since no single factor is capable to explain such a complex phenomenon over the surface of the earth ,more so in a mountainous region like Upper Kosi watershed of Kumaun Himalaya where the distribution is largely influenced by the physical diversity of the landscape. Apart from this, the population distribution is also governed by the agricultural inequality of the region. Secondly, the forest resources and the small-scale industries, although very limited, have their influence in population distribution. Lastly, we have to take into account the evolution and present pattern of transport network which has been governed largely by topographic conditions of the region and has played a dominant role in determining the distribution of man in these areas. An insight into all such economic activities, provide a true reflection of the measure in which the population

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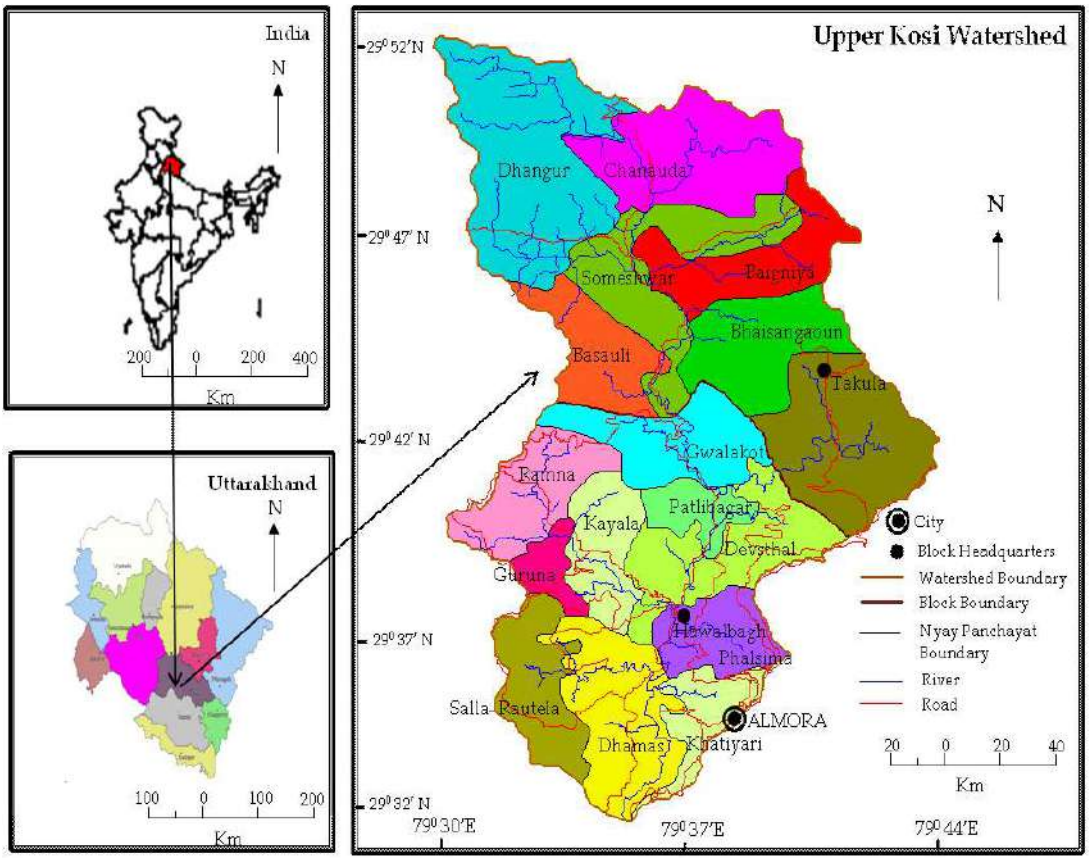

Fig. 1

is distributed over space.

The physical setting of an area bears definite relations to distribution and density of population. It is worthwhile to mention that the study area is a hilly tract wherein both restrictive and permissive aspects of physical conditions have a direct bearing upon human activities, dwellings, distribution and density of population. The steep zones of upper and middle hills are thinly populated as compared to the warm alluvial level surface valleys and mid slope zones which are densely populated.

Methodology

In the present study primary and secondary data both have been used. The population data were taken from census reports from 1991 to 2011. Data on migration obtained from perception study carried out in the study area.

Study Area Profile

The Upper Kosi watershed is situated in Almora district and extends from 29^0 33' 10"N to 29^0 52' 25" N and 79^0 30' 28"E to 79^0 44' 55" E with an area of 462.81 km^2. The whole region is mountainous with successive mountain range and river valley. The altitude varies between 1,000 m to 2,750 m above mean sea level. In the north, the study area is separated by

Table 1. *Upper Kosi Watershed, Population Growth, 1991 - 2011*

Nyay Panchayat	1991	2001	2011	Population Growth (in %)1991-2001	Population Growth (in %)2001-2011
Baigniya	1546	2968	2690	91.9	-9.37
Basauli	7705	7647	7490	- 0.8	-2.05
Bhanisargaon	3619	3834	3410	5.9	-11.06
Chanauda	6336	6565	7024	3.6	6.99
Dhaungar	5281	5476	3844	3.7	-29.80
Someshwar	4416	5747	5835	30.1	1.53
Takula	2894	2968	2922	2.6	-1.55
Devsthal	3384	4071	3588	20.3	-11.86
Dhamas	8147	9306	8594	14.2%	-7.65
Guruna	1462	1657	1627	13.3	-1.81
Gwalakot	5372	5202	5004	- 3.2	-3.81
Kayala	1811	1813	1730	0.1	-4.58
Khatiyari	9088	13255	10934	45.9	-17.51
Patlibagar	1917	2219	2098	15.8	—5.45
Phalsima	3266	4772	4915	46.1	3.00
Ramna	3251	3177	2963	- 2.3	-6.74
Salla-Rautela	2633	3630	3624	37.9%	-0.17
Total	72128	84307	78292	16.9	-7.13

Source: Calculated as per Census of India, PCA, 1991, 2001 and 2011

Birrachuwakot Dhar mountain from the Gomti river basin. This range is higher in the northwestern part i.e. above 2520 meters in elevation, and acts as the source of the Kosi River. Towards the north east, the demarcation range includes the upper parts of the Kausani reserved forest and follows 1800 meters contour approximately up to Jogipatal and finally joins Binasar (2050 mts). It is bordered in the west by Ranikhet Tehsil, in the south by the Nanital District, in the east by the Lamgada block of district Almora and in the north by Garun town of Bageshwar district (Fig. 1). There are two development blocks in the watershed Hawalbagh and Takula covering 234 revenue villages and a small north – west part of Almora city.

Population Growth

Population growth, of the study area has been analyzed from 1991 to 2011. However, at the watershed level there has been a decrease in the total population corresponding to almost 7.13 percent negative growth. The basic reason is heavy family out migration in search of better employment has also had its impact upon the natural decrease of population in the study area. Highest population growth found in Chanauda *nyay panchayat* (6.99%) followed by Phalsima (3%) and Someshwar *nyay panchayat* (1.53%). Table 1 presents the negative population growth of the various *nyay panchayats* of the study area. The highest negative population growth found in Dhaungar *nyay panchayat* (-29.80%) followed by

Khatiyari (-17.51%), Devsthal (-11.86%), Bhanisargaon (-11.06%) and Baigniya *nyay panchayat* (-9.37%) and others. The main reason for such kind of population growth is massive outmigration in search of better opportunities as agricultural practices in the region are a futile exercise as there is a lack of off farm activities.

Population Distribution

Mountainous areas present a unique and characteristic environment for the distribution of population that is conditioned by a variety of geographical factors. The first and foremost is the climate, availability of water and dominance of slope always assert a strong influence on population distribution. Many such factors, in combination with local geographic characteristics have asserted a strong influence on the population distribution of Upper Kosi watershed that have given rise to distinct pattern and arrangements of population.

In mountainous region, the principal determinants of population concentration are slope and altitude, but the condition of the slope influence the activity of human beings sometimes greater than altitude. The distribution of population in the mountain area is highly irregular and without apparent order. Hence the concentration are mostly found along valleys, the uplands are predominating in slopes may sometimes even be too cold for agriculture or human existence. This largely explains why the density figures along the Trans Himalaya and the greater Himalayan zone are the lowest i.e. Munsyari, Dharchula, Kapkot and moderately high along areas of less steeper slopes, lower altitudes and moderate climatic zone of the lesser Himalaya i.e. Bhimtal and Dwarahat of Kumaun Himalaya.

The distribution of population in the study area is widely varied due to innumerable geographical conditions like terrain, climatic conditions, availability of water, fuel, fodder and socio-economic factors. Each imprints upon the mosaic of the population distribution in the study area. Guruna (1627), Kayala (1730), Patlibagar (2098) and Baigniya (2690) are the most sparsely populated *nyay panchayats* of the area, while Khatiyari (10934), Dhamas (8594), Basauli (7490), Chanauda (7024) and Someshwar (5835) are moderately populated *nyay panchayats* of the area (Table 2). Khatiyari and Dhamas *nyay panchayats* are moderately populated as they are situated near the Almora city. Basauli, Someshwar and Chanauda *nyay panchayats* are situated in Someshwar valley with moderate population and good agricultural land. Hence, the concentration of population in the entire watershed is mostly along the Kosi river and decreases in both the directions upwards from the river (Fig. 2). This also hampers the agricultural pursuits hence the *nyay panchayats* in close proximity of the river wherein the agricultural potentials are good in comparison more populated than those lying at higher altitudes. The remaining *nyay panchayats* of the region are sparse to moderately populated.

The availability of land resources and its utilization pattern has a direct bearing upon the distribution of population in the study area. Consequently, maximum concentrations of population is noticed near the arable lowlands in the proximity of the Kosi river, socio-economic factors like education, health facilities, market centers have also lured population to concentrate in certain pockets in the study area. Bio-physical elements like

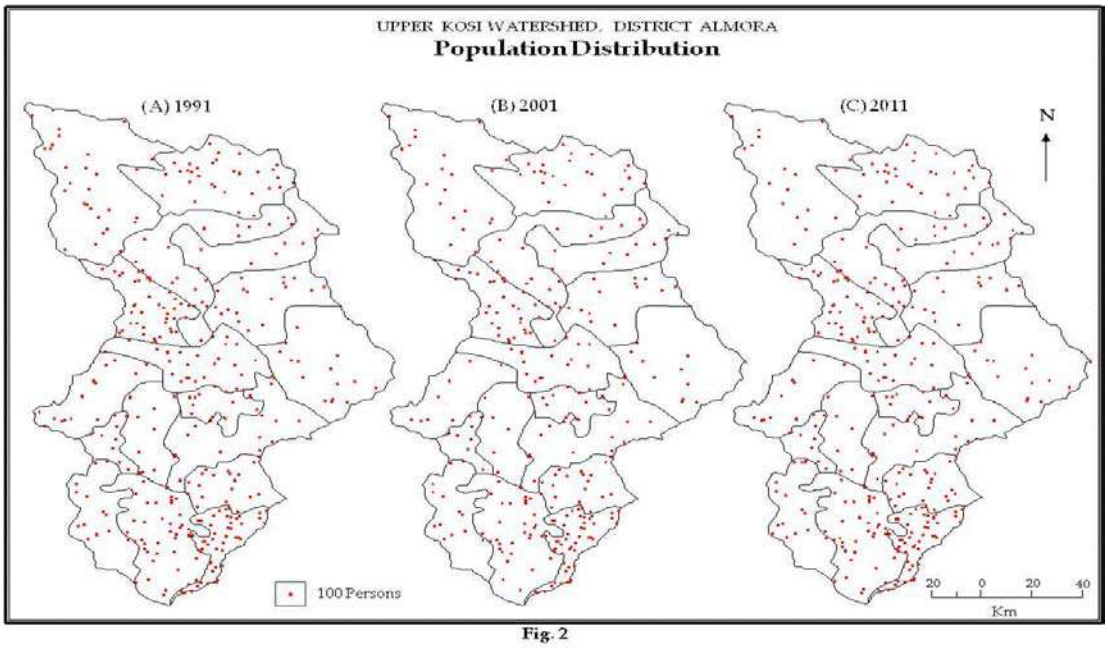

Fig. 2

Table 2. *Upper Kosi Watershed, Population Distribution, 1991 - 2011*

Nyay Panchayat	Population						Area km²	%
	1991	%	2001	%	2011	%		
Baigniya	1546	(2.14)	2968	(3.52)	2690	(3.44)	5.77	(2.64)
Basauli	7705	(10.68)	7647	(9.07)	7490	(9.57)	25.51	(11.69)
Bhaisangaoun	3619	(5.02)	3834	(4.55)	3410	(4.36)	12.74	(5.84)
Chanauda	6336	(8.78)	6565	(7.79)	7024	(8.97)	8.07	(3.70)
Dhaungar	5281	(7.32)	5476	(6.50)	3844	(4.91)	10.92	(5.00)
Someshwar	4416	(6.12)	5747	(6.82)	5835	(7.45)	10.03	(4.60)
Takula	2894	(4.01)	2968	(3.52)	2922	(3.73)	6.09	(2.79)
Devsthal	3384	(4.69)	4071	(4.83)	3588	(4.58)	12.41	(5.69)
Dhamas	8147	(11.30)	9306	(11.04)	8594	(10.98)	36.08	(16.53)
Guruna	1462	(2.03)	1657	(1.97)	1627	(2.08)	5.60	(2.57)
Gwalakot	5372	(7.45)	5202	(6.17)	5004	(6.39)	18.25	(8.36)
Kayala	1811	(2.51)	1813	(2.15)	1730	(2.21)	8.53	(3.91)
Khatiyari	9088	(12.60)	13255	(15.72)	10934	(13.97)	20.30	(9.30)
Patlibagar	1917	(2.66)	2219	(2.63)	2098	(2.68)	7.25	(3.32)
Phalsima	3266	(4.53)	4772	(5.66)	4915	(6.28)	10.22	(4.68)
Ramna	3251	(4.51)	3177	(3.77)	2963	(3.78)	10.36	(4.75)
Salla-Rautela	2633	(3.65)	3630	(4.31)	3624	(4.63)	10.06	(4.61)
Total		72128		84307		78292		218.28

Source: Calculated as per Census of India, PCA, 1991, 2001 and 2011

Table 3. *Upper Kosi Watershed, Population Density, 1991 - 2011*

Nyay Panchayats	Population Density (Persons /km^2)				
	1991	2001	2011	Change from 1999-2001 (%)	Change from 2001-2011 (%)
Baigniya	268	514	466	91.79	-9.34
Basauli	302	300	294	-0.66	-2.00
Bhaisangaoun	284	301	268	5.99	-10.96
Chanauda	785	814	870	3.69	6.88
Dhaungar	484	501	352	3.51	-29.74
Someshwar	440	573	582	30.23	1.57
Takula	475	487	480	2.53	-1.44
Devsthal	273	328	289	20.15	-11.89
Dhamas	226	258	238	14.16	-7.75
Guruna	261	296	291	13.41	-1.69
Gwalakot	294	285	274	-3.06	-3.86
Kayala	212	213	203	0.47	-4.69
Khatiyari	448	653	539	45.76	-17.46
Patlibagar	264	306	289	15.91	-5.56
Phalsima	320	467	481	45.94	3.00
Ramna	314	307	286	-2.23	-6.84
Salla-Rautela	262	361	360	37.79	-0.28
Total	330	386	359	16.97	-6.99

Source: Calculated as per Census of India, PCA, 1991, 2001 and 2011

availability of forest resources, pasture land and sources of water have also played their role in the distribution of population.

Population Density and Change

The density of population presents a true picture of the extent of population pressure on the resource base of the region and is measured in terms of population per unit of land area, expressed as ratio of the area of land and number of people. The population density (Table 3) in the study area is increasing as in any other part of the country. The Chanauda *nyay panchayat* has the maximum population density amounting to 870 person /km^2 followed by Someshwar (582 person /km^2) and Khatiyari *nyay panchayats* (539 person / km^2), while Kayala *nyay panchayat* has the least population density i.e. 203 persons /km^2 (Fig. 3). The Basauli, Gwalakot and Ramna *nyay panchayat* have shown a negative population density due to persistent out migration.

Table 3 also reveals that the highest negative change in density found in Dhaungar *nyay panchayat* (-29.74%) followed by Khatiyari (-17.46%), Devsthal (-11.89%) and Bhaisangaon (-10.96%) etc. and highest positive change shown in Chanauda (6.88%), Phalsima (3%) and Someshwar *nyay*

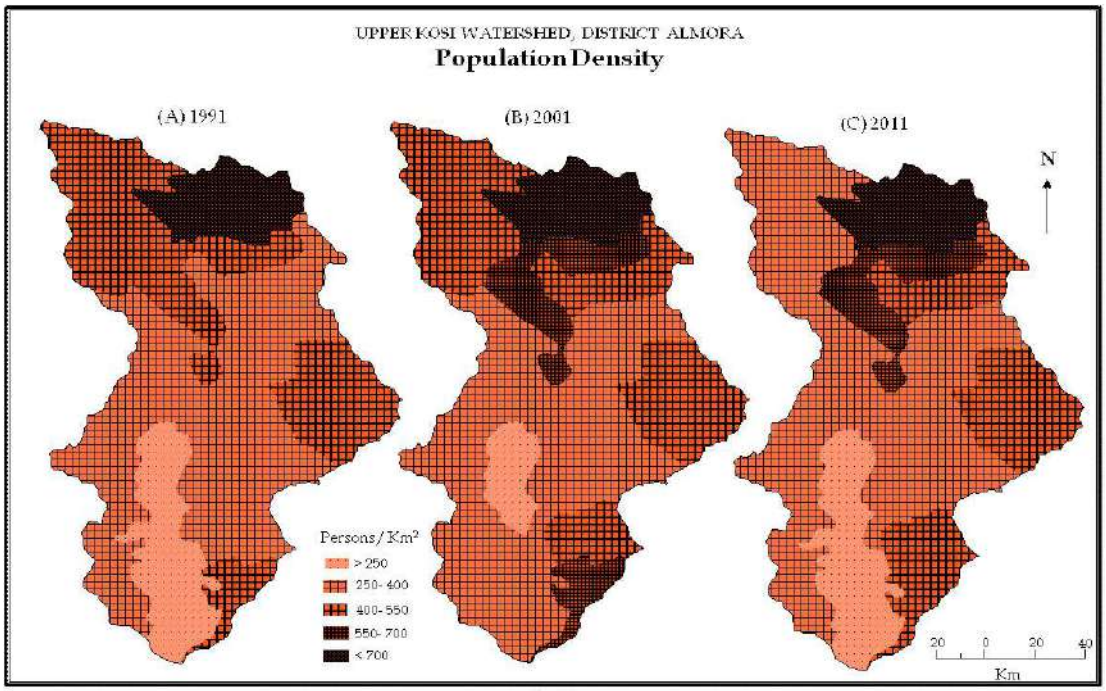
UPPER KOSI WATERSHED, DISTRICT ALMORA
Population Density
(A) 1991
(B) 2001
(C) 2011
N
Persons/ Km²
> 250
250- 400
400- 550
550- 700
< 700
20 0 20 40
Km

Fig. 3

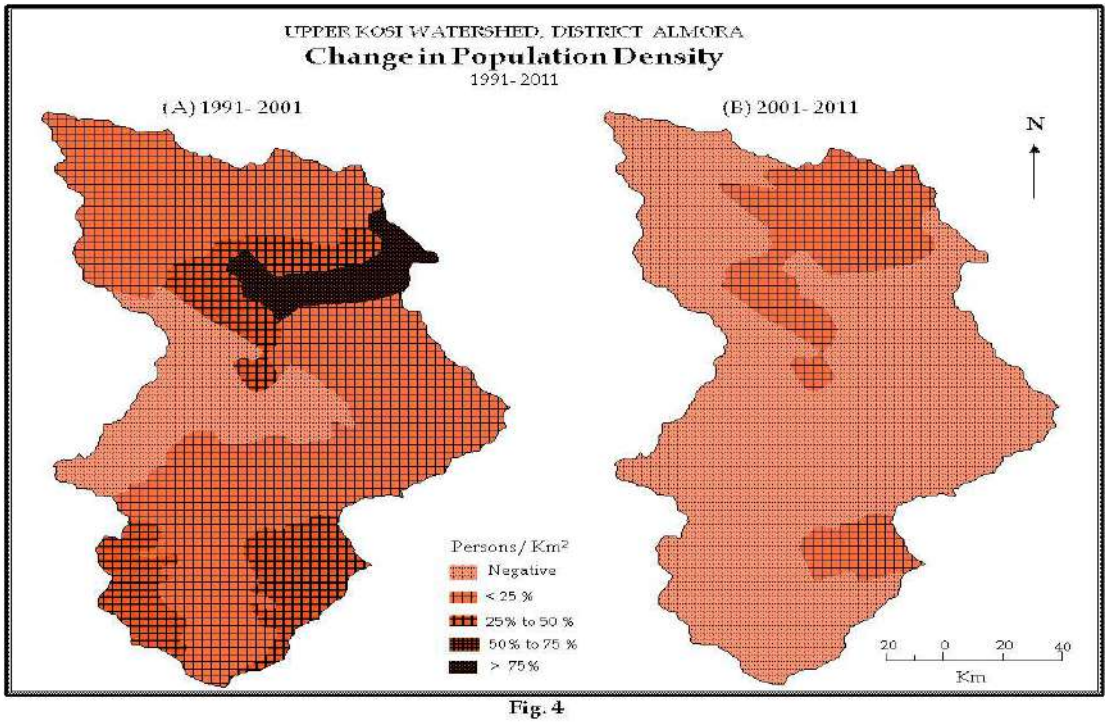
UPPER KOSI WATERSHED, DISTRICT ALMORA
Change in Population Density
1991- 2011
(A) 1991- 2001
(B) 2001- 2011
N
Persons/ Km²
Negative
< 25 %
25% to 50 %
50% to 75 %
> 75%
20 0 20 40
Km

Fig. 4

Table 4. *Upper Kosi Watershed, Physiological and Agricultural Densities, 2011*

Nyay Panchayats	Agricultural Land (Km^2)	Agricultural Population	Total Population 2011	Physiological Density	Agricultural Density
Baigniya	3.2	667	2690	840.63	208.44
Basauli	14	1024	7490	535	73.14
Bhaisangaoun	7	470	3410	487.14	67.14
Chanauda	4.4	917	7024	1596.4	208.41
Dhaungar	6	427	3844	640.67	71.17
Someshwar	7.5	1112	5835	778	148.27
Takula	3.4	211	2922	859.41	62.06
Devsthal	6.8	870	3588	527.65	127.94
Dhamas	19.9	1192	8594	431.86	59.90
Guruna	3.1	228	1627	524.84	73.55
Gwalakot	10.1	537	5004	495.45	53.17
Kayala	4.7	523	1730	368.09	111.28
Khatiyari	11.2	865	10934	976.25	77.23
Patlibagar	4	169	2098	524.5	42.25
Phalsima	5.7	603	4915	862.28	105.79
Ramna	5.7	723	2963	519.82	126.84
Salla-Rautela	5.5	444	3624	658.91	80.73
Total	120	10982	78292	652.43	91.52

Source: Calculated as per Census of India, PCA, 2011

panchayat (1.57%) because of flat land topography good for agricultural and horticultural practices (Fig. 4).

The high level of physiological density signifies a supporting capacity of the land along with certain facilities for agriculture. But this cannot be generalized for such a heterogeneous topographical region where the factors widely varying from one place to another. It often refers to the limitations of environment. The high values refer to a very critical state of human pressure on land resources. The mountainous region is characterized by medium to very high physiological densities and broadly, the factors for such a situation may be categorized as follows:

a. The dominant land uses in the mountainous area such as forest cover, pastures, horticulture areas etc. always leaving a low proportion of land for cultivation of crops.

b. There is always a critical time to which agriculture can be extended in these areas.

c. Since the principal economic pursuit and backbone of rural economy is agriculture, land is being tilled for generations and obviously much of the cultivable land has already been utilized.

d. Under the present agrarian setup, therefore a slight addition in the population has a vital role in creating a greater pressure on land unless the surplus population has economic pursuits to follow other than agriculture.

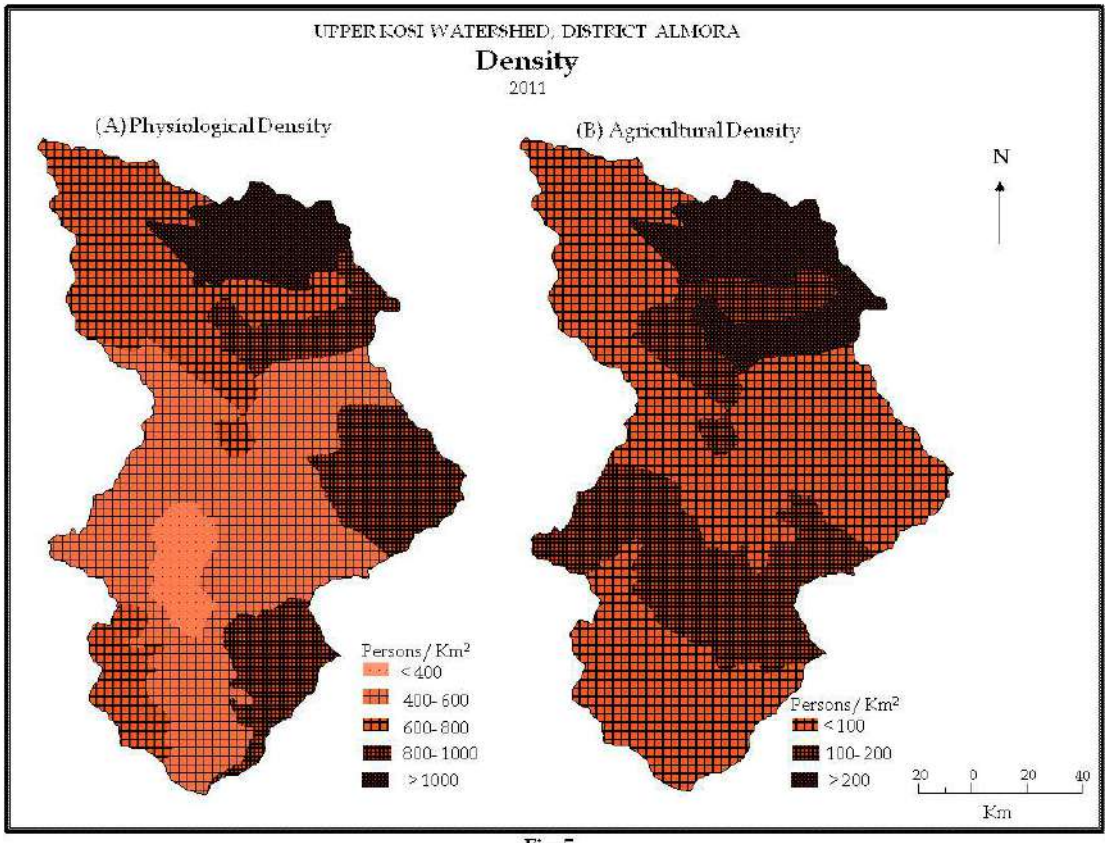

Fig. 5

The overall physiological density (Table 4, Fig.5) in the study area is 652 persons /km^2 of cultivated land with significant variation from 368 to 1596 persons /km^2 within the *nyay panchayats* in the study area. The highest physiological density observed in Chanauda *nyay panchayat* (1596 persons /km^2) and the lowest physiological density observed in Kayala *nyay panchayat* (368 persons /km^2). The ratio of rural population to the total cultivated land, i.e. agricultural density in the study area is 92 persons /km^2. The highest agricultural density observed in Baigniya *nyay panchayat* (208 persons /km^2) and the Lowest Density observed in Patlibagar *nyay panchayat* (42 persons /km^2).

Sex Composition

The sex composition normally measured by the sex ratio as an expression of number of females / 1000 males and the barometer of women's status in the society. But in mountainous regions of the country these figures could be misleading as there is huge single male out migration from these regions. However, the sex ratio in the study area (Table 5) is on the healthier side and increased from 1112 females / 1000 males in 1991 to 1137 females /1000 males in 2011. The sex ratio increased in all the *nyay panchayats* excepting only in Khatiyari *nyay panchayat* it is below 1000 i.e. 984 females / 1000 males because of low migration while in Bhaisangaoun it is 1282

Table 5. *Upper Kosi Watershed, Sex Ratio, 1991 - 2011*

Nyay Panchayats	Sex Ratio		
	1991	2001	2011
Baigniya	1382	1315	1274
Basauli	1147	1230	1210
Bhaisangaoun	1166	1170	1282
Chanauda	1147	1219	1147
Dhaungar	1099	1228	1198
Someshwar	1200	1206	1189
Takula	1105	1166	1056
Devsthal	1212	1242	1140
Dhamas	1005	1135	1099
Guruna	1141	1177	1266
Gwalakot	1245	1314	1199
Kayala	1328	1266	1182
Khatiyari	883	1006	984
Patlibagar	1282	1251	1271
Phalsima	983	1038	1048
Ramna	1366	1273	1138
Salla-Rautela	1088	1118	1152
Total	1112	1167	1137

Source: Calculated as per census of India, PCA,1991, 2001 and 2011

females /1000 males. The sex ratio in 2011 decreases in many *nyay panchayats* i.e. Khatiyari (984 females / 1000 males), Devsthal (1140 females / 1000 males) Kayala (1182 females / 1000 males) Chanauda (1147females / 1000 males) and Baigniya *nyay panchayats* (1274 females / 1000 males) in comparison to 2001. After 2004 – 2005, a new trend of migration emerges in the area. Now instead of single male out migration, whole family migrated to the near urban centers for better opportunities.

Literacy

Education, the basic need of human resource development plays an important catalytic role in opening one's inherent knowledge and skill in the adoption of appropriate technology for socio-economic changes and also in preventing environmental degradation (Dangol, 1998). The study area exhibits a varied literacy levels owing to the accessibility of schools, schooling costs and other educational facilities on one hand while parent's perception towards the value of education on the other. In 1991 the male and female literacy is 65.1 and 34.8 percent respectively. In two decades it goes upto 92.61 percent and 69.70 percent respectively. Total literacy in 2011 was 70.05 percent. The highest male literacy (95%) is found in Khatiyari *nyay panchayat* and highest female literacy (77%) is in Phalsima *nyay panchayat* due to proximity to the Almora city. The lowest male literacy is recorded in Chanauda (83%) and female literacy in Salla-Rautela *nyay panchayat* i.e. 66 percent (Table 6).

Occupational Structure

The occupational classification of population generally refers to different branches of activity based on the type of establishment, product made or service rendered. In order to overcome the difficulties in comparing the detailed information in this respect, it is customary to categorize it into three principal occupational groups or sectors for the purpose of analysis (Clarke, 1966) i.e. the primary sector which directly dependent on land comprising the cultivators and the agricultural laborers, the second group made up of population engaged in different occupation where the common denomination is the production of material goods and the tertiary sector that provides various services

Table 6. *Upper Kosi Watershed, Literacy Rate, 1991 - 2001*

Nyay Panchayats	Literacy in percent					
	1991		2001		2011	
	Male	Female	Male	Female	Male	Female
Baigniya	61.3	38.9	69.3	49.7	91.44	67.46
Basauli	68.8	37.3	73.7	51.4	92.18	68.84
Bhaisangaon	52.1	28.4	73.6	47.8	91.66	65.31
Chanauda	70.1	37.4	75.2	59.2	83.24	70.44
Dhaungar	66.1	30.4	72.7	51.9	91.67	65.13
Someshwar	67.6	39.5	73.2	51.0	92.47	67.75
Takula	67.5	47.4	71.5	54.3	92.31	75.00
Devsthal	66.9	38.9	73.8	51.8	94.16	73.84
Dhamas	57.0	23.2	69.6	47.0	93.13	68.92
Guruna	53.1	24.5	72.8	51.9	91.42	69.28
Gwalakot	60.1	34.2	75.7	54.3	94.28	67.80
Kayala	66.6	35.4	74.5	56.2	93.53	68.85
Khatiyari	71.1	38.6	80.4	60.4	95.19	75.74
Patlibagar	71.3	41.5	76.1	55.1	96.41	69.07
Phalsima	75.7	42.2	79.4	56.9	96.59	76.58
Ramna	58.2	33.8	72.9	52.8	92.42	68.78
Salla-Rautela	58.0	26.5	74.8	52.1	92.33	66.11
Total	65.1	34.8	75.4	53.9	92.61	69.70

Source: Calculated as per Census of India, PCA,1991,2001 and 201

for the population such as trade, commerce and transport etc. region exhibits the relationship

Table 7 exhibits the salient characteristics of the occupational structure in the Upper Kosi watershed. More than half (55.96 %) of the total population of the study area are non workers while only 44.04 percent are total workers in which 55.34 per cent are main and 44.7 per cent are marginal workers respectively.

Migration

Migration is one of the most important demographic variables in relation to population change and matter of interest for policy makers, planners, and researchers in reference to study the population-resource relationship, which signifies the special variation along the region (Mcintyre and Weeks 2002). It is widely accepted that migration can affect environment in several ways having consequences for place of origin. The Upper Kosi watershed has a complex impact of migration on its environment, economy and on the life style of the people in the region for the decades.

Direction

In Upper Kosi Watershed, the nature of migration is out migration. The male members are the main migratory of the area, so the all burden comes to women folks in the area. The economy of the region is postal economy and hand to mouth survival is the main characteristic

Table 7. *Upper Kosi Watershed, Occupational Structure, 2011*

Nyay Panchyat	Total	Main Workers		Marginal Workers		Non Workers	
	Worker	Number	Percent	Number	Percent	Number	Percent
Baigniya	994	853	85.81	141	14.19	1696	63.05
Basauli	3133	1503	47.97	1630	52.03	4357	58.17
Bhaisangaoun	1526	631	41.35	895	58.65	1884	55.25
Chanauda	3254	1839	56.52	1415	43.48	3770	53.67
Dhaungar	1980	595	30.05	1385	69.95	1864	48.49
Someshwar	2641	1713	64.86	928	35.14	3194	54.74
Takula	1225	405	33.06	820	66.94	1697	58.08
Devsthal	1454	1301	89.48	153	10.52	2134	59.48
Dhamas	3739	1858	49.69	1881	50.31	4855	56.49
Guruna	809	354	43.76	455	56.24	818	50.28
Gwalakot	2534	993	39.19	1541	60.81	2470	49.36
Kayala	888	671	75.56	217	24.44	842	48.67
Khatiyari	3767	2605	69.15	1162	30.85	7176	65.63
Patlibagar	993	331	33.33	662	66.67	1105	52.67
Phalsima	1764	1283	72.73	481	27.27	3151	64.11
Ramna	1257	881	70.09	376	29.91	1706	57.58
Salla-Rautela	1610	759	47.14	851	52.86	2014	55.57
Total	33568	18575	55.34	14993	44.66	44733	55.96

Source: Calculated as per Census of India, PCA, 2011

of the region. The population of the area is generally migrating towards plain region i.e. Haldwani, Barelley, Lucknow, Delhi and other metro cites of country for the good education, job, medical and other facilities. The percentage of in migration is very low and basically in the form of tourism.

Reason for Migration

The causes for migration range from availability of life supporting resource to the war and peace of society in the study area. The hill regions are sending emigrants for reducing pressure on environmental resource (Ojha, 1983). Therefore, the factors for both in and out migration as a 'push-pull' mechanism have contributed to the present scenario of population movement in the area. Table 8 presents the reasons and causes for in and out migration in the region perceived from the local populace. As per respondents, the factors which governs the out migration from the areas are difficulty to meeting the demand F3 (24.44%) followed by unemployment (23.33%), insufficient education and health services (19.34%), scarcity of agricultural land (15.88%) and natural calamities (10.45%). It is also clear from the table i.e. natural resource degradation increased migration in the region. The trend of in migration is very low in the area. In reference to the in migration, more than 50 percent of respondents stated the attraction of healthy environments is the main factor followed by social relations (28%), purchasing of land (10.2%) and business purposes (9.67%).

Table 8. *Upper Kosi Watershed, Reasons for Migration (in %)*

Sub-Reasons	Percent of respondents		
	High altitude Region	Mid Altitude Region	Valley Region
1. Out Migration			
Scarcity of Agricultural Land	29.48	30.2	15.88
Difficult to meet F3	15.66	18.89	24.44
Insufficient Social Services	21.56	20.20	19.34
Insecurity	11.12	11.24	10.45
Unemployment	20.1	17.86	23.33
Others	2.08	1.61	6.56
2. In Migration			
Purchasing of Lands	-	-	10.2
Attraction of Healthy Environments	54.56	58.67	50.58
Security	-	-	-
Business Purpose	-	-	9.67
Social Relation	43.34	40.23	28
Others	2.1	1.1	1.55

Source: Field Survey, 2013

The limited agricultural land, substances farming, low productivity, lack of employment opportunity, scarcity of fuel and fodder, environmental degradation and inter community conflicts are the main factors responsible for out migration in the study area. According to Dixon (1996) scarcities of life supporting resources such as arable land, clean and fresh water, fuel and fodder etc are the main factors that causes mass violent and fierce competition among the communities and ultimately have forced to be migrated from the birth place to elsewhere (Markides, 2001). Out migration from resource poor region (high lands) to the resource rich low lands has calmed the pressure of population in the arable land of sending region i.e. hill. However, it has brought many ill effects on the low land environment i.e. irresponsible destruction, encroachment of forest resources, improper land utilization practices and numerous environmental stresses (Urs, 1996; NPC, 1988).

Concluding Remarks

A cursory look over these values would imply the fact that there is huge surplus population with no off farm activities. Dependency is solely upon agricultural pursuits and it is pertinent to note here that a huge section of the main workers are females as males of the region in lack of any off farm activity migrate for economic purposes and the entire agricultural burden falls upon the shoulders of women of the area. It can be safely concluded that a balanced approach of development between ecological regions and amongst the resources could prove an effective mechanism for sustainable development of the Upper Kosi Water shed of Kumaon Himalya, Uttarakhand.

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Decreasing Child Sex Ratio in Jammu and Kashmir: A Serious Social Problem

Rakesh Jasrotia and Sarvjeet Singh

The imbalanced sex ratio of the population in Jammu and Kashmir has become a serious problem, for the society. In recent decade more male babies have been born in state due to people's preference for having male children. The phenomena of sex determination and sex selective abortion is now concentrating not only in towns and cities but also approaching in rural areas with the availability of better road and transport facilities. The findings of this paper reveal that in spite of the various legal provisions and women's specific developmental programs, the gender bias and deep-rooted prejudices still persist. The most influential factor that has affected the sex ratio in the state is a strong son preference. With this view in mind, the present paper aims to identify how different forces of social change are responsible for the problem of declining sex ratio. Paper also looks into the different concepts of sex ratio and concludes with some suggestions, which can be utilized for solving the problem of declining child sex ratio.

Keywords: Child sex ratio, female feticides, female infanticide, humanity, sex determination, abortions.

Introduction

Female sex ratio is the number of females per every 1000 males in a given place. Sex ratio is an index of socio economic conditions of an area. It is an important tool of regional analysis. It has a profound effect on demographic structure of a region (B.N. Ghosh 1987). Female sex ratio again, is recalculated based on the age groups like 0-6 years and above. The child sex ratio stands for the number of girls per 1000 boys in the age group of 0-6 years. Sex ratio among children is not influenced by sex selective spatial mobility of population. In this male dominated society due to unequal treatment of male and female children in a society results in higher death rates among female declining sex ratio among children in the age group 0-6 years results another disturbing feature of sex composition of India's population. The phenomena of sex determination and sex selective with the availability of better road and transport facilities (P.N. Mari and Bhat 2003). According the Bose (2001) attributes the recent steep decline in child sex ratios to the greater availability of such technologies. Since the 1980s' these technologies have come into side spread use in both rural and urban areas. The prevailing

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socio-economic and cultural milieu including the impact of modernization has further aggravated the situation with regard to these factors. At the household level or micro level, the relationship of population to available resources, the nature of localized risk, and heir ship strategies have been the main considerations. Nagrajan and Mulay (2009) in their study note that majority of the sonography centers are working illegally in major prosperous districts and areas of the Maharashtra.

The Child Sex Ratio (CSR) for the age group of 0-6 is not the best way of finding out what is happening to the girl child. A better method will be to calculate the number of girls per 1000 boys at birth. But this assumes a good system of registration of births and deaths. In spite of the legal provision for compulsory registration of births, very few people care to register births of children especially of girls. This is because some people think that if there is a government record of their sons, whatever the property they have will be passed on to their sons, which is mistaken notion.

Study Area

The border, mountainous and northern most stat of India is formed by the territories of Jammu, Kashmir, Gilgit and Ladakh. According to the latest census of India, the J&K state occupies an area of 138942 sq.kms at present Jammu division has an area of 26293 sq.kms, Kashmir 15948 sq.kms, Ladakh (Leh) 82665 sq.kms and Gilgit (Kargil) 14036 sq.km and the rest of the land is under the occupation of Pakistan and China. The Jammu and Kashmir state extends over 480 km. from east to west and 640 km from north to south. The valley of Kashmir alone is 15520 sq. km in area. The Jammu and Kashmir state constituting the

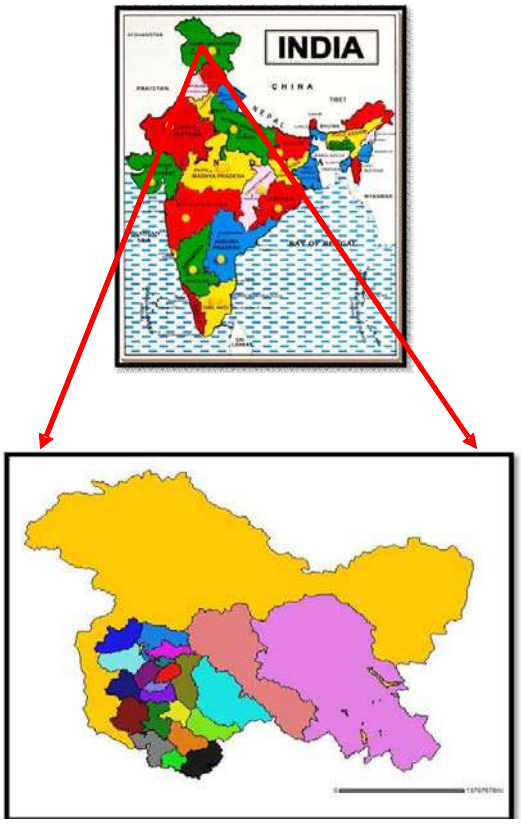


Fig. 1. Study Area
Source: Census of India, 2011

extreme western section of the Himalayas lies between 32^0 17' and 36^0 50' North latitude and 73^0 26' and 80^0 30' East longitude. It is bounded by China, Russian, Turkistan in the north, China, Tibet in the east, Pakistan in the west and by Punjab and Himachal Pradesh in the southwest and south respectively.

Objectives

1. To analyze regional pattern of sex ratio in Jammu and Kashmir for the age group of 0-6 years.
2. To study the relationship of child sex ratio with female literacy rate, male literacy rate and urbanization.

3. To suggest certain measures for improving child sex ratio in state.

Methodology

The present study is exclusively based on secondary data collected from Census of India 2011, Statistics and planning department of Jammu and Kashmir, Health department etc.

Table 1 : District wise Child Sex Ratio in J&K in 2001-2011

Districts	2001	2011	Difference between 2001-2011
Kupwara	1021	854	-167
Budgam	1004	832	-172
Leh	955	944	-10
Kargil	980	978	-02
Poonch	959	895	-64
Rajouri	905	837	-68
Kathua	847	836	-11
Baramulla	961	866	-95
Bandipora	967	893	-74
Srinagar	928	869	-59
Ganderbal	1014	863	-151
Pulwama	1046	836	-210
Shupiyan	1011	883	-128
Anantnag	977	832	-145
Kulgam	1003	882	-121
Doda	959	932	-27
Ramban	968	931	-37
Kishtwar	977	922	-55
Udhampur	912	887	-25
Reasi	952	921	-31
Jammu	819	795	-24
Samba	798	787	-11
Jammu and Kashmir	941	859	-82

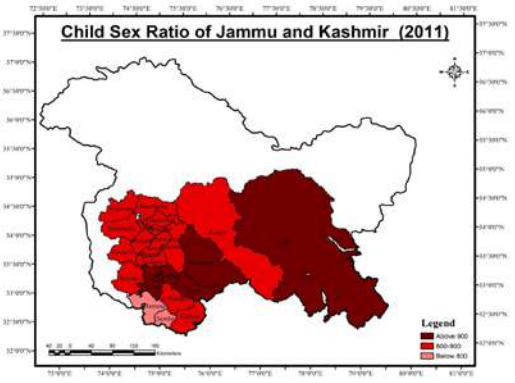
Source: Census of India 2011

Spearman rank correlation method has been used to find out the impact of correlation of child sex ratio with female literacy rate, male literacy rate and urbanization. The formula is given below:

$$f = 1 - \frac{6 \Sigma d_i^2}{N (N^2 - 1)}$$

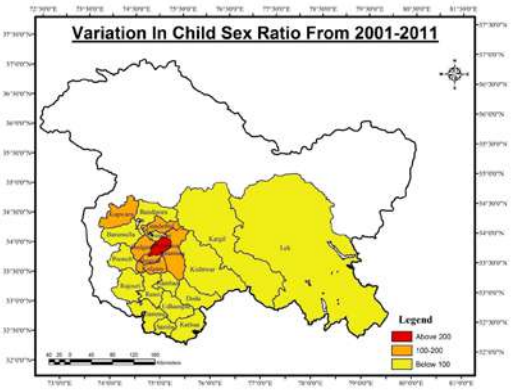
In the present study an attempt has been made to present the picture of decreasing child sex ratio in the state.

Child Sex Ratio of Jammu and Kashmir 2011



Source: Prepared on the basis of Census of India 2011

Variation in Child sex ratio from 2001-2011



Source: Prepared on the basis of Census of India 2011

The most disturbing aspect of 2011 census data by far is the growing imbalance between the sexes in the youngest age group 0-6 (Child Sex Ratio). The Child Sex Ratio has declined from 941 in 2001 to 859 in 2011 as shown in table No. 1 over a period of 10 years, Child Sex Ratio is found to have gone down by as much as 82 points. This declining trend of the sex ratio is a dangerous drift for the humanity. In the nationwide hall of shame, Jammu and Kashmir is at second spot, just behind to Haryana, which has a ratio 834 females per 1000 males. In 2001 Census had shown some districts of the state actually recording a higher number of girls than boys. Six districts shows a positive ratio in the age group of 0-6, including Pulwama (1046:1000), Kupwara (1021: 1000), Ganderbal (1014:1000), Shopian (1011:1000), Budgam (1004:1000) and Kulgam (1003:1000). In the 2011 Census, the number of girl children in these districts has slipped into the 800. The latest census figures have, however, jolted the state government. There has been a sharp decline of more than 150 points in a few of these districts.

If a straight comparison is made between 2001 and 2011, Child sex ratio is found to have gone down in all the district of the state – the largest being in the case of Pulwama (210) Ganderbal (151), Budgam (172), Kupwara (167), Shopian (128), Kulgam(121) as shown in Fig. 1.2.Jammu and Kashmir, which was once hailed by the UNICEF in its 1994-1996 study as a place where no female foeticide took place, has suddenly become averse to the fairer sex. The declining of sex ration in Kashmir is much worse than Jammu which is tough to understand. While earlier the sex of the child was considered to be a matter of fate, and girl children could only be eliminated through infanticide or neglect, it has now become a matter of 'choice', part of a modern, rational approach of family planning.

In the Jammu region, Child sex ratio decreased from 905 to 837 in Rajouri district in comparison to 1000 males and it is considered among one of the worst district where the discrimination against females was in its height. In Poonch it comes down from 959 to 895. Udhampur shows 912 to 887 females in comparison to 1000 males. In Jammu region 8 districts out if 10 has child sex ratio below the 900. If we look on the sex ratio of capitals of the state, winter capital Jammu has 871sex ratio in comparison 869 of summer capital. In a startling revelation, over 21,000 foetus may have been killed in parts of Jammu during past 5 years as Health Department has lost track of these pregnant cases after they were registered by the department. The Comptroller of Auditor General (CAG) of India report on Jammu district released here makes revelations about the alarming foetus killings. The report revealed that 57,503 cases of pregnancy were registered since 2006 in test-checked blocks of Jammu district while only 35669 deliveries had been registered by the department. "The 21,834 registered pregnant cases have neither been traced nor has department any information about them", the report said. The report added that chances of foetus killings after illegal sex determination of these 21,834 cases can't be ruled out.

All this is indicative of female foeticides. An easy availability of doctors for the ultrasound test and a better transport network along with the ability to pay for the services are the factors responsible for rampant practice of female foeticide even in the rural areas of the region. A large part of the increased

Table 2 : Child Sex Ratio by residence

Districts	Child Sex Ratio 2001			Child Sex Ratio 2011		
	Total	Rural	Urban	Total	Rural	Urban
Kupwara	1021	1026	886	854	852	873
Budgam	1024	1009	957	832	832	829
Leh	955	964	921	944	936	969
Kargil	980	984	914	978	974	1029
Poonch	959	964	849	895	894	902
Rajouri	905	909	829	837	835	904
Kathua	847	854	796	836	840	805
Baramulla	961	967	925	866	869	848
Bandipora	967	966	979	893	894	885
Srinagar	928	997	918	869	965	868
Ganderbal	1014	1009	1104	863	875	809
Pulwama	1046	1055	969	836	830	877
Shupiyan	1011	1011	1008	883	888	803
Anantnag	977	994	890	832	826	852
Kulgam	1003	1008	891	882	879	897
Doda	959	965	848	932	937	847
Ramban	968	971	882	931	933	855
Kishtwar	977	986	843	922	924	863
Udhampur	912	924	849	887	897	820
Reasi	952	963	786	921	923	889
Jammu	819	831	801	795	776	820
Samba	798	804	778	787	785	797
Jammu and Kashmir	941	957	873	859	860	854

Source: Census of India 2011

Table 3 : Division wise child sex ratio in Jammu & Kashmir

Region	Total		Rural		Urban	
	2001	2011	2001	2011	2001	2011
Kashmir	983	854	999	851	919	862
Jammu	886	861	902	867	811	827
Ladakh	946	965	943	961	961	988

Table 4 : Distribution of Districts in the state by range of child sex ratio

Ranges	Total		Rural		Urban	
	2001	2011	2001	2011	2001	2011
Above 1000	6	0	6	0	2	1
950-1000	10	1	11	2	3	1
900-950	3	9	2	5	4	2
850-900	0	5	1	8	4	9
Below 850	3	7	2	7	9	9

preponderance of male child at birth can, thus, be related to widespread incidence of sex selective foeticide. In short the girl child is not wanted and therefore not allowed to be born, thanks to the use of modern medical technology: it should certainly be cause for concern to our leaders of society and the government.

In case of division wise the condition of Kashmir division is worse as compared to the Jammu and Ladakh division in child sex ratio from 2001-2011 as shown in table No.3. Districts by different range of child sex ratio (0-6years) for 2001 to 2011 are given in Table No.4 it is observed that highest increase is reflected in the range between 850-900 and below 850, in which the number of districts has increased from 3 in 2001 to 12 in 2011. However it is worrying to note that number of districts in the range of 950-1000 and above 1000 has been reduced from 16 in 2001 to 01 in 2011. The main reason behind this is that the growing widespread use of medical ultrasound technology to determine the gender of new born is thought to be one of the largest factors now affecting the girl-to-boy sex ratio in Jammu & Kashmir. The rural child sex ratio is not same all over the state. During 2001, 11 and 6 districts out of 22 districts of the state come under the range between 950-1000 and above 1000 which is closer to average rural sex ratio 957 of the state. Rest of the 5 districts of the state comes below 900.

The proportion of urban child sex ratio also varies again from one region to another region in the state, out of 22 districts in the state 13 and 18 districts respectively in 2001 and 2011 have the proportion of urban child sex ratio between ranges 850-900 and below 850 which is closer to the state average of 860 in 2001 and 854 in 2011. Of the remaining districts 4 comes in 900-950, 3 comes in 950-1000 and 2 comes in above 1000 ranges in 2001. In case of 2011, 2 districts come in 900-950 range and rest of 2 districts comes in 950-1000 and above 1000 ranges 1 each. The highest urban child sex ratio is found in Ladakh region of the state in Leh and Kargil districts which have 969 and 1029 respectively in 2011. The reason for the worsening of the child sex ratio in especially in urban areas despite higher level of education and affluence as compared to the rural areas is the availability of Pre Natal Sex Determination Test (PNDT). It shows that practice of sex determination was more common in the civilized areas of the state.

Table 5 : District wise Child Sex Ratio, Female Literacy, Male Literacy and Urbanization (2011)

Districts	Child Sex Ratio	Female Literacy Rate	Male Literacy Rate	Urbanization
Kupwara	854	54.79	77.10	11.33
Budgam	832	47.10	68.56	11.74
Leh	944	64.52	89.39	42.96
Kargil	978	58.05	86.73	8.89
Poonch	895	54.80	81.04	8.10
Rajouri	837	57.20	78.38	7.09
Kathua	836	64.56	81.40	14.38
Baramulla	866	55.01	77.35	17.19
Bandipora	893	46.24	68.41	16.89
Srinagar	869	63.48	77.95	98.73
Ganderbal	863	47.62	70.74	15.76
Pulwama	836	53.81	75.41	13.80
Shopian	883	52.77	71.86	5.62
Anantnag	832	54.16	74.13	26.04
Kulgam	882	49.72	70.58	18.77
Doda	932	50.34	80.36	7.95
Ramban	931	40.04	71.97	4.16
Kishtwar	922	44.13	71.75	6.42
Udhampur	887	58.22	79.93	19.72
Reasi	921	47.55	69.93	8.42
Jammu	795	77.41	89.77	49.65
Samba	787	77.39	89.76	16.83

Source: Census of India, 2011

Findings

Child Sex Ratio and Female Literacy Rate= -0.32 Low correlation

Child Sex Ratio and Male Literacy Rate = -0.059 Negligible correlation

Child Sex Ratio and Urbanization = -0.3 Low correlation

Interestingly, it has been observed in the study area that the three parameters i.e., female literacy rate, male literacy rate and urbanization do not have any significant correlation with child sex ratio. In case of female literacy rate it has been noted that Jammu, Samba and Srinagar depict high female literacy rate i.e. 77.41, 77.39 and 63.48 respectively where as the child sexratio figures fall, 795,787 and 869 shown in the table No.5 respectively. In case of male literacy rate and child sex ratio same phenomena has been observed and the recorded data has been Jammu, Samba and Kathua is 89.77, 89.76 and 81.40 for male literacy rate and the declined of child sex ratio

for the same districts has been 795,787 and 836 respectively. Urbanization too highlights the same trends as the first two indicators in which Srinagar, Jammu and Anantnag denotes 98.73, 49.65 and 26.04 figures and the child sex ratio stands decreases again with 869,795 and 832 values. On the other hand it has been noted that districts like Ramban, Doda, Kishtwar, Reasi and Kargil in which the female literacy rate and degree of urbanization is low even than the child sex ratio figures are high i.e. 931, 932, 922, 921, and 978 respectively. This observation clearly implies the mindset of the persons whom do not seem to have changed with the literacy as well as by getting urbanized. All kind of infrastructure which is provided by an urban area in turn has helped the mindset of the people to live with their tradition approach which bends towards the male choice.

Reasons for low child sex ratio in State

➢ Determining the sex of a foetus is illegal in India, but many clinics in Jammu and Kashmir offer the service for a small fee in the state, fuelling the demand for sex-selective abortions. Portable ultrasound machines are now available even in the most remote villages of the state.

➢ The Pre Conception and Pre Natal Diagnostic Technique (PCPNDT) Act was enacted in J&K in 2006. The 2001 Census has shown some districts of the state recording a higher number of girls than boys. Though the Pre Conception and Pre Natal Diagnostic Techniques (PCPNDT) Act to prevent female foeticide is in force in the state, it was not being implemented strictly following Jammu and Kashmir's decent performance in the last Census.

➢ Modern diagnostic tools for pregnancy have made it possible to determine a child's sex in the earliest phase.

➢ Another root cause of the problem is that a woman is being harassed after marriage.

➢ The birth of the girl child is considered as a bad investment in future. She is consider to be consumer rather than a producer.

➢ There are virtually no non-governmental organizations in Kashmir who are complaining against sex determination tests.

➢ The son preference attitude in Northern India. Some new trends, such as the two-child family encouraged by the Indian government gave birth to family planning effectively means, "planning for sons". Under two-child policy people express greater desire for sons and they did not want to take any risk.

Immediate steps taken by Jammu & Kashmir Government after 2011 Census

➢ Alarmed over the declining child sex ratio, the Jammu and Kashmir government has come up with a novel way to check female foeticide. The state government has announced a cash reward of Rs.25, 000 to anyone who provides information on doctors or families indulging in the crime. Jammu and Kashmir State in India is the first to announce such an award.

➢ All ultrasound clinics and genetic laboratories must be registered with appropriate authority and display a board/notice that sex determination of foetus is prohibited under law.

➢ The Health Department ordered the closure of nearly 100 ultrasound clinics across the state. Most of these clinics were not registered with the state department or had to failed submit the mandatory form F, filled at the time of each scan to record the patients history and reasons for undergoing the test.

➢ Now the government decides strictly to implement the Pre Conception and Pre Natal Diagnostic Techniques (PCPNDT) Act to prevent female foeticide in the state.

➢ The State has introduced a new initiative under NRHM in which a healthy fully immunized female child is given a cash award of Rs.500 with a view to ensure that the female babies are fully immunized.

Strategies for controlling the declining child sex-ratio

Following strategies were suggested for controlling the declining child sex-ratio:

➢ The existing PCPNDT Act, which aims at preventing female infanticide, must be implemented very strictly, judiciously and rigorously. Licenses of the doctors who perform sex selective abortions should be cancelled.

➢ On private institutions over which no effective control could be exercised, they should not be issued with licenses for carrying out prenatal diagnostic procedures and techniques. Only Govt. hospitals should be facilitated with these services.

➢ The NGO's, which work for women empowerment should take this serious issue on their agenda and give priority in their many interventions.

➢ The women *Self Help Groups* (SHG's) should take active lead in educating their SHG members and others in the society through organizing the social campaigns aggressively because it is need of the time to start a vigorous campaign against female forticide and infanticide.

➢ Men and women of our society need counseling to change their mindset. All men should know that they are responsible for determing the sex of the child and not only women. Mentality of people should be changed. Killing of the foetus is against human rights.

➢ Religious and Political leaders should be involved for spreading awareness against the every kind of women discrimination and also engage sarpanchs and panchs as they deal public at grass root level.

➢ Promoting the "*Save the Baby Girl Campaigns*" with the help of schools, colleges (particularly women's colleges) through NSS and other programs. Creating the awareness among college girlswho are in the age group i.e. 18-22 yrs through Saksharta Abhiyan. (through poster and banner exhibition in the colleges)

➢ Giving following motivational incentives to those couples who stop their issues after one or two baby girl issues-

1. Reservation in school and college admission.

2. Reservation in government jobs (State and central)

3. Housing loan with concessional interest rate to the couples with ½ baby girl issues.

4. Free education to the girls up to graduation.

➢ Totally ban on dowry system and strict punishments against woman crime. These are some important reasons that instigate families for sex determination tests.

➢ The most important suggestion for controlling child ratio is Value your daughter. Each one of us can change our immediate environment by treating our daughters equal to our sons. If each of us looks at the girl child with a changed mindset, it will break the prevailing social apathy.

Conclusion

The study has revealed that families resort to various practices such as sex selection

techniques, foeticide, infanticide and neglect to do away with the girl child at pre-birth or conception or infancy stage itself, and also due to many social reasons like the increasing demand of dowry, the increasing violence against women, prevention of division of poverty, etc., to name a few. Therefore, it is the need of the time that the government's as well as the society's efforts to ensure the safety of women and girls at all stages. The declining sex ratio is warning signal for the state government to wake up. The matter should be taken seriously; we are leading towards a crises situation.

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Determination of Climatic Type of the Kuhdasht Synoptic Meteorological Station of Lorestan Province, Iran

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The climatic behavior of each area is predictable using the long-term data and applying the appropriate method of climatic classification for the area under study. The basic objective of the present study is to determine the climatic type of the Kuhdasht synoptic meteorological station and to achieve the desirable result , the following steps have been followed. At the first stage, we collected the total annual rainfall and average annual temperature data for the Kuhdasht meteorological station from year 1998 up to year 2014 for the duration of 17 years. At the second step using the De Martonne method drought coefficient for each listed years has been calculated. At last ,drought coefficient obtained for 17 years is being averaged which comes to 14.40. As per De Martonne classification table, climatic type of the Kuhdasht synoptic meteorological station falls into the category of Semi-dry climate. This means that the Kuhdasht station experiences a dry season followed by rainy season. The dry season would be at least, more than three months. In the case of Kuhdasht station, it observes dry season or low rainfall season for longer period than its rainy season and often observes the activities associated with an air mass in range of our study station during every year.

Keywords : De Martonne, County, Semi-dry climate, Kuhdasht, Drought coefficient

Introduction

The major crisis in production of food materials in the world is caused by the widespread occurance of frequent copious droughts particularly in Africa. Many of the social and environmental problems have arisen need to focus upon climatic factors.This recognition has been continuing since a lot of human problems depend upon fragile effects of climate (Faraji, 2005). Existance of diffrent enviromental economic potential , searching of human for increasing food resource and development of urban and industrial centres have increased amplitude of their information in diffrent climate. Therefore the climatic classification of an area has become necessary since many of the elements of weather and climate play crucial role in the developmental processes.

The climate of each area is average of the long-term atmospheric condition for that area (Jafarpur, 2006). The atmospheric condition consists of observed rainfall , temprature, humidity, the sun radiation and

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speed of wind. These are really the result of the consequences of observed weather condition of the atmosphere at a particular space and time and from combination of these atmospheric weather elements for long period we determine climate of that area. Geographic position, topography, distance from sea, occuring in the direction of warm, cold and dry winds,weather, and the combination of these factors beget the climatic brigade effectively. The angle of incidence of sun radiation is also an other effective factor in begetting the climatic brigade.In fact the determination of type of climate of a region is the recognition of a method which is based on the application of a scientific method using relevant informations and this might be useful in performance of different planning. Therefore in this paper an attempt has been made to determine the climatic type of the Kuhdasht meteorological station to help the various development programs. This meteorological station is located in the center of a big plain, therefore the recognition of climatic behavior of this station will be of much significance and importance, specially in the adaptation of agricultural activities. Hitherto, a lot of researches have been done regarding climatic classification using different methods of classification. De Martonne method for instance was applied by Zareiee in 2014, in the evaluation of spatial variation in climates of Iran. He has arrived to the result that Iran experiences differen types of climate i.e. hyper dry, semi dry, humid and hyper humid and the climatic category of hyper dry has had a ascending trend. Botzan , et al. 2013 have applied this method in the paper under title 'Modified the De Martonne aridity index : Application to the Napa Basin, California. A new classification scheme was presented by Sadeghi Sangdehi, et al. in 2009.They have presented a paper about the study of efficiency of geostatistics methods for the purpose of climatic classification of the Isfahan Province and have designed a climatic classification map applying GIS.They have arrived to the result that 80% of the province area of Isfahan is located in dry and semi dry area. However there are a lot of similar researches in other different area of the world which do not need to mention all of them here.

The study area

Location of the Kuhdasht county lies between 33º 9¹ to 33º 56' N latitude and 46^0 51' to 47º 50' E longitude (Face of economic,society,...of the Kuhdasht county, 2008). This county is located in the west of Lorestan province in the west of Iran. According to the maps of the country mapping organization, the area of the Kuhdasht as obtained by GIS is 3982.133 sq.km. The Kuhdasht synoptic meteorological station is located in the east part of the Kuhdasht county.

Discussion and Result

For determination of type of climate of an area, there are many of the climatic classification methods amongst which each one has more suitability and conformity to the prevailing climatic condition of that area. Hitherto several scientists have presented climatic classification schemes with specific formula and that one each has specific degree of credibility. The Greeks had performed the first climatic classification. Rapid progress of technology and utilization facilities of computer softwares like Arc GIS and Arc Info which are giving us easy application opportunity and the possibility of utilization of several other

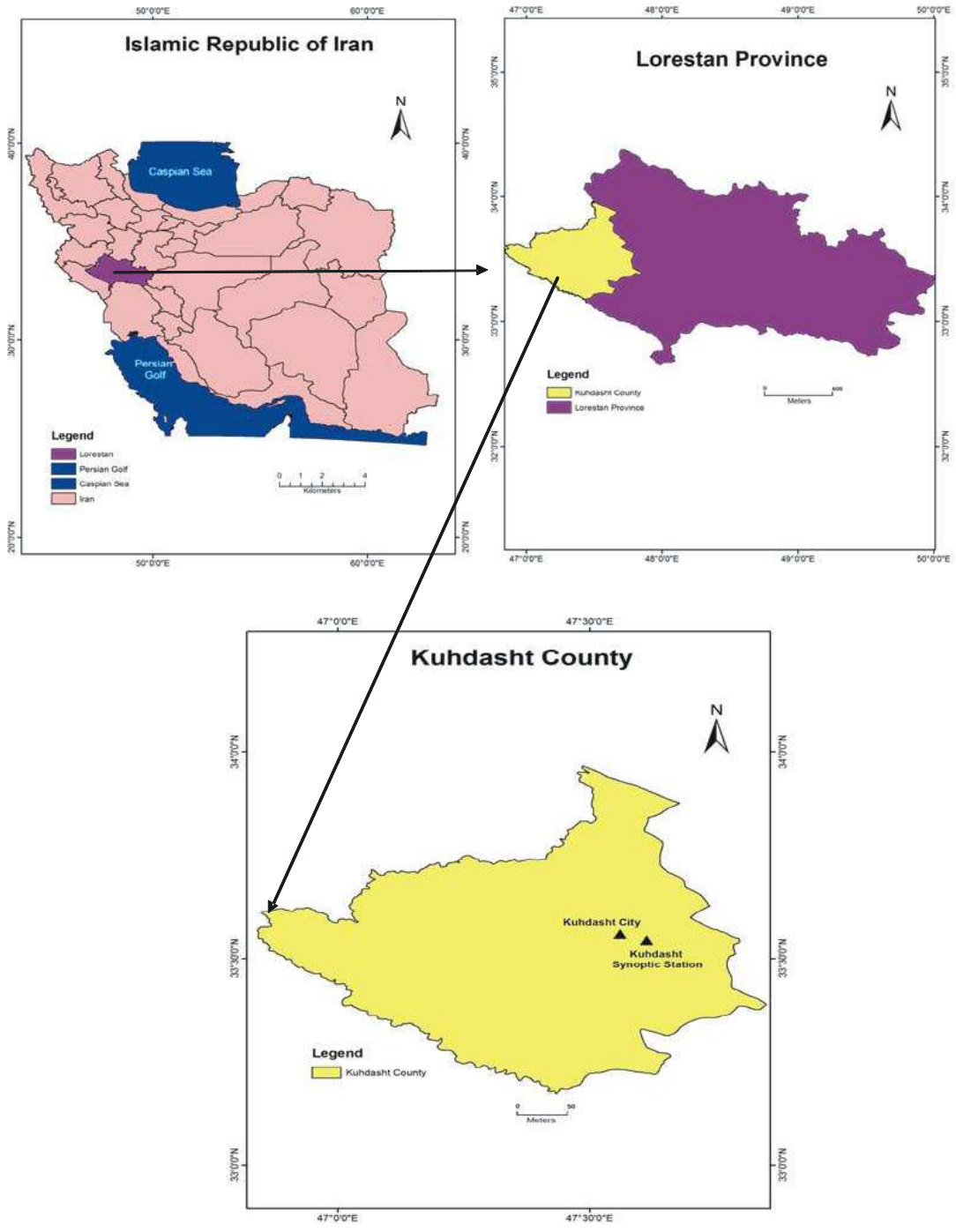
Islamic Republic of Iran
Caspian Sea
Persian Golf
Legend
Lorestan
Persian Golf
Caspian Sea
Iran
Lorestan Province
Legend
Kuhdasht County
Lorestan Province
Kuhdasht County
Kuhdasht City
Kuhdasht Synoptic Station
Legend
Kuhdasht County

Fig. 1

complex parameters. Furthermore easy availability of climatic elements data like temperature and rainfall have encouraged the interest of scientists towards the study of climatic classification. The climatic classification scheme often has been applying the available data about the atmospheric factors like temperature and rainfall and also the presence of types of vegetation since 18th century and there after too. The climatic classification methods can be divided into two categories empirical or generic and genetic methods.The empirical or generic method is based on observed climatic elements themselves or their effects on other phenomenon usually vegetation or man to cause observable effect of climate on total environmental phenomenon. The classification methods of Thornthwaite (1948), Hans((1802), De Martonne(1909), Koppen (1918) and Ambrgeh (1955) can be put into the generic approach. The second type of climatic classification i.e. genetic approach focuses upon the climatic controls i.e. general circulation of atmosphere, net radiation and moisture fluxes which are responsible for begetting the types of climate. The basis and origin of these classifications are causal factors of climate like the sun radiation, property of air mass,atmospheric general circulation (Sayedan, et al.1997).

The purpose of climatic classification is to analyze the weather informations yielded from atmospheric situation for atmospheric elements, for long period with use of specific formula in specific frame and in specified time and submit the result.Therefore the climatic classification system is a set of laws that with applying them,can separate regions that from certain point of view, has common property from together and put those regions with common property in one class (Jafarpur.2002). In this paper for determination of type of climate of the Kuhdasht station , De Martonne method has been used. Total amount of annual rainfall and total average of annual temperature of this station have been obtained for the period of 1998 to 2014. Then the concept of arithmetic average has been applied to calculate of the drought coefficient of this station.To the other expression, drought coefficient has been calculated for the statistical periods from 1998 to 2014 and all these drought coefficients have been added together to get the average which has been obtained as 14.40 for the Kuhdasht station. Conformation of this drought coefficient with the De Martonne classification, it exists in the range of between $10 < I < 20$.The result,according to the De Martonne climatic classification, Kuhdasht meteorological station comes into the category of semi-dry climate. The table 1 shows the pattern table for the De Martonne climatic classification method and

Table1: Pattern table of climatic classification by De Martonne method

Climatic Type	Drought Coefficient
Per-humid B	$I > 55$
Per- humid A	$35 < I < 55$
Humid	$28 < I < 35$
Subhumid	$24 < I < 28$
Mediterranean	$20 < I < 24$
Semi – dry	$10 < I < 20$
Dry	$5 < I < 10$
Extra dry	$I < 5$

Table 2: Average monthly and total annual rainfall in mm at Kuhdasht station for the statistical period 1998 to 2014

Month Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total annual rainfall
1998	67.3	59.6	78.3	74.7	28.0	0.2	0.0	0.0	0.0	6.7	43.4	0.2	358.4
1999	60.9	50.1	67.8	13.2	2.2	0.0	6.2	1.5	0.0	0.0	63.3	68.0	333.2
2000	50.4	53.2	0.8	19.5	8.0	0.0	0.0	0.1	0.0	54.9	31.3	123.8	342
2001	50.4	71.2	55.5	70.7	66.2	4.6	0.0	0.0	0.0	1.0	20.4	91.1	431.1
2002	58.6	45.9	55.2	109.6	7.9	0.0	0.0	0.0	0.0	1.6	80.1	63.1	422
2003	27.6	82.2	13.1	44.0	18.1	1.2	0.0	0.0	0.0	2.5	107.7	93.4	389.8
2004	106.1	66.7	0.5	39.8	49.9	0.1	0.0	0.0	0.0	1.6	59.4	70.5	394.6
2005	63.8	49.1	96.2	76.6	25.0	10.7	0.0	0.0	0.0	0.0	41.7	17.8	380.9
2006	71.2	186.4	6.5	102.4	16.7	1.0	0.0	0.0	0.0	13.7	122.5	42.0	562.4
2007	32.6	104.1	50.3	98.6	43.5	0.6	0.0	0.0	0.0	0.0	6.7	72.5	408.9
2008	31.1	16.4	23.0	8.8	13.7	0.0	0.0	0.0	12.0	0.0	77.5	60.2	242.7
2009	12.9	25.1	8.9	55.0	17.1	2.1	0.0	0.0	6.2	0.0	153.3	37.8	318.4
2010	22.8	40.3	61.6	60.7	78.0	0.2	0.0	0.2	0.0	0.6	2.5	39.2	306.1
2011	30.0	77.8	53.7	34.0	104.0	0.0	0.0	0.0	0.0	0.0	93.9	3.8	397.2
2012	4.8	26.2	17.7	91.0	11.8	0.0	0.0	0.0	0.0	2.7	42.3	57.0	253.5
2013	61.4	60.6	28.0	9.9	91.9	0.1	*0.0*	*0.0*	*0.0*	*0.0*	*69.1*	*52.3*	*373.3*
2014	75.0	51.1	72.2	59.3	26.6	2.0	0.0	1.1	1.8	41.1	36.8	59.1	426.1

Source : Kuhdasht synoptic station ,Iran

table 2&3 are the raw data regarding precipitation and temperature for the said period and table 4 shows the drought coefficients of each year for the statistical period 1998 to 2014 of the Kuhdasht station obtained by simple expression given below.

Statistical period :1998 to 2014

$$I = \frac{p}{T+10}$$

p= total amount of annual rainfall in millimeter

T= total average annual temperature in ^{0}C

I = Drought coefficient

Conclusion

The amount of rainfall as listed in the table - 2 is self explanatory. More rainfall have been appertained to the seasons of autumn and winter in each year. The highest amount of annual rainfall has existed to the amount 562.4

Table 3: Average monthly and average annual temperature in ^{0}C at Kuhdasht station for the statistical period 1998 to 2014

Month Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total annual rainfall
1998	1.1	5.1	6.8	12.6	16.5	22.8	27.1	28.8	25.7	19.1	13.2	10.6	15.78
1999	7.9	6.3	8.0	11.1	18.2	24.3	27.1	29.3	25.1	20.0	12.8	8.2	16.52
2000	5.4	4.1	6.2	13.7	18.2	23.3	28.1	28.7	23.6	17.2	12.5	7.2	15.68
2001	5.9	4.9	8.6	13.2	16.7	22.4	26.5	29.0	23.5	19.8	12.8	8.7	16
2002	6.2	4.8	9.3	11.1	15.3	21.7	26.0	26.5	23.4	20.5	12.8	7.4	15.41
2003	4.7	5.8	7.4	12.7	16.5	22.4	26.3	26.9	22.8	19.6	13.1	7.8	15.5
2004	6.5	6.3	10.6	11.8	16.3	22.3	26.8	27.0	24.2	20.0	14.3	5.1	15.93
2005	4.7	3.5	8.9	11.9	17.5	22.9	26.9	27.8	22.8	19.2	11.9	10.4	15.7
2006	4.7	6.2	9.6	12.6	17.4	24.0	27.6	28.6	24.7	19.5	12.3	4.6	15.98
2007	2.1	5.1	7.7	10.5	17.4	24.1	26.4	27.7	24.6	19.1	13.5	7.0	15.43
2008	0.1	4.3	9.1	15.5	18.2	24.3	28.7	28.8	25.1	19.5	12.0	6.2	15.98
2009	4.0	6.5	8.5	10.2	17.5	24.0	27.5	27.4	23.8	18.1	12.9	6.9	15.60
2010	7.7	6.2	10.6	12.4	17.1	24.4	27.6	28.8	25.7	21.1	14.2	8.8	17.05
2011	5.6	4.8	8.4	12.2	17.5	24.1	27.6	28.5	24.9	18.5	10.9	5.0	15.66
2012	4.7	3.9	5.3	12.0	18.7	24.8	28.0	29.3	25.1	20.4	13.8	7.7	16.14
2013	4.7	7.5	9.7	13.5	15.9	23.3	28.3	26.9	24.0	17.5	12.3	7.5	15.92
2014	3.9	5.2	9.7	12.2	18.5	23.6	28.2	28.4	25.0	19.0	10.8	8.3	16.06

Source : Kuhdasht synoptic station ,Iran

mm in 2006 year and the lowest amount of annual rainfall has existed to the amount 242.7 mm in 2008 year. The maximum temprature has been appertained to the season of summer.Highest maximum annual average temprature has been recorded as 17.05 degree centigrade in the year 2010 and the lowest average of annual temprature has been observed as 15.41 degree centigrade in year of 2002. These raw data are good evidences of variation in two important climatic elements that shows the overview of climatic condition of the case study station Kuhdasht.

With careful observation of the available data of rainfall and temperature for duration of 17 years, and belief that the rainfall and temperature together play more than 80% role in determination of climatic type, De Martonne method has been applied for the determination of type of climate of the Kuhdasht meteorological station. Drought coefficient obtained by this method is 14.40 which as per

Table 4: Variation in Drought coefficient obtained for the meteorological station Kuhdasht for the period 1998 to 2014

Year	Drought coefficient
1998	13.90
1999	12.56
2000	13.31
2001	16.58
2002	16.60
2003	15.28
2004	15.21
2005	14.82
2006	21.64
2007	16.07
2008	9.34
2009	12.43
2010	11.31
2011	15.47
2012	9.69
2013	14.40
2014	16.35

Source : Computed by author using the above mentioned mathematical expression

table -1 shows the semi-dry type of climate at Kuhdasht station. There are many reasons for establishment of semi-dry climate at Kuhdasht meteorological station. (i) The existence of low and sporadic rainfall during continuous 4 months from June to Sept.every year.This problem causes to accelerate the process of evaporation. (ii)The establishment of high pressure at the sub-tropical latitudes in the end of spring and overall in the summer season.This phenomenon causes to prevent the occurrance of rainfall during this period.(iii) The proximity with the Iraq and the Saudi Arabian deserts : This factor causes to blow dry and hot winds which prevent the neccessary saturation condition for water vapor in the atmosphere at the end of spring. (iv) The activity of an air mass i.e. Mediterranean in the whole year which causes rainfall in the autumn and winter season. However, these factors have been effecting combinedly and ultimately affirms the semi-dry type of climatic condition at the Kuhdasht meteorological station.

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An Inventory of Brick Kilns in Kanpur Dehat District

Srabani Sanyal and Divanshu S. S. Niranjan

Urbanization in India is characterized by unplanned and uncontrolled growth leading to urban sprawl. As a result there is an increase in the demand of infrastructural facilities such as housing, transport and communication which requires large quantities of constructional materials such as bricks. Brick making is a traditional industry but has emerged as an important activity. India is the second largest producer of clay bricks in the world after China with an estimated brick production of around 140 billion bricks per year from nearly 50,000 small/ cottage scale brick kilns distributed throughout India. There are 3.5 million workers employed in this sector. For manufacturing bricks at least 2.4 hectares of land is required; 0.8 hectares for the brick kilns itself and 1.6 hectares for digging out 0.9 meters of topsoil. Brick making has directly or indirectly caused environmental and health problems. The present study tries to investigate the distribution of brick kilns in Kanpur Dehat district in India and examine the type of workforce engaged in brick kilns in the study area.

Keywords : Brick making, Brick kilns, Workforce

Introduction

Brick making is one of the most ancient industries, the craft is as old as that of the Indus Valley Civilization (2500-1500 B.C.). Fired bricks were used by the ancient people of the civilizations of Egypt and Mesopotamia for building tombs and temples (Muhammad, 2006).The brick kiln operation over the years not only covers the neighbouring area of vegetation with layers of brick dust, but also alters the physico-chemical properties and habitats of nearby soils by destroying the top soil nutrient elements and soil biota which are likely to impact species diversity and biomass structure of the neighbouring plant communities (Gupta and Narayan, 2010).

The brick making industry in developing countries is mostly in the informal sector. The worldwide brick production in developing countries is 1,266 billion bricks per annum, which is from three main regions: China producing 700 billion bricks (55.3%); India producing 144 billion bricks (11.3%) and Asia, Africa, South America and Mexico producing 422 billion bricks (33.4%). To produce these 1, 000 billion bricks, the Asian brick industry consume 110 million tons of coal per annum. There are approximately 3, 00,000 polluting brick kilns throughout the developing world with over 1, 00,000 estimated to be in India alone. The

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brick industry in India is the third largest user of coal, over 30 million tonnes per year. Out of the total National Carbon Emission (180 million tons of CO_2), 17 percent are from construction sector which is roughly one-third of the total CO_2 emissions of the global airline industry (550 million tons of CO_2) (Heierli and Maithel, 2008).

India is the second largest producer of bricks (140 billion) after China. Brick making in India is still a manual process and is rapidly developing to meet the increasing brick demand for construction (Singh and Asgher, 2005). It is a source of income for many small farmers and landless agricultural workers especially in South Asia, where workers along with their families migrate to brick kilns in North India and Nepal for six months to work as moulders and firemen in brick kilns. Moreover, in brick kilns the working condition is poor and exploitative and sometimes wages are well below the minimum as specified by the Government. Workers live in temporary housing without access to basic sanitation, water and electricity. Such condition prevails in Kanpur Dehat district in Uttar Pradesh, which is one of the major pocket of brick production in North India.

History of brick and brick making

Bricks are one of the oldest known building materials dating back to 7000 BC. They were first found in Southern Turkey around Jericho. The first bricks were sun dried mud bricks. Fired bricks were found to be more resistant to harsher weather conditions, which made them much more reliable for use in permanent buildings, where mud bricks would not have been sufficient.

The Ancient Egyptians also used sun dried mud bricks as building materials, evidence of which can be seen today at ruins such as Harappa and Mohenjo-Daro. These bricks consisted of a 4:2:1 ratio which enabled them to be laid more easily.

The Romans further distinguished those which had been dried by the sun and air and those bricks which were burnt in a kiln. Preferring to make their bricks in the spring, the Romans held on to their bricks for 2 years before they were used or sold. Using mobile kilns, the Romans were successful in introducing kiln fired bricks to the whole of the Roman Empire. These bricks differed from other ancient bricks in size and shape. The Greeks also considered perpendicular brick walls more durable than stone walls and used them for public edifices.

During the 12th century bricks were reintroduced in Northern Germany from Northern Italy. This created the brick Gothic period which was a reduced style of Gothic architecture previously very common in Northern Europe. The buildings around this time were mainly built from fired red clay bricks.

With modern machinery, powerful electric motors and modern tunnel kilns, making bricks has become much more productive and efficient. Bricks can be made from variety of materials and the most common being clay but calcium silicate and concrete are also used. With clay bricks being the more popular, they are now manufactured using soft mud, dry press and extruded process. In 2007, '*fly ash'* brick was manufactured from the by-products of coal power plants.

Brick industry in India

Brick making in India is a small-scale, traditional industry with mostly all the kilns

located in the rural and peri-urban areas. These brick kilns are generally of medium and large production capacities (2–10 million bricks per year). In India, brick industry can be grouped into three broad regions i.e. Northern Mountains, Gangetic Plain and Peninsula. The Gangetic Plains of North India account for 65 percent of total brick production. Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal are the major brick producing states in this region (Singh and Asgher 2005). The brick industry is mainly unorganized with only a small number of units registered with the department of Micro, Small and Medium Industries (MSME) unit. Brick units are normally set up on leased-out lands on temporary permission for seasonal operation every year. The industry is characterized by traditional firing technologies with high emissions, manual labour, low mechanization rate, small-scale brick kilns with limited financial, technical and managerial capacity, dominance of single raw material (clay) and firing fuel burnt at a temperature of 700 -1100^{0}C (Maithal and Uma, 2012).

Brick making process

In India, making of common clay bricks consists mainly of five operations *i) soil winning ii) soil-mix preparation iii) moulding iv) drying and v) firing:*

Soil winning: The brick making process starts with the mining of soil or soil winning. In India, soil winning operation is mostly carried out in agriculture fields by manual excavation of soil at a depth of around 1 m. The typical human energy requirement for soil winning and soil-mix preparation is 2 to 4 persons per hour for making 1000 bricks.

Soil-mix preparation: During soil-mix preparation, water is added to the soil. The typical moisture content of the mix is about 25-35percent w/w. At this stage, internal fuels such as rice husks, saw dust, powdered coal, fly ash etc. are added to the soil with water and mixed into a homogenous mass. All operations during soil-mix preparation are carried out manually.

Moulding: During moulding, the clay mass is transformed into the shape of brick. In the manual method or hand moulding, the prepared soil-mix is filled into a wooden or metallic mould and excess soil is scraped off. The typical human energy requirement for hand moulding is 15 to 25 person per hour for moulding 1000 bricks.

Drying: Freshly moulded green bricks (unbaked bricks) are left in open for drying. The combined action of the sun and wind removes the moisture in the bricks. Typical 400 to 800 kg of moisture per 1000 bricks is removed during the drying process. In the case of artificial drying, fuel is burnt to supply energy (2,900 - 8,200 MJ) for drying 1000 bricks (containing 700 g of water).

Firing: The brick firing process consists essentially of increasing the temperature of the bricks progressively over a period of time, holding it at a peak temperature of about 1000^{0}C, and then cooling back to the ambient temperature (Maithal and Uma, 2012).

The present study tries to investigate the distribution of brick kilns in Kanpur Dehat district. It also examines the type of workforce engaged in brick kilns to assess its composition in the study area. In view of the content, following are the broader objectives of the study:

Objective

1. To study the history of brick and brick industry in India.
2. To assess the distribution pattern of

Table 1: Distribution of Sampled Brick Kilns, Kanpur Dehat District

Sl. No.	Name of Block	Total Brick Kilns (in No.)	Type of Brick Kilns (in No.)		Sampled Brick Kilns (in No.)
			Working	Abounded	
1	Kakwan	1	1	-	1
2	Jhinjhak	8	8	-	4
3	Rasulabad	6	6	-	3
4	Maitha	8	8	-	4
5	Sandalpur	9	9	-	5
6	Sarbankhera	11	11	-	6
7	Derapur	12	12	-	6
8	Malasa	15	15	-	8
9	Akbarpur	18	18	-	9
10	Rajpur	22	22	-	11
11	Amrodha	95	95	-	48
	Total	205	205	Nil	105

Source: Personal Survey, 2014-15

brick kilns in Kanpur Dehat district.

3. To identify the type of workforce engaged in brick kilns.

Methodology

To conduct the present study relevant data was obtained both from primary and secondary data sources. Primary data was collected from field survey and field observation by interview schedule. Interview schedule was distributed among selected samples (Unit Survey) to acquire information related to brick kilns. Out of the total 205 working brick kilns, 105 has been selected so that atleast 50 percent of the total no. of brick kilns in each block is represented (table 1).

However, secondary data was collected from different governmental and non-governmental sources such as Census of India (2001), District Handbook of Kanpur Dehat (2011) and other relevant literatures. Further, along with field survey the result has been anticipated through comparative analysis and interpretation of remotely sensed temporal dataset. The topographical sheet number 54 N/9, 54 N/10, 54 N/11, 54 N/12, 54 N/13, 54 N/14, 54 N/15, 54 N/16 63 B/2, 63 B/3, 63 B/4 has been digitized along with satellite imageries to delineate the location of brick kilns in the study area. The Arc GIS was used for delineating and mapping the brick kilns.

Study Area

Kanpur Dehat district ($25^0 56'$ N to $26^0 0'$ N latitude and $79^0 30'$ E to $80^0 0'$ E longitude) is situated in lower doab of River Ganga and Yamuna at a stretch of 3,021 Km^2. Two types of topography are distinctly found i.e. the plateau of Ganga-Yamuna and its badland topography. On the basis of geological structure, soil, topography, climate and natural vegetation the area is further divided into three

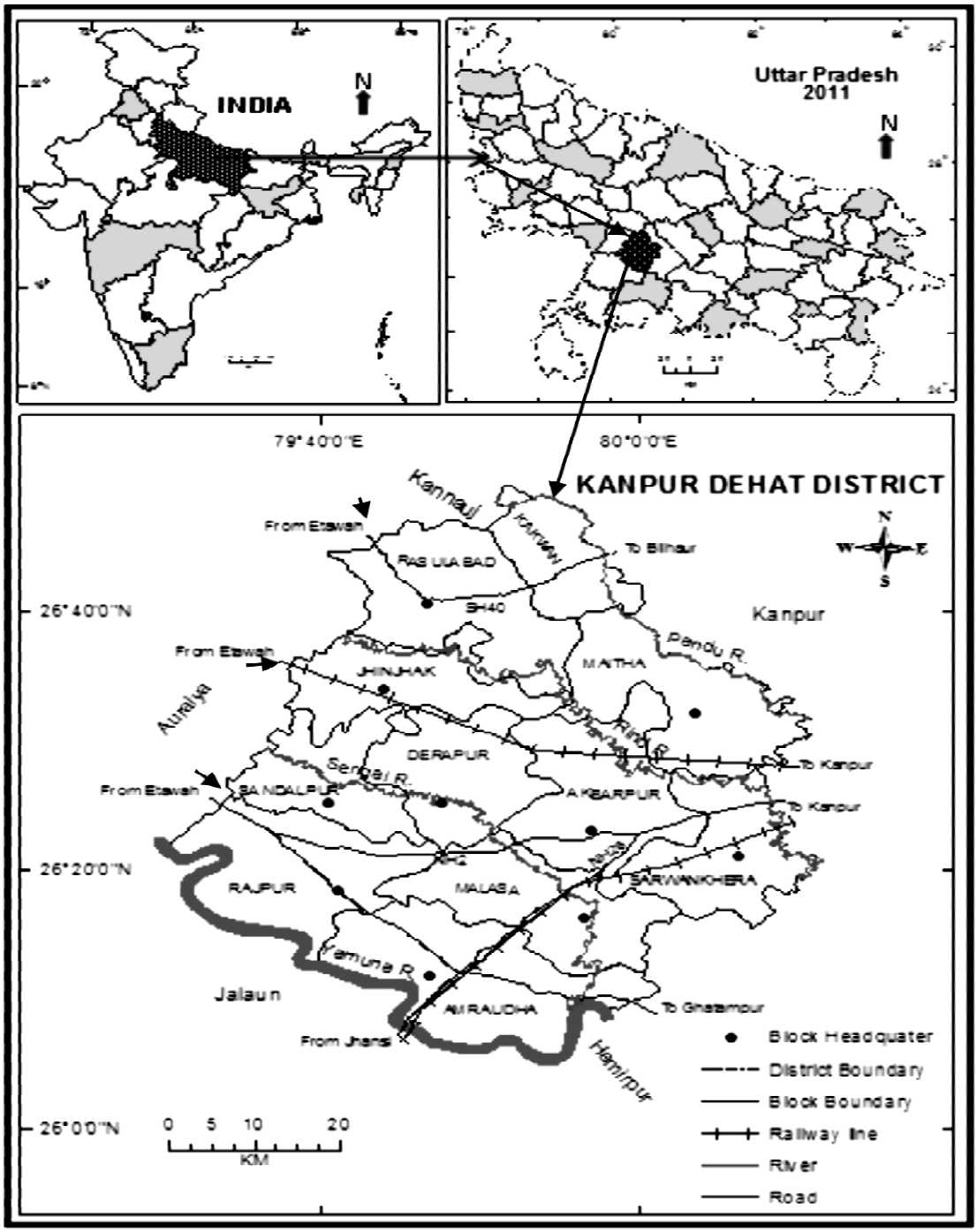
INDIA
N
Uttar Pradesh
2011
N
79°40'0"E
80°0'0"E
KANPUR DEHAT DISTRICT
Kannauj
From Etawah
To Bilhaur
RASULABAD
SH40
Kanpur
26°40'0"N
From Etawah
JHINJHAK
MATHA
Pandu R.
Auraiya
Rind R.
DERAPUR
Sengar R.
To Kanpur
From Etawah
SANDALPUR
AKBARPUR
To Kanpur
26°20'0"N
RAJPUR
MALASA
SARVANKHERA
Yamuna R.
Jalaun
AMRAUDHA
To Ghatampur
From Jhansi
Hamirpur
Block Headquater
District Boundary
Block Boundary
Railway line
River
Road
26°0'0"N
0 5 10 20
KM

Fig. 1

Table 2: Administrative Division, Kanpur Dehat District

Sl. No.	Name of Tehsil	Sl. No.	Name of Block	Gram Panchayat	Villages		
					Inhabited	Uninhabited	Total
1.	Akbarpur	1.	Akbarpur	59	101	4	105
		2.	Maitha	70	111	5	116
		3.	Sarvankhera	54	75	0	75
2.	Derapur	4.	Derapur	53	78	3	81
3.	Rasoolabad	5.	Rasulabad	86	84	8	92
		6.	Jhinjhak	47	73	3	76
		7.	*Kakwan	-	-	-	56
4.	Bhognipur	8.	Amraudha	69	105	14	119
		9.	Malasa	61	105	15	120
5.	Sikandara	10.	Sandalpur	53	86	5	91
		11.	Rajpur	60	105	15	120
			TOTAL	612	979	72	1051

Source: Statistical Handbook, 2011

physiographic regions i.e. Plain of River Rind, Plain of River Sengai, and Badland topography of River Yamuna. The major rivers running through the district are river Yamuna, Pandu and Rindh (fig 1). The soil type in this region can be broadly classified into six categories based on its characteristics. These are Ganga flat and recent alluvial, Ganga upland and lowland, Yamuna flat and recent alluvial soil. The district experiences three seasons with maximum temperature in the month of May (39.76^0C) and minimum (8.69^0C) in December. The average rainfall is 862.76 mm per annum.

History and Growth of Kanpur Dehat District

Old name of Kanpur was "*Kanhpur*" which was a small village at the bank of Holy Ganga, given by Hindu Singh of Sachendi and Ghanshyam Singh of Ramaipur. The British ruler Hobson Johnson found the word difficult to pronounce and he changed it to Cawnpore. Later on it was renamed as Kanpur. In 1977, Kanpur district (Kanpur Nagar District) was divided into two separate districts namely Kanpur Nagar and Kanpur Dehat to ensure smooth and proper administration. Kanpur Dehat was again renamed as Ramabai Nagar (2010) and later on as Kanpur Dehat (2012). It is surrounded by Kanpur Nagar, Jalaun, Hamirpur, Etawah district (GOI, 2010). Presently, there are 1051 villages, 5 tehsil and 11 blocks namely Kakwan, Jhinjhak, Rasulabad, Maitha, Sandalpur, Sarbankhera, Derapur, Malasa, Akbarpur, Rajpur and Amrodha in the study area (Statistical Handbook, 2011).Out of the total villages 1051 villages, (979) are inhabited with 84 in Rasulabad block only. There are 1 Nagar Palika Parisad, 8 Town areas, 102 Nyaya Panchayat and 612 Gram Sabhas (table 2).

District Kanpur Dehat is well connected

Table 3: Block-wise Distribution of Inhabited Villages, Kanpur Dehat District, 2011

Name of Block	Primary School (in No.)	Length of road (in No.)	Agricultural Implement (Tractor) (in No.)
*Kakwan	N/A	N/A	N/A
Jhinjhak	151	182	661
Rasulabad	264	279	754
Maitha	190	298	691
Sandalpur	109	123	610
Sarbankhera	144	191	681
Derapur	116	219	473
Malasa	141	222	545
Akbarpur	178	184	632
Rajpur	155	199	574
Amrodha	197	176	584
TOTAL	1645	2173	6205

Source: Statistical Handbook, 2011

* N/A: Data Not Available

by roads with rest of the country. National Highway 25 connects the district with Jhansi, Bombay, Kanpur and Lucknow city. The total length of pucca road in the district is 839 km. However, road network in the rural areas is insufficient. The district is well connected by Northern and Central Railway. The total length of railway line is 210 km (Statistical Handbook, 2011). The health care facilities are not sufficient in number in compare to its total area and population. There are only two district hospitals with 11 CHC's, 36 PHC's and 217 sub-centers in the district. The educational institutions are also not adequate in number. There are only 1645 primary and 49 secondary schools with no technical institution to support. As a result unskilled workers are increasing in unorganized sectors such as brick kilns in

Table 4: Population and Health Indicator, Kanpur Dehat District, 2011

Indicator	India	Uttar Pradesh	Kanpur Dehat
Crude Birth Rate/1000	27.2	33.5	85.5
Crude Death Rate/1000	9.0	10.3	10.3
Infant Mortality Rate/1000	71	85	85
Couple Protection Rate/100	45.5	39.1	36.5
Male & Female Ratio/1000	927	879	852
Density of Population/Sq. Km	274	472	517
Total Fertility/1000	3.8	5.67	4.5

Source: Census of India, 2011

Kanpur Dehat district (table 3).

Population

In compare to India and Uttar Pradesh, the average birth rate (85.5), death rate (0.3) and infant mortality rate (85) per thousand in Kanpur Dehat district is much above average.

During 2001-2011, the growth rate was 14.82 percent and at this rate population is expected to double. The sex-ratio (862 females for every 1000 males) and the literacy rate (77.52 percent) are well below the average indicating poor socio-economic condition, lack of infrastructural development and inadequate health care facilities in the district (table 4). The population of Kanpur Dehat district is 17, 96,184 persons with 9, 63,255 males and 8, 32,929 females (Census, 2011). The population density is 594 persons per square kilometer (1,540/sq. mile). The density is highest in Amrodha block (1167 per Km^2) due to good connectivity and availability of fertile land (table 5) (Census, 2001).

Distribution of Brick Kilns

Brick-making is an important economic activity in rural India. There are over 1, 00,000 brick kilns producing more than 140 billion bricks per year (Asgher, 2004). There are 205 brick kilns distributed in Kanpur Dehat district. Maximum number of brick kilns (95) are found in Amrodha block because of its strategic location, availability of market, labour, easy accessibility. Out of the total 1051 villages, 103 have brick kilns in its surrounding (table 6 & fig 2).

Table 5: Block-wise Distribution of Population, Kanpur Dehat District, 2001

Name of Block	No. of House Hold		Population						Scheduled Caste		Popul-tion D-ensity
			Total		Male		Female				
	No.	%	No.	%	No.	%	No.	%	No.	%	Per sq. Km
Rasulabad	25233	10.4	154747	10.63	83589	10.63	71158	10.64	38494	10.39	463
Jhinjhak	20965	8.64	124684	8.57	67802	8.62	56882	8.5	33848	9.13	615
Kakwan	11288	4.65	67659	4.65	36810	4.68	30849	4.61	17629	4.76	412
Maitha	26479	10.91	158060	10.86	85511	10.87	72549	10.85	42422	11.45	611
Derapur	19215	7.92	114533	7.87	62030	7.89	52503	7.85	29100	7.85	555
Akbarpur	24046	9.91	147410	10.13	79408	10.09	68002	10.17	37215	10.04	498
Sarbankhera	26139	10.77	155949	10.71	84018	10.68	71931	10.75	44175	11.92	582
Malasa	22558	9.3	134152	9.22	72135	9.17	62017	9.27	36360	9.81	409
Amrodha	27571	11.36	163816	11.25	88058	11.19	75758	11.32	38159	10.3	1167
Sandalpur	18109	7.46	106659	7.33	57786	7.35	48873	7.31	27247	7.35	752
Rajpur	21079	8.69	127900	8.79	69477	8.83	58423	8.73	25997	7.01	547
Total	242682	100	1455569	100	786624	100	668945	100	370648	100	601

Source: Census of India, 2001

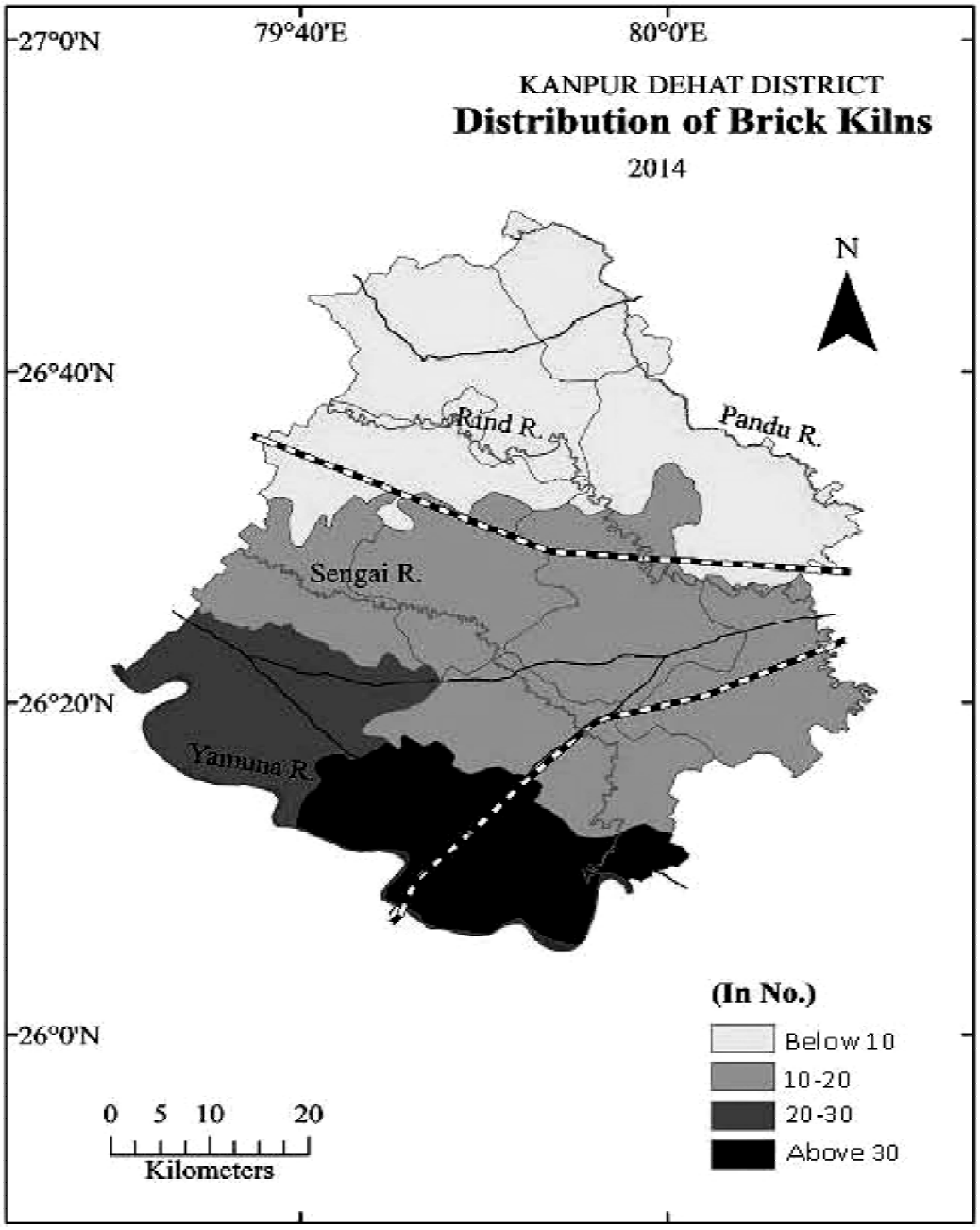
27°0'N
79°40'E
80°0'E
KANPUR DEHAT DISTRICT
Distribution of Brick Kilns
2014
N
26°40'N
Rind R.
Pandu R.
Sengai R.
26°20'N
Yamuna R.
(In No.)
Below 10
10-20
20-30
Above 30
26°0'N
0 5 10 20
Kilometers

Fig.2

Table 6: Location of Brick Kilns and Number of Villages, Kanpur Dehat District, 2014

Sl. No.	Name of Block	Brick Kilns (in No.)	Number of Villages (in No.)	Villages having Brick Kilns (in No.)
1	Kakwan	1	56	1
2	Jhinjhak	8	76	7
3	Rasulabad	6	92	6
4	Maitha	8	116	7
5	Sandalpur	9	91	7
6	Sarbankhera	11	75	8
7	Derapur	12	81	7
8	Malasa	15	120	13
9	Akbarpur	18	105	9
10	Rajpur	22	120	9
11	Amrodha	95	119	29
	Total	205	1051	103

Source: Census 2001, Personal Survey 2014

Table 7: Distribution of Brick Kilns, Kanpur Dehat District, 2014

Range	No. of Brick Kilns	Name of Block
Below 10	31	Kakwan, Rasulabad, Jhinjhak, Maitha, Sandalpur
10-20	58	Sarwankhera, Derapur, Malasa, Akbarpur
20-30	22	Rajpur
Above 30	95	Amrodha

Source- Personal Survey, 2014

Small and big kilns are concentrated in two major pockets along NH 25 and NH 2. Only bull's trench kiln with fixed chimney and masonry of two type one round is used in the district.

For brick making land is leased for 7-10 years and soil is leased for 3-4 year (2-5 feet down to earth). 90 percent of the land used for brick making is on partnership basis. Total brick production in Kanpur Dehat district is around 40, 00, 00,000 bricks per year, with an average of 20, 00,000 bricks per brick kiln (205 in total).

At an average 8 to 9 permanent workers are involved in brick firing and about 150 workers (ranging between 50 -200) are engaged in other brick making process at daily wages. Further, concentration of brick kilns range between 10 to 30 kilns per block. The lowest concentration is in Kakwan block followed by Rasulabad, Jhinjhak, Maitha and Sandalpur because of less connectivity, availability of raw material and market in the surrounding district. Maximum is in Amrodha block (above 30) followed by Rajpur block (20-

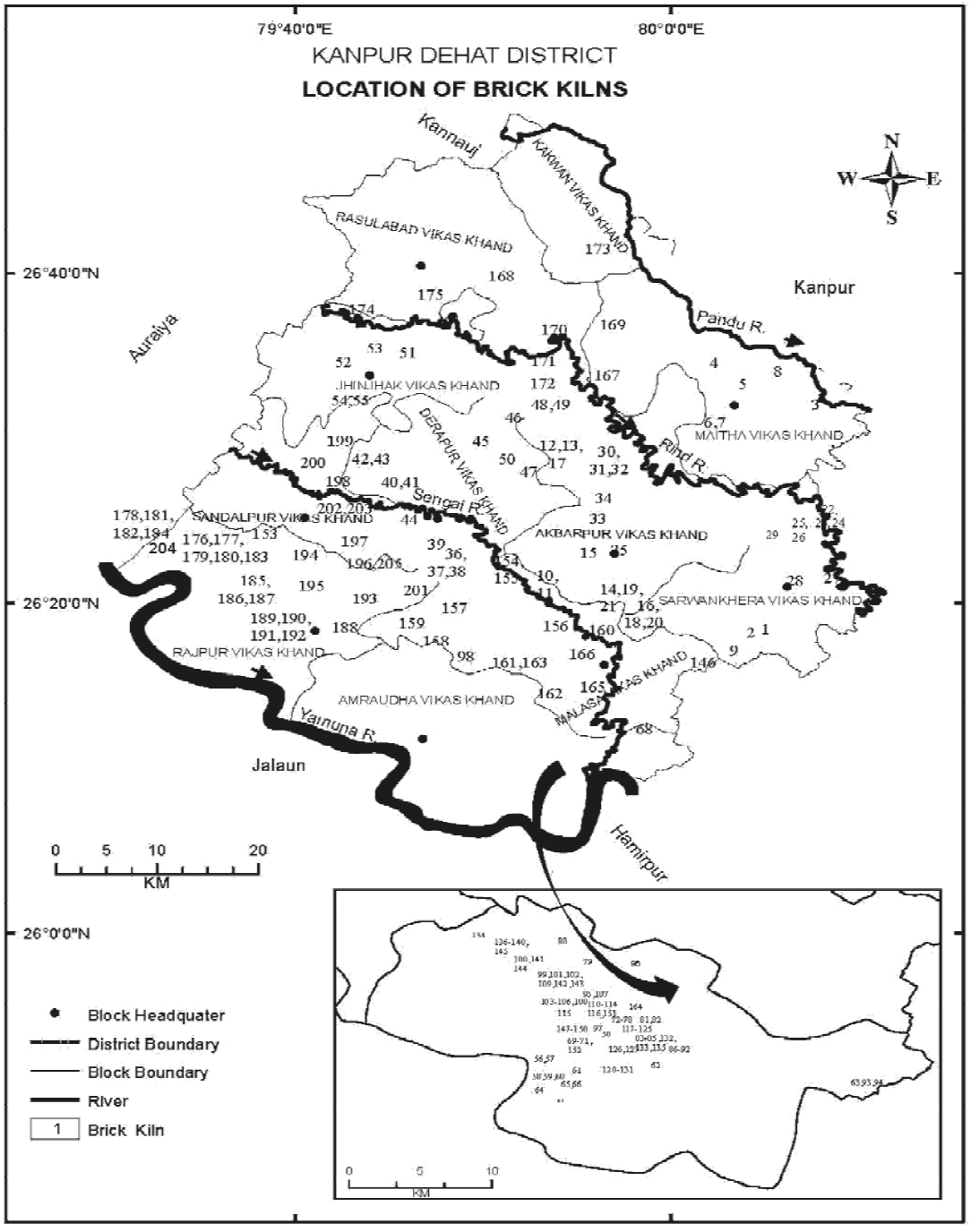
79°40'0"E
80°0'0"E
KANPUR DEHAT DISTRICT
LOCATION OF BRICK KILNS
Kannauj
KUKWAN VIKAS KHAND
RASULABAD VIKAS KHAND
Kanpur
Pandu R.
Auraiya
JHINJHAK VIKAS KHAND
DERAPUR VIKAS KHAND
Rind R.
MAITHA VIKAS KHAND
Sengai R.
SANDALPUR VIKAS KHAND
AKBARPUR VIKAS KHAND
SARWANKHERA VIKAS KHAND
RAJPUR VIKAS KHAND
AMRAUDHA VIKAS KHAND
Yamuna R.
Jalaun
Hamirpur
26°40'0"N
26°20'0"N
26°0'0"N
N
W
E
S
0 5 10 20
KM
0 5 10
KM
Block Headquater
District Boundary
Block Boundary
River
1 Brick Kiln

Fig. 3

Table 8: Distribution of Sampled Brick Kilns according to the Height of the Chimney, Kanpur Dehat District

Sl. No.	Name of Block	Sampled Brick Kilns (in No.)	Height of the Chimney (in %)		
			< 110 feet	110-115 feet	> 115 feet
1	Kakwan	1	-	100.00	-
2	Jhinjhak	4	50.00	50.00	-
3	Rasulabad	3	32.00	68.00	-
4	Maitha	4	25.00	75.00	-
5	Sandalpur	5	40.00	60.00	-
6	Sarbankhera	6	-	100.00	-
7	Derapur	6	33.00	67.00	-
8	Malasa	8	-	100.00	-
9	Akbarpur	9	100.00	-	-
10	Rajpur	11	100.00	-	-
11	Amrodha	48	76.00	12.00	12.00
	Total	105			

Source: Personal Survey, 2014-15

Table 9: Distribution of Sampled Brick Kilns according to the Status of Land and Period of Lease (in years) in the Kanpur Dehat District

Sl. No.	Name of Block	Sampled Brick Kilns (in no.)	Own Land (in %)	Leased Land (in %)	Period of lease (in %)		
					<3 yrs.	3-7 yrs.	> 7 yrs.
1	Kakwan	1	100.00	-	-	-	-
2	Jhinjhak	4	50.00	50.00	25.00	25.00	50.00
3	Rasulabad	3	66.00	34.00	32.00	34.00	34.00
4	Maitha	4	25.00	75.00	25.00	75.00	-
5	Sandalpur	5	40.00	60.00	60.00	20.00	20.00
6	Sarbankhera	6	17.00	83.00	-	66.00	34.00
7	Derapur	6	20.00	80.00	50.00	50.00	-
8	Malasa	8	75.00	25.00	50.00	37.00	13.00
9	Akbarpur	9	-	100.00	5.00	65.00	30.00
10	Rajpur	11	100.00	-	-	-	-
11	Amrodha	48	72.00	28.00	50.00	40.00	10.00
	Total	105					

Source: Personal Survey, 2014-15

Table 10: Distribution of Workers in Brick Kilns, Kanpur Dehat District

*Category	Workers (in %)		Function	Duration of Work	Wages (Rs./ week/ month)
	Male	Female			
Pathnewala (Moulders)	46.70	61.70	Preparing clay, making & stacking bricks	12-16 hrs.	Rs. 150/1000 brick
Dhoaiwala (Loaders)	13.68	14.76	Transporting raw bricks to kiln	12-16 hrs.	Rs. 50/1000 brick
Beldar (Stacker)	6.67	-	Stack raw bricks inside kiln's chamber	12-16 hrs.	Rs. 2700/ week
Rabishaha (Rabish)	6.33	-	Give coal and cover bricks with ash	12-16 hrs.	Rs. 2700/ week
Jhokwa (Firer)	5.07	-	Firing & baking in kiln	In shift (24 hrs,)	Rs. 2700/ week
Nikasi (Unloder)	21.55	23.54	Unloading, transporting & stacking	12-16 hrs.	Rs. 40/1000 brick
Munshi (Supervisor)	-	-	Supervision	8 hrs.	App. Rs.2200 & fooding & logging

Source: Personal Survey , 2014-15.
*Information collected from brick owners and *Munshis*

30) due to increasing demand and good connectivity with surrounding district like Jalaun, Jhansi, Hamirpur district (table 7 & fig 3). Table 8 is showing the height of the chimney in the sampled brick kilns. Height of chimney ranges between 110-115 feet. Minimum height is more than 115 feet in Amrodha block. In Akbarpur and Rajpur block the height of the chimney is less than 110 feet. Larger the chimney lesser is the level of pollution.

Table 9 reveals that nearly 51 percent of the sampled brick kilns were located on their owners land while 49 percent were on leased. The period of lease varies between less than three years to more than seven years. The overall picture shows that of 33.14 percent are leased for less than 3 years, 45.83 percent for 3-7 years and another 21.02 percent for more than 7 years. Field investigation revealed that farmers give preference to leasing off land to the brick kiln owners rather than growing crops because the brick owners offer them more money than they could earn from agriculture.

Distribution of Workers

Brick making is a low technology process which is characterized by distinct division of labour. Starting from moulding till extraction of

the baked bricks from the kiln, the division of labour may be broadly categorized as six fold: moulders (pathnewala), carter/loader (dhoaidar), stacker (beldar), (rabishaha), firer (jhokwa) and unloader (nikasi). The table 10 shows work-wise distribution of workers in Kanpur Dehat district. The Brick makers are generally very poor and minimally educated. The homes of the brick makers are extremely modest. They work an average of seven months per year due to weather condition that limit the production. The process of making bricks begins when workers mix clay, water and sand, often using their feet to ensure the correct consistency. The finished mix are than left covered with plastic overnight and thrown by hand into open brick moulds. The bricks are dried before they are fired. To dry the bricks, the moulded bricks are placed on ground and periodically rotated. Otherwise, the workers carry the raw bricks from the soil quarrying sites to the kiln to fire the bricks and take them out.

Key Issues

Brick industry is a source of land degradation and environmental pollution. Emissions from the brick kilns are known to affect the worker health, people living nearby and surrounding environment. The villages within the vicinity of the brick kilns also suffer from environmental problems such as land degradation, soil infertility etc. The majority of brick kilns in the Indo-Gangetic plains particularly in Kanpur Dehat district are on leased land. Unfortunately, brick kilns are mostly situated on fertile agricultural land, as brick manufacturers need salty clay loam to salty clay soils with good drainage condition. The removal of topsoil has direct impact on agricultural crop production via reduced fertility status of soils. Among air pollutants causing health risks are total suspended particulates, heavy metals, nitrogen oxides, carbon monoxide and sulphur dioxide. Incidences of premature mortality due to exposure to pollutants and chronic effects, including reduction in fitness and permanent lung damage has been observed among brick workers (Avitia and Covarrubias, 2012). According to HRW (1995) report, the working hours of kiln workers are upto 12-14 hours a day and are paid minimal on flat rate basis. During off seasons no wages are paid to the workers and as a result they have to take loans from the brick kiln owners for their survival. Due to poverty, limited number of children of brick kiln workers goes to school, rest of them share work with their families. Damage of workers is also expressed in economic terms such as absenteeism, increased medical costs etc.

Conclusion

The brick industry lies at the very heart of the rural economy in India. Like any other traditional industry, the Indian brick industry is strongly resistant to change. With the demand for bricks increasing to meet the growing needs of infrastructure, commercial and housing sectors, it remains the most important source of livelihood in rural areas. Therefore, any intervention aimed at bringing about change in the brick industry must address socio-economic issues, basic infrastructure, alternative livelihoods and technology to curb pollution. The shift from FCBTK to clearer brick technology

is one of the step towards modernizing the brick industry in India. There is an urgent need to shift brick industry from unorganized sector to mainstream so that proper wages and other facilities could be provided to workers. Further, an integrated management strategy can help to identify the linkages and enable to set up a framework to give future direction to the brick industry in eastern Uttar Pradesh and particularly in Kanpur Dehat district.

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Harbans Lal Chhibber : A Bibliography

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> Dr. Chhibber I know to be an assiduous worker, who places the progress of his studies first and foremost always, and is a scientist for science's own sake. - L. Dudley Stamp (1933: xxviii)

This article maps the academic trails of late Prof. Harbans Lal Chhibber (1899-1955) with the help of bibliography of his published and unpublished works. Prof. Chhibber was one of the foremost earth scientists of India. During the course of over three decades of academic career (1923-1955), he made seminal contributions in various sub-fields of geography, geology, geophysics and ceramics. Only an exceptional scholar like him could contribute in such diverse fields of knowledge. However, his writings are scattered in various books, journals, bulletins and proceedings of seminars and conferences published from across the world. Therefore, an exhaustive list of his research contributions is lacking. Though his bio-data, available with the Indian National Science Academy (New Delhi), provides a reasonably extensive list of his published works, it is by no means a complete one. Some of his works published prior to 1952 are not given in this bio-data. Further, he published many papers and articles during the last three years of his life. In view of this, the present article provides a comprehensive bibliography of the research works of Harbans Lal Chhibber. It would benefit students and researchers interested in his academic life and works.

Keywords : Harbans Lal Chhibber, bibliography, academic path, economic geography, geology, geomorphology, geography, petrology, ceramic and mineral resource.

Introduction

A bibliography serves knowledge-building through cataloging of publications on a country, a subject, an era or even on an individual. It may also include the listing of published and unpublished works of an author. Bibliography may be comprised of books, research papers, articles, letters, abstracts, etc. It is the list of documentary sources (Brewer, J. Gordon, 1973: 16). The bibliography of the contributions of a scholar is a pre-requisite for understanding his life history and professional pathways (Khan, Mumtaz, 2011: 74). Besides, an exploration of the academic trails of great scholars also offers a reasonably reliable evidence for expanding and enriching the understanding of the evolution of discipline. This also applies to the makers of Indian geography and the evolution of geography as a discipline in India.

A careful examination of academic pathways of early pioneers of Indian geography would suggest that modern geography in India evolved around them at the department/centres

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of geography in various universities. Most of the early pioneers were trained in the western countries and had training in sister disciplines of geography such as geology and history. Some of them turn to geography rather accidently. Others deliberately opted for geography because of their utmost fondness of the subject. No matter what may have been factors and motivations for their opting of geography as a professional career, the fact remains that the pioneers of geography departments in Indian universities were endowed with rare blend of scholarship and academic leadership. Most of them worked with full dedication to develop geography and nurture future geographers in their respective departments. They successfully shaped Indian geography by producing not only high-quality research works but also excellent researchers and teachers. One among those towering scholars and academic leaders of Indian geography was Prof. Harbans Lal Chhibber. This article lists the bibliography of his published and unpublished works. However, before listing his contributions, a brief summary of the circumstances, which shaped his evolution as a great teacher, researcher and academic leader, would help in placing his contributions in a proper perspective.

The Academic Milieu

Prof. Harbans Lal Chhibber had rather eclectic research interests. Therefore, his contributions to research are in diverse fields– petrology, mineralogy, earthquake, volcanology, geomorphology, climatology, economic geography, geography of India, physiography, ceramics, progress of geography as a discipline in India, etc. What is more, his fields of studies were not only spatially extensive but conducted on geographically diverse terrains. His published works are scattered in a number of books, and a range of research journals, bulletins and proceedings of seminars and conferences. The variety in the themes of his research topics and areas of his field works were due to a combination of various factors.

First, Prof. Chhibber worked in various institutions with different academic orientations at different points of time. He started his professional career as an Assistant Professor of Geology in Banaras Hindu University (B. H. U.) in 1923. Soon after, he joined the University of Rangoon in 1924. There he taught geography and geology at undergraduate level and conducted extensive fieldworks. Together with Prof. L. Dudley Stamp and other colleagues, he conducted fieldworks in various parts of Myanmar (then Burma) and jointly produced some research papers of very high quality. Afterwards, he joined the Geological Survey of India (GSI) in 1928 where he was attached to the famous Burma Party. As a member of the Burma Party, he travelled extensively and made observations across the length and breadth of that country in difficult conditions. After resigning from the GSI in 1935, he led a relatively secluded life due to protracted ill health. He rejoined the Department of Geology of Banaras Hindu University in 1941 and worked there till 1946. For a brief period, he was also associated with the famous Department of Geology of Lucknow University as well. On the invitation of Dr. Sarvapalli Radhakrishnan, the then Vice Chancellor of Banaras Hindu University, he joined as the Professor and founder head of the Department of Geography of Banaras Hindu University in 1946 and remained there till his untimely death in 1955 at the age of 56.

In this way, in course of his academic journey, he worked in many institutions located at different places of the erstwhile British India.

Prof. Chhibber physically visited and conducted field works in different regions of the erstwhile British India either as part of his duties for the academic institutions in which he worked or out of his own insatiable research curiosities. He conducted field works in geographically diverse terrains ranging from plains and mountains of Burma to different regions of the Himalayas (Kashmir, Kumaun, Garhwal, Nepal and Assam) and many other parts of India, such as Gujarat, Jharkhand and Jubbulpore (Jabalpur), Punjab, parts of Uttar Pradesh, Rajasthan and north eastern states. This very fact was an important reason for his contributions to the diverse fields of earth sciences. He was perhaps the greatest field workers of all professional Indian geographers. He instilled the habit of fieldworks in research as well as teaching of geography in the minds of his students.

As a teacher Prof. Chhibber guided research works of many students working on different topics as well as on different parts of India. As a result, his research fields got considerably expanded thematically and regionally. Finally, Prof. Chhibber also collaborated with many scholars from India and abroad on various research themes of common interests which also greatly stretched his research interests.

Before Prof. H. L. Chhibber died at a very young age of 56, he was able to author six books and nearly a hundred articles, research papers, scientific notes, academic letters, abstracts, etc. Prof. Chhibber was internationally recognized as an outstanding authority on the physiography and Geology of Burma. His writings on Burma are comprehensive and are in details. He authored three seminal books on Burma, apart from several research papers. The New Encyclopaedia Britannica (1983: 51) describes his first book - *The Physiography of Burma* (1933) as a standard work on the Burmese geology. This book was also reviewed in the *Nature*. However, his most outstanding publications were the companion volumes - *Geology of Burma* and *The Mineral Resources of Burma*. A reviewer described these books in *The Journal of Geography* (1935: 559-560) as follows:

"Dr. Chhibber has certainly accomplished a sound piece of work in writing these two volumes, which are likely to remain for a considerable time the standard works on Burmese geology. These two volumes form a very useful compendium on the geology and related subjects of Burma. They are written by a man who knows much of the country, and they form a very good source for general information. They are well produced and the illustrations are good."

Famous British geologist John Brooke Scrivenor (1935 : 519) described his second book– *Geology of Burma* (1934), as 'valuable addition to regional geology', written with 'admirable clearness'. In his third book, *The Mineral Resources of Burma*, H. L. Chhibber has systematically described all the mineral resources of the country, their modes of occurrence, how they are worked and their uses and trade. *The Mineral Resources of Burma* has been considered as the classic work on the subject. His study was extensive, and remains to this day the most detailed look at the mines in print. This book went to five

editions in English between 1934 and 1942. It was also translated into Japanese language by N Kyôkai with the title *Biruma kôsan shigen*.

Prof. Chhibber had completed a trilogy on the Geography of India. However, only the first and the third volumes could be published. The second volume was titled as the Geomorphology of India. The manuscript of this volume was already in the press but could not be published due to his sudden death. Prof. Chhibber was also writing a book on the Himalayas. It is worth noting that next only to Burma; he had devoted maximum time and energy on conducting field research in the Himalayas. His understanding of the geological and geomorphological aspects of the Himalayas was solid. This is clearly evident from his scholarly articles on various aspects of the Himalayas. It is mainly on the basis of extensive field observation and research that he was writing a book on the Himalayas. At that time he was at the prime of his academic life. But unfortunately, due to his untimely death the earth science community was deprived by what could have been a wonderful book on the Himalayas.

H. L. Chhibber was able to establish a name of himself as a geologist at a very young age by producing works of very high standard. In 1926, H. L. Chhibber received the *Silver Medal* of the *Mining, Geological and Metallurgical Institute of India* (Kolkata) for his research paper on *The Igneous and Associated Rocks of the Kabwet Area, Shwebo and Mandalay Districts, Burma,* published in the institute's journal *Transactions of the Mining and Geological Institute India*. He was the first Indian to receive any medals of this institute, which was established in 1906 (Stamp, L. D., 1959 : 289).

In 1954, he was elected as the President of the Geology and Geography Section of the Indian Science Congress. He was the first geographer to accomplish this feat. The National Institute of Sciences of India invited Dr. Chhibber to write 'Progress of Geography in India during 1938-50' for their second volume on *The Progress of Science in India*. Interestingly, the progress report on geography (earth science) for the first volume on *The Progress of Science in India* was written in 1938 by his teacher and famous Indian Geologist Darashaw Nosherwan Wadia. Unfortunately, the report has not at all been utilized by geographers to further the cause of geography in India.

Prof. Chhibber's works and stature grew together with time. What Allen Churchill Semple (1911 : vi) wrote about her great master of geography, Friedrich Ratzel (1840-1904): 'He grew with his work, and his works and its problems grew with him. He took a mountain view of the things, kept his eyes always on the horizons, and in the splendid sweep of his scientific conceptions sometimes overlooked the details near at hand. Here in lay his greatness and his limitations'. I think it fittingly applies to H. L. Chhibber as well. His academic achievements are marked by depths as well as details. As a true pioneer, he played a major role in laying the foundation of geography in India. However, the inexplicable nonchalant treatment by the subsequent generations of Indian geographers has resulted in dumping H. L. Chhibber and his legacy into the dustbin of history.

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Footnotes

[1] The article is written to mark the centenary year celebration of the foundation of Banaras Hindu University (founded in 1916) and the 70 th Year of the foundation of the Department of Geography, Faculty of Science (B.H.U.) and the National Geographical Society of India (NGSI) (both founded in 1946). Prof. H. L. Chhibber was the founder head of the Department of Geography (1946-1955) and the founder President of the NGSI (1946-1955). The year 2015 is the 60th death anniversary of Prof. Chhibber.

Book Review

Small Cities and Towns in Global Era (Edited by R.N. Sharma and R.S.Sandhu (2013), Rawat Publications, Jaipur, pp IX+ 358 including Contents, Tables and Figures, Acknowledgements , Introduction, References and Index, Price : Rs. 995 ISBN 978-81-316-0575-2.

The new market system emerged under the new global regime, have made significant impact on the conventionally existing cities and there is a strong need of understanding the impact of such changes on Indian urban settlements, particularly small cities and towns which have been on the margins. This volume has come out of the papers presented in a national seminar organized at the Tata Institute of Social Sciences (TISS), Mumbai in August 2011.The book is divided into two sections containing sixteen papers. The first section gives the theoretical perspectives of small cities and towns in the globalised world and the second section deals with case studies.

The paper of Swapna Banerjee-Guha entitled 'Small Cities and Towns in Contemporary Urban Theory, Policy and Praxis' sets the tone of discourse and advocates for the need of a corrective urban policy in favour of small cities and towns for balanced regional development. Annapurna Shaw's paper entitled 'Emerging Perspectives on Small Cities and Towns' presents an appraisal of India's urban policy and planning and highlights that though small cities and towns have been at the periphery fact remains that under the influence of globalization, privatization and liberalization such urban centres are emerging as potential markets. The paper 'Citiness and Urbanity: The Privilege of Megacities' by R.N.Sharma advocates for a large number of small cities/ towns which are in the process of being written off. The paper concludes that in terms of quality of life, opportunities for growth and basic dignity of life, small cities and towns appear to have no future in India hence it attracts anyone's attention for their betterment. Rowena Robinson's paper 'Culture of Small Towns India' explores the form of city/town culture and values being shaped and reshaped under the neo-liberal market-oriented urban India. ' The Academic Bias Against Towns : A Cultural Audit' by Rajesh Gill raises the question like 'does the urban way of life (metropolitan culture) percolate to the smaller towns' by highlighting the growing socio-cultural and economic differences between the mega cities and other cities and towns of India. Biraj Swain's paper 'Small Towns, Their Limited Resourcing Options and Equity Deficits' examines resource generation and financial options available to small cities and towns of India. The paper 'Industrial Dispersal and Clustering in India During Post Reform Period and the Role of Small and Medium Towns' by Abdul Shaban and Sanjukta Sattar is well documented and critiqued paper on the issue of deflating over concentrated economy from the mega citied towards under developed region in the country. The authors consider two distinct dynamics underway in this regard. Firstly the concentration of workers is growing in class I towns particularly million plus cities and secondly it shows some evidences of dispersal of industrial and commercial activities during the post reform period. However this dispersal is confined to the major industrial cluster of the country. Debolina Kundu's paper on 'Financing and Access to Basic Amenities in Small and Medium Towns of India' gives country level database on the role of central and state government in financing urban infrastructure base in small cities and towns. The author has traced the trend of growth of small cities and towns and highlighted the spatial pattern in access to basic services and makes an attempt to analyse the financing pattern of urban development across the size class of towns. On the basis of this study the author draws conclusion that JNNURM has provided substantial assistance to the cities and towns for infrastructural development but it is confined to the big cities of the developed states.

Part two of the volumes contains eight papers mainly case studies. 'Urban Development and Small Towns in Punjab' by R..Sandhu and Jasmeet Sandhu presents a detailed critique of the neglected state of small cities and towns and is reflected at various fronts including research. The authors conclude the small towns in Punjab are ignored by planning and development processes and the poor live in slum like conditions as marginalized by their municipal authorities. K.N.Bhatt and Lalit Joshi's paper 'The Changing Face of Urban India: Allahabad City in Context' presents the changing nature of Allahabad and examines how the glory has decayed and the life has become miserable as a result of high density, traffic jam, encroachment and illegal construction.

Abdul Shaban's paper ' The City of Terror: Deprivation, Segregation and Communal Conflicts in Malegaon' presents the case of bubbling city i.e Malegaon whose economy is based on power loom industry. The author holds the view that the financing of production of cloth and its trade is under the control of Marwaris who segregate the city into their secured residential places and rest of the muslim dominated areas where the migrant muslim youths are forced to live a life of penury. The author admits that because of apathy and lack of vision for urban development the industrial city has suffered a lot. 'Ethnic Conflicts in the Small City: The Case of Shillong' by Nikhlesh Kumar gives a historical perspective focusing on inter-ethnic relationships more based on tensions and conflicts in a small multi-ethnic, multi-religious city (Shillong) in the NEn India. He also highlights the role of various Acts introduced by the Indian Government in protecting tribal properties and their customary practices. Port Blair , the capital of Andaman and Nicobar Islands , is highly sensitive both ecologically and anthropologically. The paper entitled 'Morphological and Demographic Changes in Port Blair Town and Their Impact' by Umesh Kumar and D.N.Pandey examines the histogenesis , morphogenesis and its consequences on the primitive tribal group due to the migrants coming to the city. Such influx has witnessed changes in physical and functional characteristics of the fringe area and the resultant extinction of primitive tribes like Jarwas and Onges.

Tura is one of the oldest towns of Meghalaya since 1866 and even after the formation of Meghalaya it continued to grow at rapid rate. However geographic isolation, topographic constraints and unsupportive urban/economic activities have arrested the growth and development of the city. The causes of historic growth of Tura and its subsequent decline have been discussed in detail by Sumit Mukherjee and Amlan Biswas in their paper 'Complexities in growth of Tura in Meghalaya'. V. Anil Kumar's paper 'Urban Governance and Planning in Karnataka' gives an overview of the status of quality and infrastructure in small cities and towns across the Karnataka state. The author admits that the planning of small cities and towns are in the grip of red tapism with little coordination and concludes that these towns are languishing due to scarcity of resources and poor basic infrastructure. Munger is a historic town of Bihar and because of its strategic location it has played important role during British period. However over a passage of time the city has become stagnant sleepy town. Sheema Fatima's paper 'Munger: A Bazaar Town in Decline' holds government responsible for the failure to harness the potential of the town for growth and better economic opportunities of the region.

The Census of India does not talk about the concepts like small city, medium towns or small towns. Such concepts vary across the discipline. Hence a paper on 'Concepts of Small Cities and Towns' could have been a welcome effort by the editors to make the things easily digestible. On the whole the book seems to be a modest attempt to highlight the problems of small cities and towns of India. It will inspire the planners and policy makers to take up the issues for the sake of management and governance of the urban areas and academicians will be motivated to initiate the studies in the dormant field of investigation i.e. small cities and towns.

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