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

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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.

Key words : 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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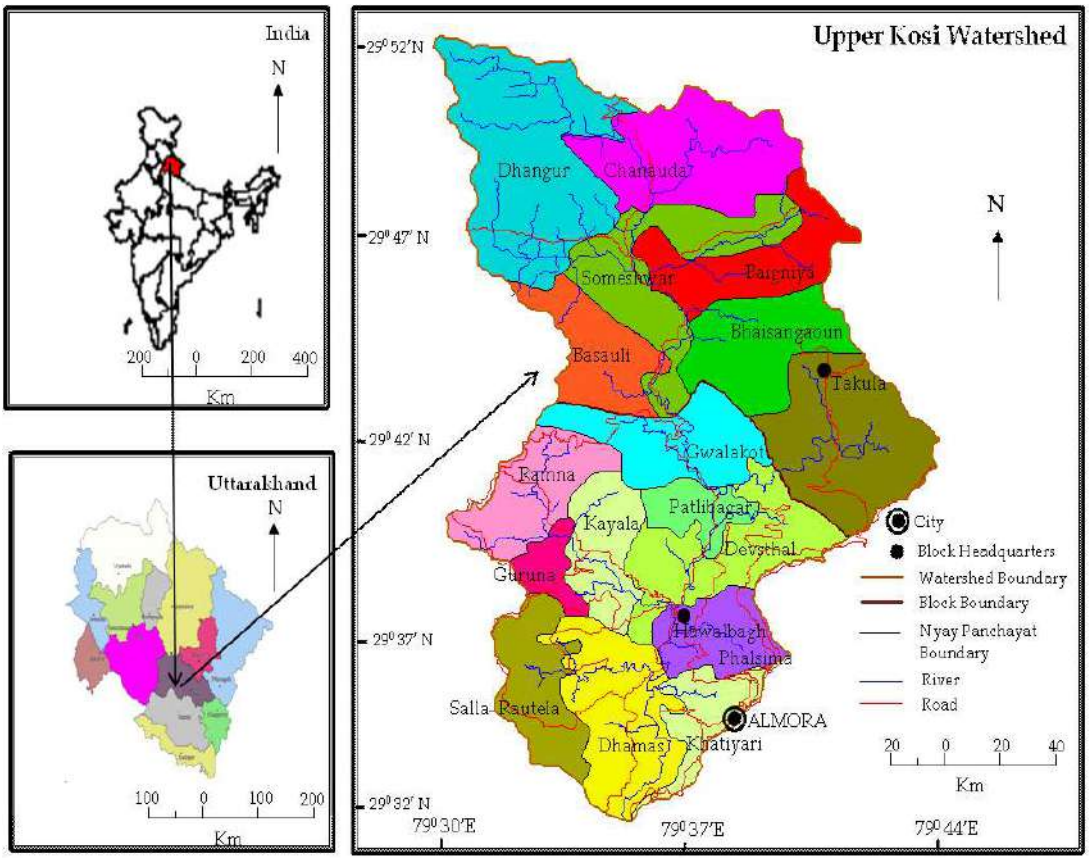

Fig. 1

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

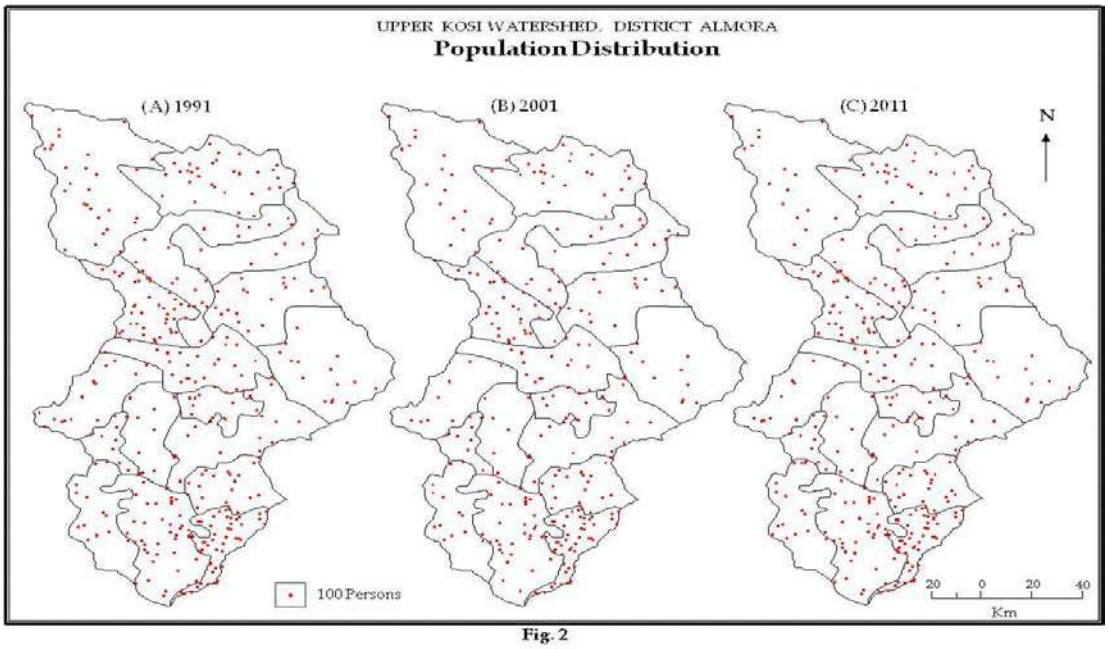

Fig. 2

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*

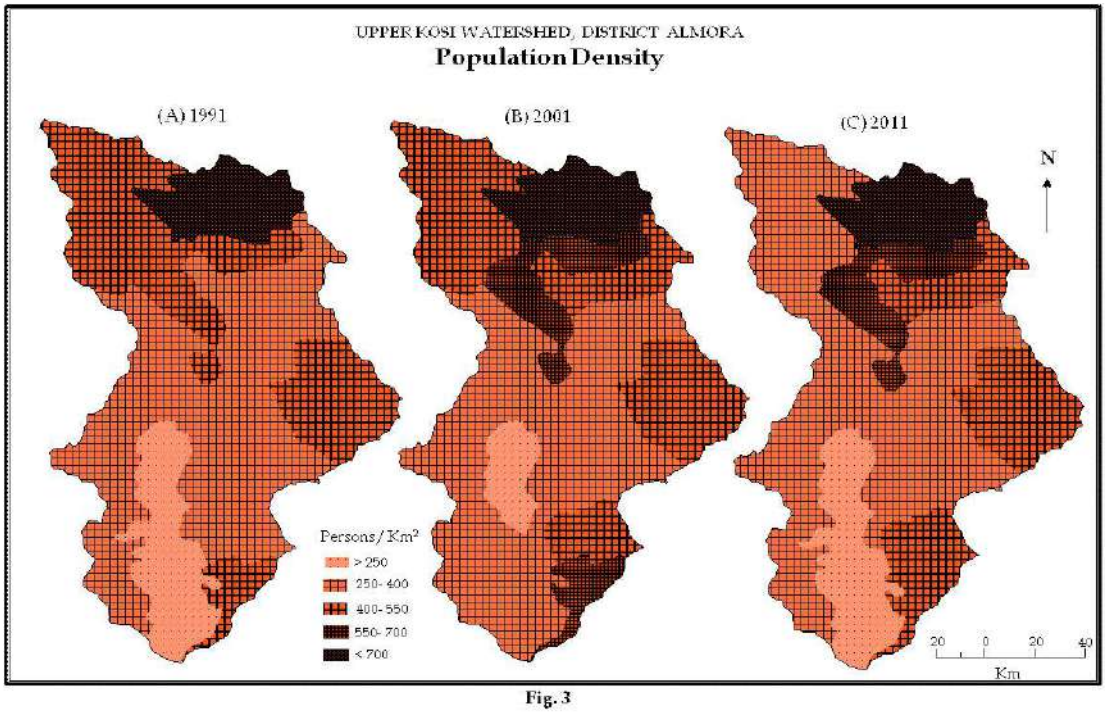
UPPER KOSI WATERSHED, DISTRICT ALMORA
Population Density
(A) 1991
(B) 2001
(C) 2011
N
Persons/ Km²
> 250
250- 400
400- 550
550- 700
< 700
20 0 20 40
Km

Fig. 3

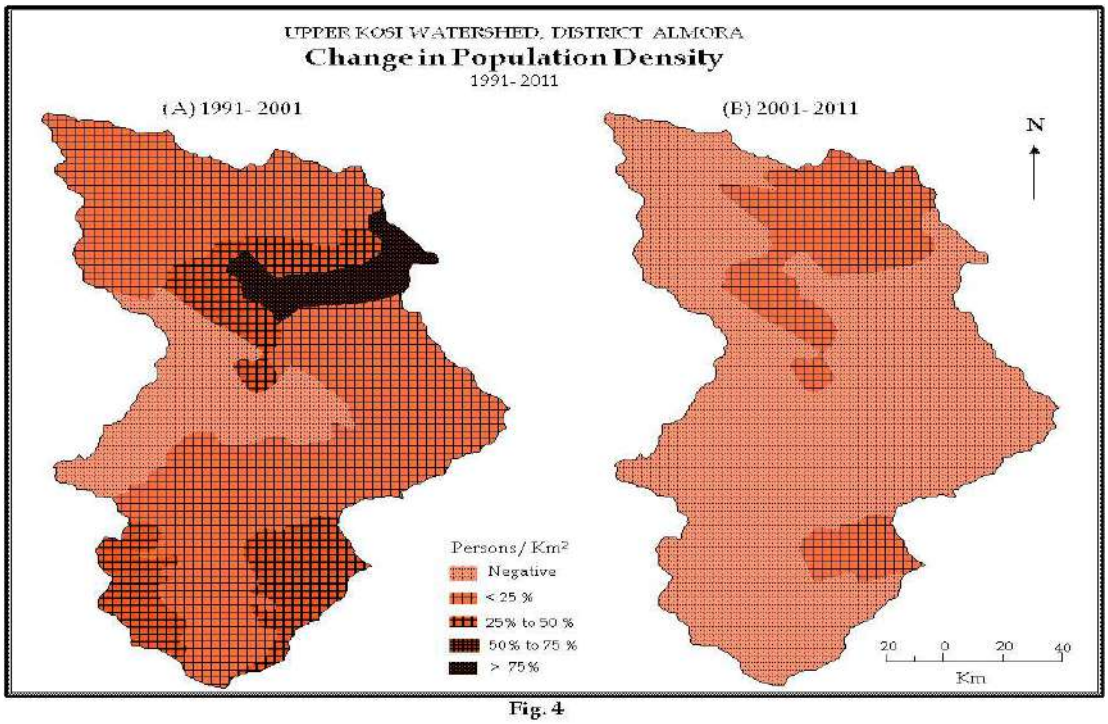
UPPER KOSI WATERSHED, DISTRICT ALMORA
Change in Population Density
1991- 2011
(A) 1991- 2001
(B) 2001- 2011
N
Persons/ Km²
Negative
< 25 %
25% to 50 %
50% to 75 %
> 75%
20 0 20 40
Km

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.

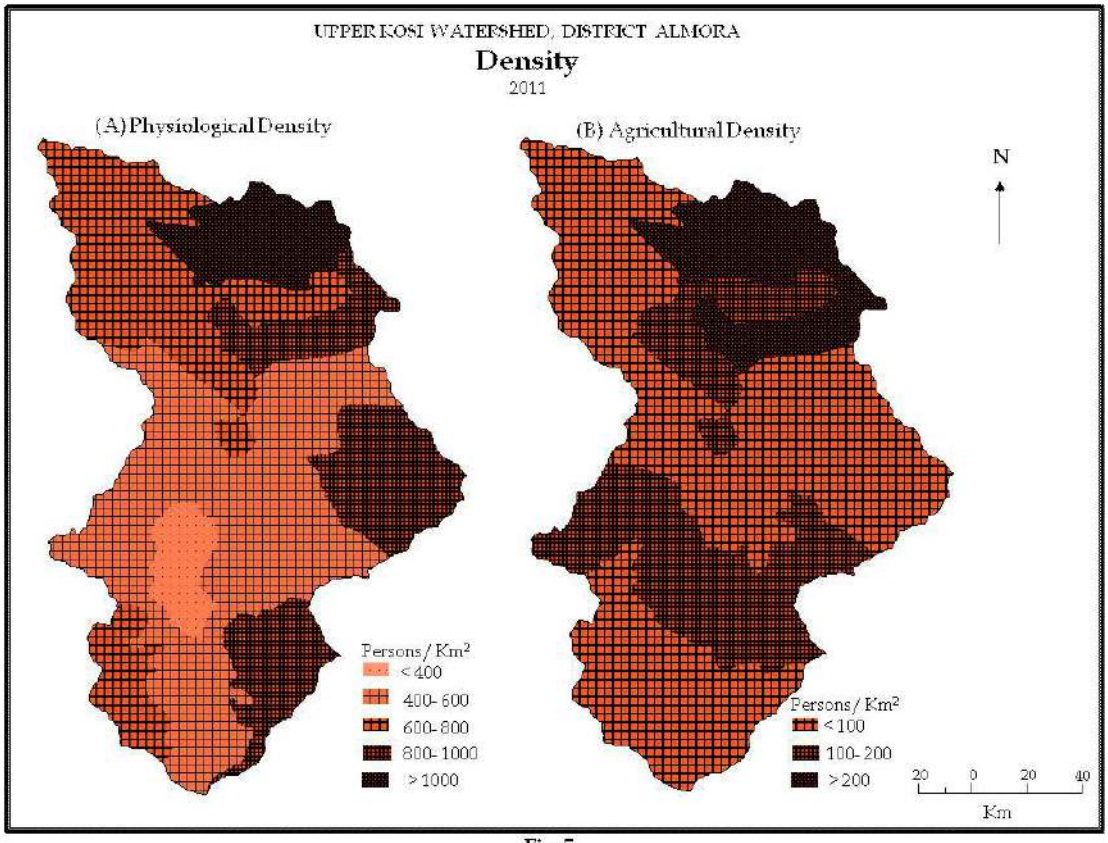

Fig. 5

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

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

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

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 of the region. The population of the area is generally migrating towards plain region i.e.

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

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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Changing Scenario of Nutritional Availability in Ballia District: A Geographical Overview

Santosh Kumar and M.B. Singh

Calories, protein, carbohydrates, minerals, vitamins, fats and water are essential nutrients for the growth of human body and its maintenance. Energy (Kcals) requirement of an individual is expressed as the total calories to be obtained from the food every day. It is supplied by carbohydrates, proteins and lipids of food. Protein is an important nutrient for the formation of regulatory compounds. Some hormones, all enzymes, and most other regulatory materials in the body are protein substances. Protein defends the human body against diseases. Protein is needed for building, maintaining and repairing body tissues. It is essential for body growth, especially for the young. The main nutritional role of carbohydrates is the production of energy. Each gram of food carbohydrate yields 4 Kcals of energy on oxidation in the body. Carbohydrates are t more suitable for the production of the energy in the body than proteins and fats, because carbohydrate molecules contain relatively more oxygen than others. Nutrition and health is one of the most appreciated aims of developing countries to be solved on priority basis. Land is the main and the most traditional source, which provides nutrition directly or indirectly to the people. The main objective of this study is to point out the spatio-temporal variations of nutritional availability in the study area during study period.

Key words: Calories, Protein, carbohydrates, Nutritional availability, Surplus area, Deficit Area

Introduction

Nutrition and nourishment are the basic requirements of an individual for the protection of health and promotion of well-being, thereby influencing the quality of life of an individual (N'gom and Woda, 2002). Nutrition and health is one of the most appreciated aims of developing countries to be solved on priority basis. Land is the main and the most traditional source, which provides nutrition directly or indirectly to the people. If land use pattern is not in a proper direction, the imbalanced land use will lead to the production, which will cause mal and under-nutrition and will eventually affect health. The correlation between population growth and food production may help in planning a balanced land use as well as balanced food that give enough nutrition to bring sustainability among the people (Ashraf, 2007). Therefore, vast amount of land are required for the production of food to fulfil human nutrition in any region, but are suitable for

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growing crops is limited. On a global scale, 31% of the soil surface can be used for arable crops, while an additional 33% is suitable for grassland (Penning de Vries et al., 1995). High quality arable land is becoming scarcer and scarcer due to ongoing industrialization, urbanization, infrastructural development, land degradation and desertification (Oldeman et al., 1999). Land requirements for food are, among other things, determined by population size and by the types and amounts of specific foods consumed, i.e. food consumption patterns. The discussion of world agricultural futures has usually been framed in a Malthusian context, with technological optimists opposing neo-Malthusian pessimists (Harris, 1996). The Second World War marked a turning point in the yield per hectare of arable crops in the Western world. For example, before World War II, yields of wheat in the United Kingdom and the USA increased only by a few kg /ha/per year (De Wit, 1992). As a result of the first 'green revolution', yields have consistently increased at much higher rates. The continued increase in production per unit of land area and per unit of livestock has led to significant increases in agricultural productivity (Rabbinge and Van Latesteijn, 1992). Over the last decades, several studies on agricultural potentials have been published that come to the conclusion that modern agriculture can theoretically provide enough food to feed the world's growing population (Penning de Vries et al., 1995). To describe the food consumption of a group, one generally tries to discern basic regularities, referred to as food consumption patterns. Food consumption patterns are repeated arrangements that can be observed in the consumption of food by a population group (Ivens et al., 1992).

Pulses are making many micronutrient-rich plant foods less available and more expensive to low-income families (Combs et al., 1996). Whole cereal grains contain relatively high levels of anti-nutrients (substances that reduce the absorption and/or utilization, i.e. bioavailability, of micronutrient metals to humans) and lower levels of substances that promote the bioavailability of these nutrients, further reducing the nutritional value of cereal products with respect to micronutrients (Graham and Welch, 1996; Welch and House, 1984). Health, nutrition, and food security are inextricably interrelated and must become explicit objectives of development policies, particularly agricultural development policy'' (Underwood, 1992). There is now a distinct message from the nutrition community to the agricultural community seeking to forge closer linkages between agricultural production and human nutrition and health in ways that will insure adequate, balanced and enduring nutrient for everyone (Buyckx, 1993).

Pulses are first presented as protein sources that are cholesterol-free, virtually devoid of fat and good sources of dietary fibres, carbohydrates, calcium and iron (Mangels, 2001a,b; Vegetarian Resource Group, 2001; Vegetarian Society UK, 2001b). Although the Vegetarian Resource Group mentions a possible deficit in methionine for grain legumes, it considers that other protein sources eaten throughout the day will easily balance the diet (Mangels, 2001a). Pulses are referred to as good sources of calcium, iron and zinc (Messina & Burke, 1997; Mangels, 2001b).

The Study area

Ballia district is located in the eastern part of Uttar Pradesh. It extends from $25^{0}33'$ N to

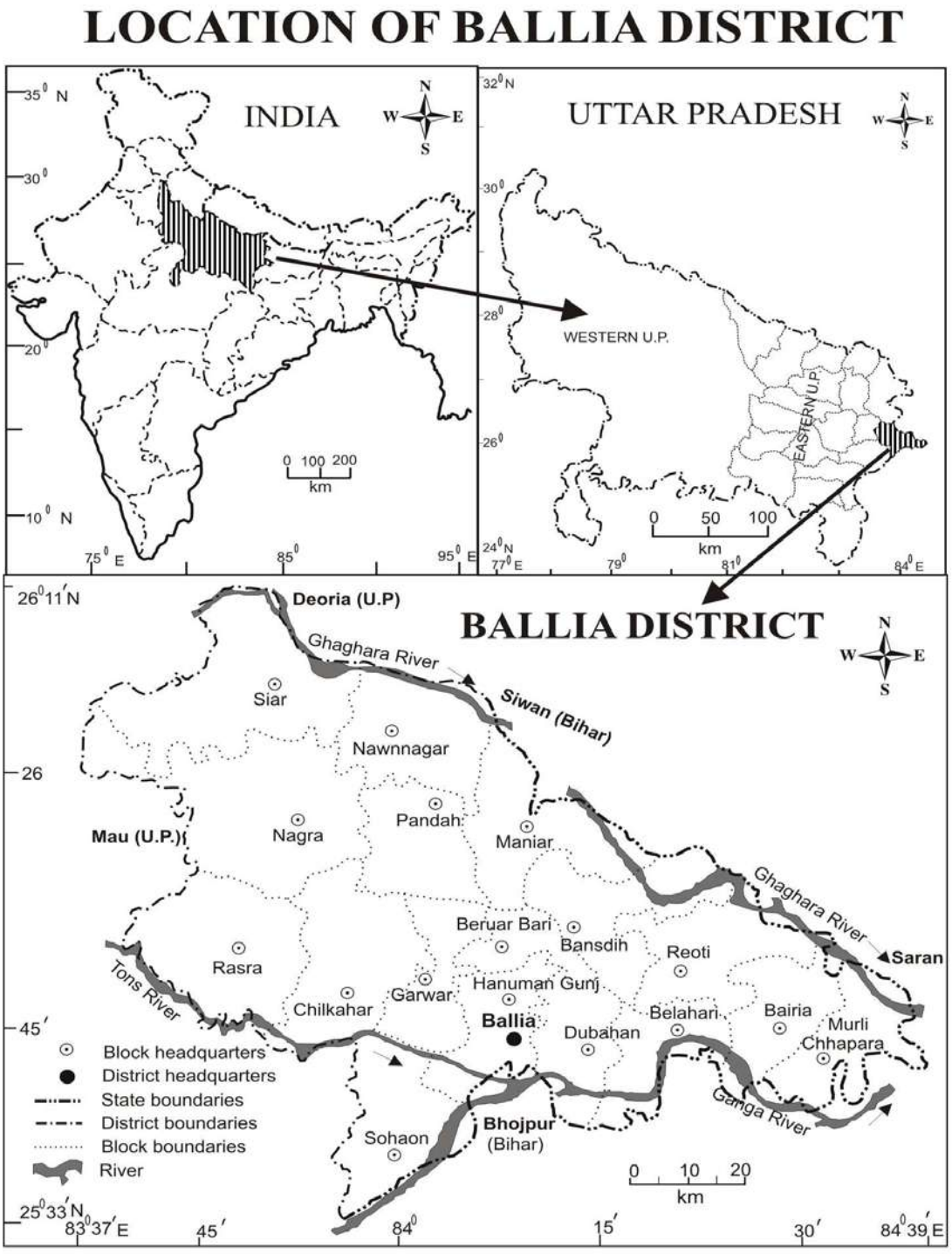
LOCATION OF BALLIA DISTRICT
INDIA
UTTAR PRADESH
WESTERN U.P.
EASTERN U.P.
BALLIA DISTRICT
Deoria (U.P)
Ghaghara River
Siwan (Bihar)
Siar
Nawnnagar
Pandah
Maniar
Nagra
Mau (U.P.)
Rasra
Tons River
Chilkahar
Garwar
Hanuman Gunj
Beruar Bari
Bansdih
Reoti
Ballia
Dubahan
Belahari
Bairia
Murli Chhapara
Saran
Ganga River
Bhojpur (Bihar)
Sohaon
Block headquarters
District headquarters
State boundaries
District boundaries
Block boundaries
River
km

Fig.1

$26^0$11' N latitudes and $83^0$37' E to $84^0$39' E longitudes. The study area is delimited by Deoria (U.P.), Siwan and Saran (Bihar) in north and by Bhojpur and Baxur (Bihar) district in the south; Saran (Bihar) in east; and Mau and Ghazipur (Uttar Pradesh) in the west. Ballia district is situated in the doab of Ganga and Ghaghara in middle Ganga plain having roughly an isosceles triangle shape. However, river Tons at some places forms the western boundary of the district (fig.1).

The Ballia district covers an area of 2,981 km^2 with a population of 32,39,774 in 2011. Administratively the study area is divided into six tahsils i.e., Belthara road, Sikandarpur, Rasra, Bansdih, Ballia and Baria and seventeen development blocks, namely Siar, Nagra, Rasra, Chilkahar, Nawnnagar, Pandah, Maniar, Beruarbari, Bansdih, Reoti, Garwar, Sohaon, Hanumangunj, Dubahan, Belahari, Bairia and Murali Chhapara.

Objectives

The major objectives of the present study are as follows:

(i) to find out the spatio-temporal variations of nutritional availability in the study area during study period.

(ii) to give some concrete suggestions related to above said facts for balanced nutritional availability for future generations in the study region.

Data base and Methodology

The food production data have been obtained from district statistical yearbook, Ballia district, 1982 and 2012. Block-wise net production has been calculated by deducting 16.80 percent from the total production of each crop on account of decay in seed for next year, change in stock and use for cattles and birds (Chakravarti, 1970). Therefore, Block-wise food balance sheets have been prepared for calculating the nutritional availability in Ballia district. The data derived from these sheets have been compiled and mapped into choropleth system of mapping to depict regional disparities. The study includes all the possible sources of food i.e. cereals (rice, wheat, barley, jower, maize, mandua, sawan, kodo, kakun) and pulses (urad, moong, masur, gram, pea, tur). Crop wise net production has been obtained by deducting 16.80 percent from the total production of each crop. Then, net production of each crop has been derived into nutritional availability (calories, protein and carbohydrates) on the basis of availability of per 100 grams amount of crop production with the help of nutritive value of cereals and pulses given by ICMR, Hyderabad (2004).

Energy (Kcals) Availability

Energy requirement of an individual is expressed as the total calories to be obtained from the food every day. It is supplied by carbohydrates, proteins and lipids of food. Energy requirement includes the environment for growth, maintenance, vital activities (heart beat, respiration, urine formation, etc.), temperature regulation, reproduction and muscular activities. Total calories requirement, therefore, depends on the age, sex and level of muscular work. It is higher per kg of body weight in a growing child and in an adult, lower in old people, higher in adult man than in an adult woman and higher during pregnancy and lactation. Calories requirement rises with the level of muscular work. The average calories recorded 1466.16 Kcals in 1981. Due to increase in production of crops it was noted 2260.47 Kcals in 2011 (Table 1 & 2).

Table 1. *Nutritional availability in Ballia district, 1981*

S.N.	Blocks	Populat-ion,1991	Total nutritional availability			Per capita/day nutritional availability			Departure on the basis of standard recommendation by ICMR, Hyderabad (2004)		
			Energy (Kcals)	Protein (g)	Carbohydrates (g)	Energy (Kcals)	Protein (g)	Carbohy-drates (g)	Energy on the basis of 2400 Kcals/capita/day	Protein on the basis of 60 grams/capita/day	Carbohydrates on the basis of 450 grams/capita/day
1	Siar	155402	80394179840.00	2879330688.00	15705495104.00	1416.37	50.73	276.70	-983.63	-9.27	-173.30
2	Nagra	127330	116277117632.00	4097947776.00	22690557760.00	2500.19	88.11	487.89	100.19	28.11	37.89
3	Rasra	88849	71296660032.00	2534081472.00	13922579840.00	2196.98	78.09	429.02	-203.02	18.09	-20.98
4	Chilkahar	124442	68250257088.00	2427121216.00	13269873344.00	1501.58	53.40	291.95	-898.42	-6.60	-158.05
5	Nawnnagar	94296	54467793536.00	1958102848.00	10630997312.00	1581.45	56.85	308.67	-818.55	-3.15	-141.33
6	Pandah	85997	57208433152.00	2011909120.00	11164471552.00	1821.32	64.05	355.44	-578.68	4.05	-94.56
7	Maniar	80855	48940854144.00	1748178432.00	9551396608.00	1657.20	59.20	323.42	-742.80	-0.80	-126.58
8	Beruarbari	70135	31723723200.00	1131753792.00	6178364608.00	1238.39	44.18	241.18	-1161.61	-15.82	-208.82
9	Bansdih	84372	46088465280.00	1625975104.00	9053691712.00	1495.56	52.76	293.79	-904.44	-7.24	-156.21
10	Reoti	81341	51809263168.00	1916316480.00	10081036992.00	1743.84	64.50	339.32	-656.16	4.50	-110.68
11	Garwar	96204	52341956992.00	1884660544.00	10164200384.00	1489.59	53.64	289.26	-910.41	-6.36	-160.74
12	Sohaon	95921	49723589760.00	2132950144.00	9455508608.00	1419.25	60.88	269.89	-980.75	0.88	-180.11
13	Hanumangunj	101569	39668661760.00	1453494016.00	7700761536.00	1069.29	39.18	207.58	-1330.71	-20.82	-242.42
14	Dubahan	105256	37621257856.00	1436442176.00	7205816384.00	978.58	37.36	187.43	-1421.42	-22.64	-262.57
15	Belahari	85013	26077795328.00	1076203648.00	4890138240.00	839.84	34.66	157.49	-1560.16	-25.34	-292.51
16	Bairia	104688	32550157120.00	1292104320.00	6243882112.00	851.27	33.79	163.29	-1548.73	-26.21	-286.71
17	Murali Chapara	91140	31372434496.00	1281341568.00	5940376000.00	942.43	38.49	178.45	-1457.57	-21.51	-271.55
18	Total district	1672810	895812600384.00	32887913344.00	173849148096.00	1466.16	53.83	284.54	-933.84	-6.17	-165.46

Source: Statistical Yearbook, Ballia district, 1982

Table 2. *Nutritional availability in Ballia district, 2001*

S.N.	Blocks	Population,2001	Total nutritional availability			Per capita/day nutritional availability			Departure on the basis of standard recommendation by ICMR, Hyderabad (2004)		
			Energy (Kcals)	Protein (g)	Carbohydrates (g)	Energy (Kcals)	Protein (g)	Carbohydrates (g)	Energy on the basis of 2400 Kcals/capita/day	Protein on the basis of 60 grams/capita/day	Carbohydrates on the basis of 450 grams/capita/day
1	Siar	235324	220119455578.88	6350529427.84	47056511324.16	2560.96	73.88	547.47	160.96	13.88	97.47
2	Nagra	270496	296800926215.04	8501517057.28	63543547882.88	3004.10	86.05	643.16	604.10	26.05	193.16
3	Rasra	194601	179241388310.40	5180388869.76	38297565388.16	2521.76	72.88	538.81	121.76	12.88	88.81
4	Chilkahar	180131	164040492270.72	4509362249.60	3537171521728	2493.29	68.54	537.62	93.29	8.54	87.62
5	Nawnnagar	159559	162237745304.96	4730852280.96	34571592631.68	2783.82	81.18	593.21	383.82	21.18	143.21
6	Pandah	154025	128926766533.76	3387778850.56	28024647248.00	2291.72	60.22	498.15	-108.28	0.22	48.15
7	Maniar	133607	151615184073.60	4401116120.96	32318458065.92	3106.87	90.19	662.26	706.87	30.19	212.26
8	Beruarbari	108949	129107530123.52	3979358040.32	27177674309.76	3244.43	100.00	682.97	844.43	40.00	232.97
9	Bansdih	169127	149278066787.20	4595011857.28	31342416992.64	2416.53	74.38	507.38	16.53	14.38	57.38
10	Reoti	167981	146009296409.60	4658322106.88	30153223900.80	2379.74	75.92	491.45	-20.26	15.92	41.45
11	Garwar	177623	142982677518.72	4160836592.64	30448346864.00	2203.91	64.13	469.33	-196.09	4.13	19.33
12	Sohaon	166465	102477116543.36	4067439950.08	20594500118.40	1685.44	66.90	338.72	-714.56	6.90	-111.28
13	Hanumangunj	195831	93060358052.48	3090775742.08	19195795565.44	1301.05	43.21	268.37	-1098.95	-16.79	-181.63
14	Dubahan	172291	90200436659.84	3152545643.52	18415763466.88	1433.36	50.10	292.64	-966.64	-9.90	-157.36
15	Belahari	134580	65258368481.28	2417510484.48	13119357305.60	1327.59	49.18	266.90	-1072.41	-10.82	-183.10
16	Bairia	165075	108609793959.68	3864733050.88	21722543215.36	1801.35	64.10	360.28	-598.65	4.10	-89.72
17	Murali Chapara	150000	93834345712.64	3379986413.44	18723599415.04	1712.70	61.69	341.75	-687.30	1.69	-108.25
18	Total district	2935665	2423799948535.68	74428064738.56	510077258912.00	2260.48	69.41	475.71	-139.52	9.41	25.71

Source: Statistical Yearbook, Ballia district, 2013

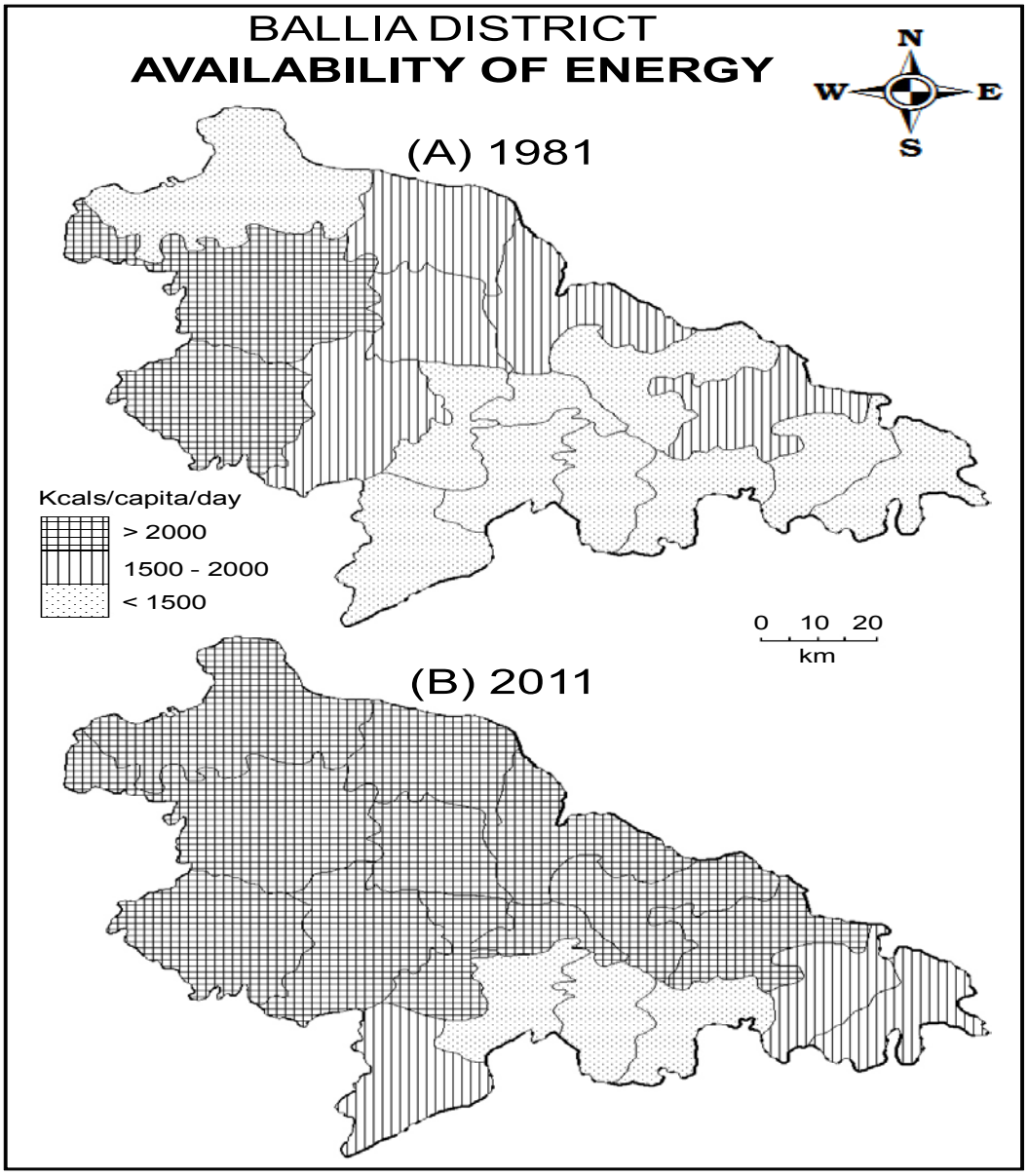

Fig. 2

High availability of Calories (> 2000 Kcals/capita/day)

Only two blocks such as Nagra and Rasra were recorded in this category in 1981. Whereas in 2011, eleven blocks namely Siar, Nagra, Rasra, Chilkahar, Nawnnagar, Pandah, Maniar, Beruarbari, Bansdih, Reoti and Garwar were included in high availability category. The reasons behind this are higher use of chemical fertilizers, better irrigation facilities, improved agricultural practices. Therefore, the net result is increase of crop production (Fig. 2).

Moderate availability of calories (1500-2000 Kcals/capita/day)

In 1981, this category included five blocks namely Chilkahar, Nawnnagar, Pandah, Maniar and Reoti. By contrast, three blocks such as Sohaon, Bairia and Murali Chhapara were found in this category in 2011.

Low availability of calories (< 1500 Kcals/capita/day)

Due to lack of irrigation facilities and less use of agricultural inputs, the crop production was low in 1981. Thus, the majority of blocks were found in the low calories availability category in 1981. While in 2011, only three blocks such as Hanumanganj, Dubahan and Belahari were remained in this category due to low crop production and high urbanization.

Departure of energy

The departure of energy is determined on the basis of the standard requirement of calories 2400 Kcals/capita/day subtracted from the availability of energy/capita/day of each development blocks in the study area. The average departure of energy was recorded -933.84 Kcals/capita/day in 1981. But in 2011, it reduced merely -to 139.52 Kcals/capita/day due to rapid growth of population and improvement in crop production in the study region.

High calories availability surplus areas (> 500 Kcals/capita/day)

This category not covered any block in the study area in 1981. While in 2011, three blocks namely Nagra, Maniar and Beruarbari came in this category due to considerable increase in production of crops.

Low calories availability surplus areas (< 500 Kcals/capita/day)

Only Nagra block was found in this category in 1981. But in 2011, this category embraced five new blocks such as Siar, Rasra, Chilkahar, Nawnnagar and Beruarbari.

High calories availability deficit areas (below -1000 Kcals/capita/day)

Due to low production of crops six blocks namely Beruarbari, Hanumanganj, Dubahan, Belahari, Bairia and Murali Chhapara were found in this category in 1981. But in 2011, only Hanumanganj and Dubahan blocks remained in this category because of high concentration of population.

Moderate calories availability deficit areas (-500 to -1000 kcals/capita/day)

Nine blocks namely Siar, Chilkahar, Nawnnagar, Pandah, Maniar, Bansdih, Reoti, Garwar and Sohaon were found in this category in 1981. While in 2011, four blocks such as Sohaon, Dubahan, Bairia and Murali Chhapara remained in this category (Fig. 3).

Low calories availability deficit areas (0 to -500 Kcals/capita/day)

Only rasra block was recorded in this category in 1981. But in 2011, Pandah, Garwar, and Reoti came in this category. The reasons behind this are low production of crops and high population concentration.

Protein Availability

Protein is an important nutrient for the formation of regulatory compounds. Some hormones, all enzymes, and most other regulatory materials in the body are protein substances. Protein defends the human body against diseases. Protein is needed for building, maintaining and repairing body tissues. It is essential for body growth, especially for the young. Their acute deficiency in food causes retardation of physical growth and mental

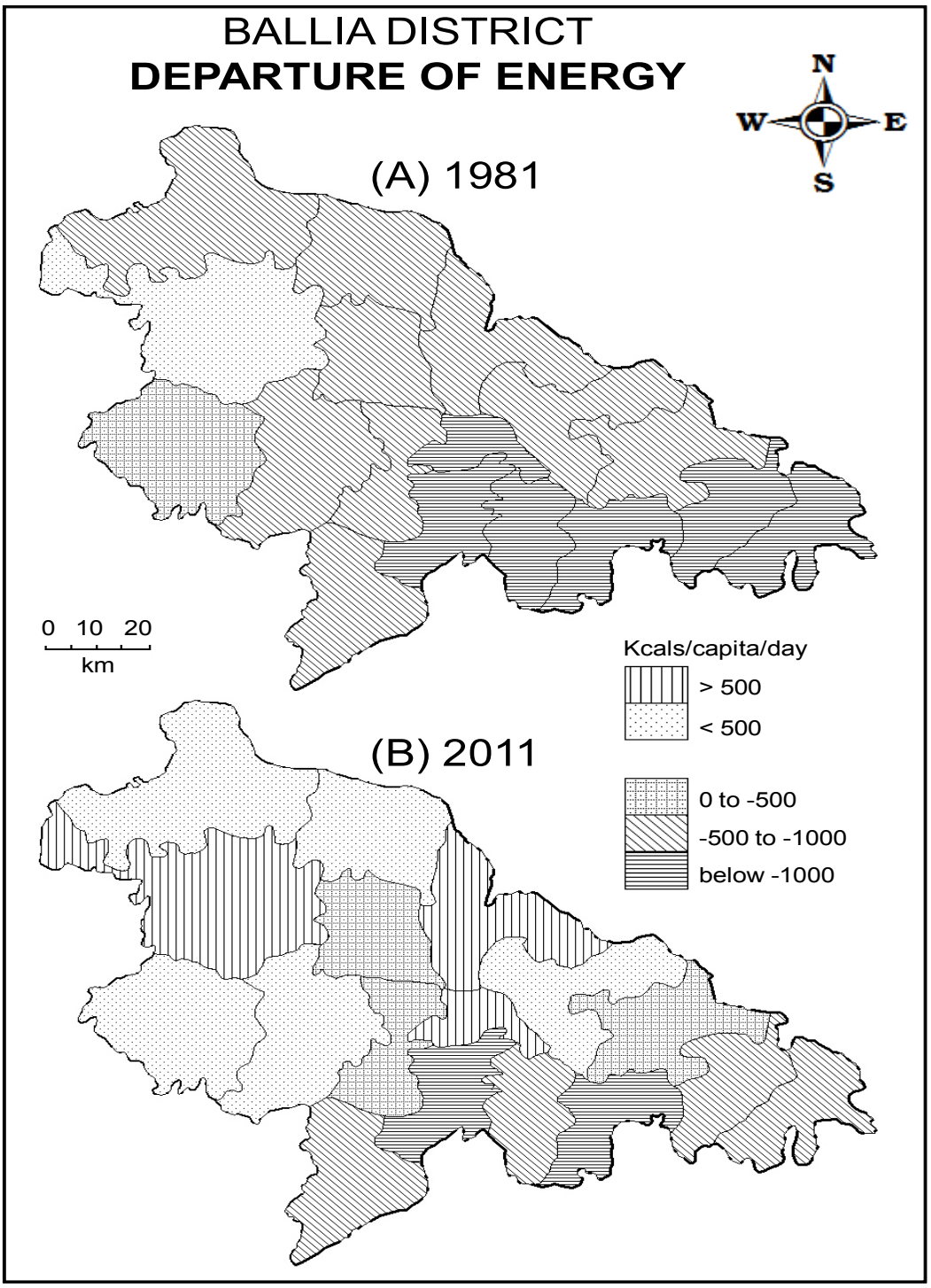
BALLIA DISTRICT
DEPARTURE OF ENERGY
N
W
E
S
(A) 1981
0 10 20
km
Kcals/capita/day
> 500
< 500
(B) 2011
0 to -500
-500 to -1000
below -1000

Fig. 3

abilities, failure of maintenance of body tissues, and anaemia. A lowering of serum protein levels and hormonal changes may result in edema, and the reduced production of antibodies makes the affected person susceptible to infection. The deficiency of protein results into various clinical conditions such as reduced growth, retarded mental development, emaciation, wasting of muscles and lack of subcutaneous fat, incidence of diarrhea, and lower working efficiency (Park, 1983). Moreover, those who exist on a low protein diet protein usually have lower resistance to diseases. They show signs of old age earlier than those who live on more adequate protein diets (Singhai, 1988). Protein is large molecules made up of amino acids bonded together by peptide linkages. It provides the essential amino acids, which is the initial materials for tissue synthesis and constituent of tissue protein. Thus, it was often referred to as the "currency" of protein nutrition and metabolism (Young, 2001). The quantity and quality of protein play an important role in human body.

High availability of protein (> 80 grams/ capita/day)

Only Nagra block was found in this category in 1981. But in 2011, three new blocks such as Pandah, Maniar and Beruarbari included in this category due to increase in area under pulses and high pulses productivity on account of use of improved seeds of pulses.

Moderate availability of protein (60 - 80 grams/capita/day)

Four blocks namely Rasra, Pandah, Sohaon and Reoti were recorded in this category in 1981. But in 2011, six new blocks such as Siar, Chilkahar, Bansdih, Garwar, Bairia and Murali Chhapara came in this category due to increase in pulses production (Fig. 4).

Low availability of protein (< 60 grams/ capita/day)

Due to low production of pulses the majority of blocks were found in this category in 1981. While in 2011, Hanumanganj, Dubahan and Belahari blocks were included in this category due to high urbanization and low production of pulses.

Departure of protein

The departure of protein is calculated on the basis of standard requirement of 60 grams/ capita/day subtracted from the actual availability of protein/capita/day in each development blocks in the study region.

High protein availability surplus areas (> 20 grams/capita/day)

Only Nagra block was found in this category in 1981. While in 2011, three new blocks such as Nawnnagar, Maniar and Beruarbari embraced in this category due to high production of pulses.

Moderate protein availability surplus areas (10 – 20 grams/capita/day)

Only Rasra block was found in this category in 1981. Whereas in 2011, three more new blocks namely Siar, Bansdih and Reoti emerged in this category.

Low protein availability surplus areas (< 10 grams/capita/day)

In 1981, three blocks such as Pandah, Reoti and Sohaon were recorded in this category. While in 2011, there new blocks such as Chilkahar, Garwar, Bairia and Murali Chhapara found in this category due to

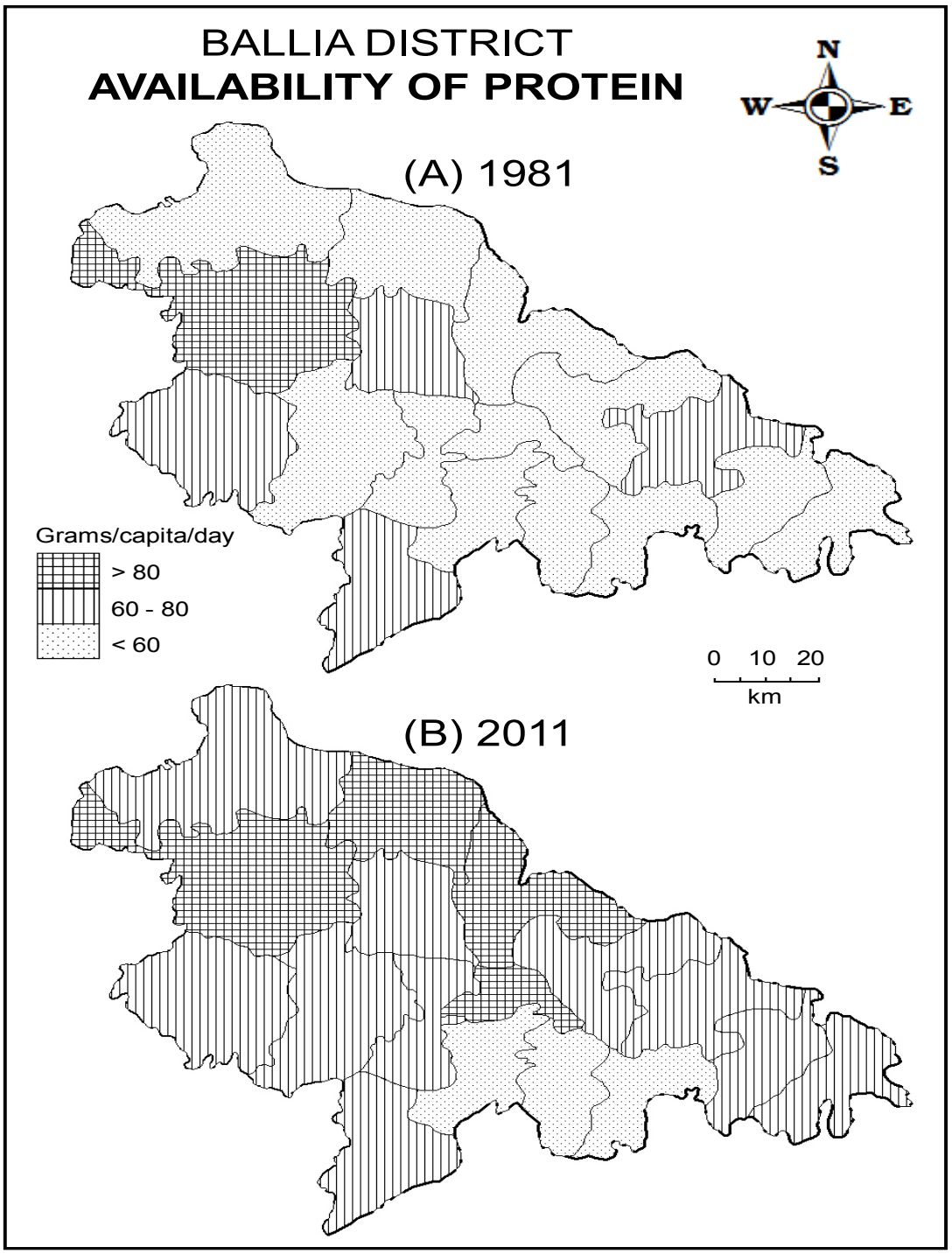
BALLIA DISTRICT
AVAILABILITY OF PROTEIN
N
W
E
S
(A) 1981
Grams/capita/day
> 80
60 - 80
< 60
0 10 20
km
(B) 2011

Fig. 4

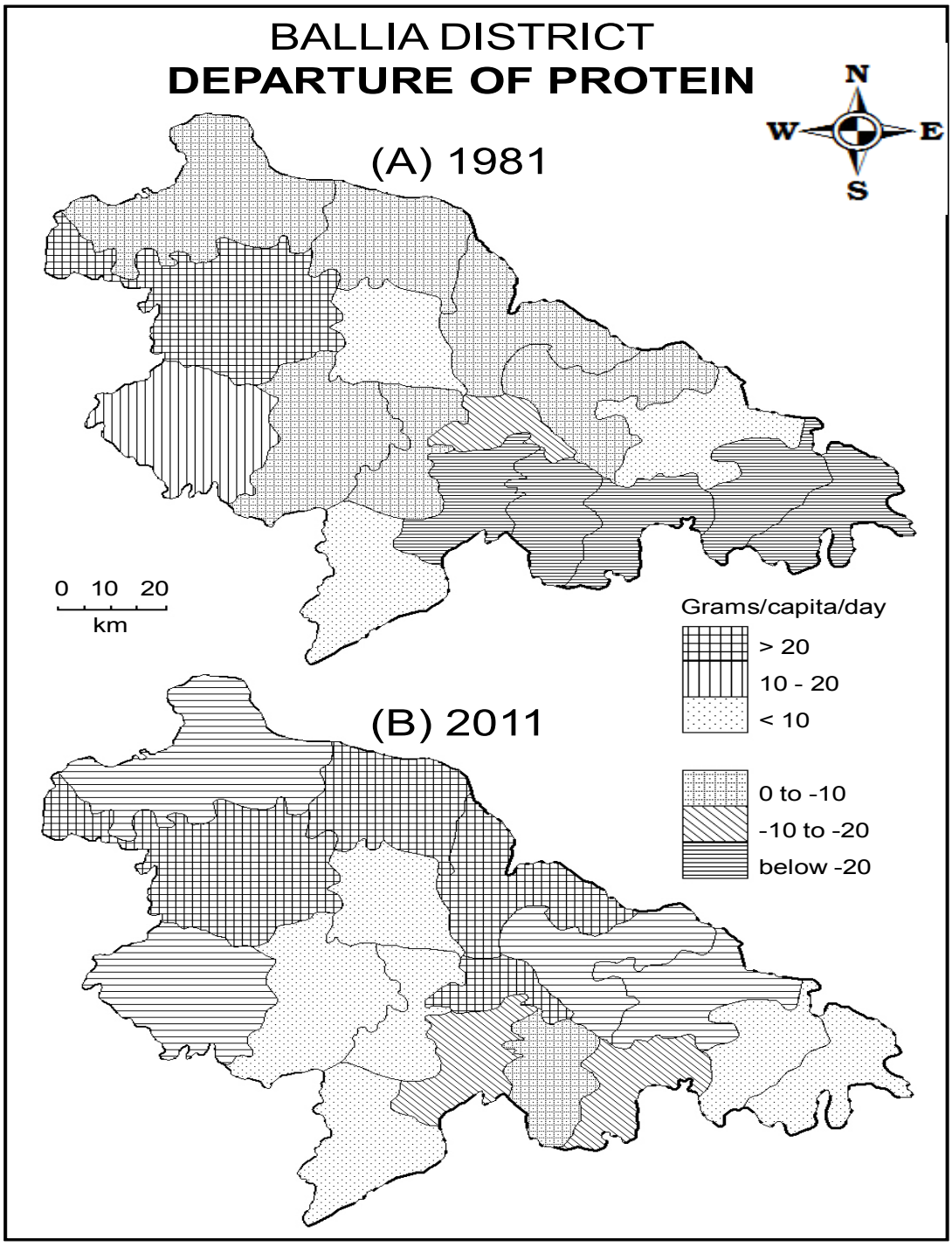
BALLIA DISTRICT
DEPARTURE OF PROTEIN
N
W
E
S
(A) 1981
0 10 20
km
Grams/capita/day
> 20
10 - 20
< 10
(B) 2011
0 to -10
-10 to -20
below -20

Fig. 5

comparatively high concentration of population.

High protein availability deficit areas (below -20 grams/capita/day)

Five blocks such as Hanumanganj, Dubahan, Belahari, Bairia and Murali Chhapara were found in this category due to low production of pulses in 1981. While in 2011, not a sigle block was found in this category because of increase in production of pulses.

Moderate protein availability deficit areas (-10 to -20 grams/capita/day)

Only Beruarbari block was found in this category in 1981. By contrast, this category included two blocks namely Hanumanganj and Belahari in 2011.

Low protein availability deficit areas (0 to –10 grams/capita/day)

In 1981, six blocks such as Siar, Chilkahar, Nawnnagar, Maniar, Bansdih and Garwar were included in this category because of low pulses production. Whereas in 2011, only Dubahan block remained in this category due to high concentration of population (fig. 5).

Carbohydrates Availability

The main nutritional role of carbohydrates is the production of energy. Each gram of food carbohydrate yields 4 Kcals of energy on oxidation in the body. Carbohydrates are the more suitable for the production of the energy in the body than proteins and fats, because carbohydrate molecules contain relatively more oxygen than others. And, consequently, require less molecular oxygen for their oxidation. Carbohydrates use less oxygen than other foodstuffs for oxidation. For humans, 55-75 % of the total food calories should be provided in the form of carbohydrates.

High availability of carbohydrates (> 400 grams/capita/day)

Only two blocks namely Nagra and Rasra were founded in this category in 1981, whereas in 2011, due to increase in crop production whole study area came in this category excepting three eastern-southern blocks of the study region (Fig. 6).

Moderate availability of carbohydrates (300-400 grams/capita/day)

In 1981, Nawnnagar, Pandah, Maniar and Reoti blocks were recorded in this category. But in 2011, three new blocks such as Sohaon, Bairia and Murali Chhapara embraced in this category.

Low availability of carbohydrates (< 300 grams/capita/day)

Majority of blocks were included in this category due to low production of crops in 1981. Whereas in 2011, this category was covered by three blocks namely Hanumanganj, Dubahan and Belahari due to low production of crops (Fig. 6).

Departure of carbohydrates

Departure of carbohydrates is computed on the basis of standard requirement of 450 grams/capita/day subtracted from the availability of carbohydrates/capita/day in each development blocks in the study area.

High carbohydrates availability surplus areas (> 200 grams/capita/day)

Fig. 7 depicts that not a single block was found in this category in 1981. Due to increase in production of crops Maniar and Beruarbari blocks included in this category in 2011.

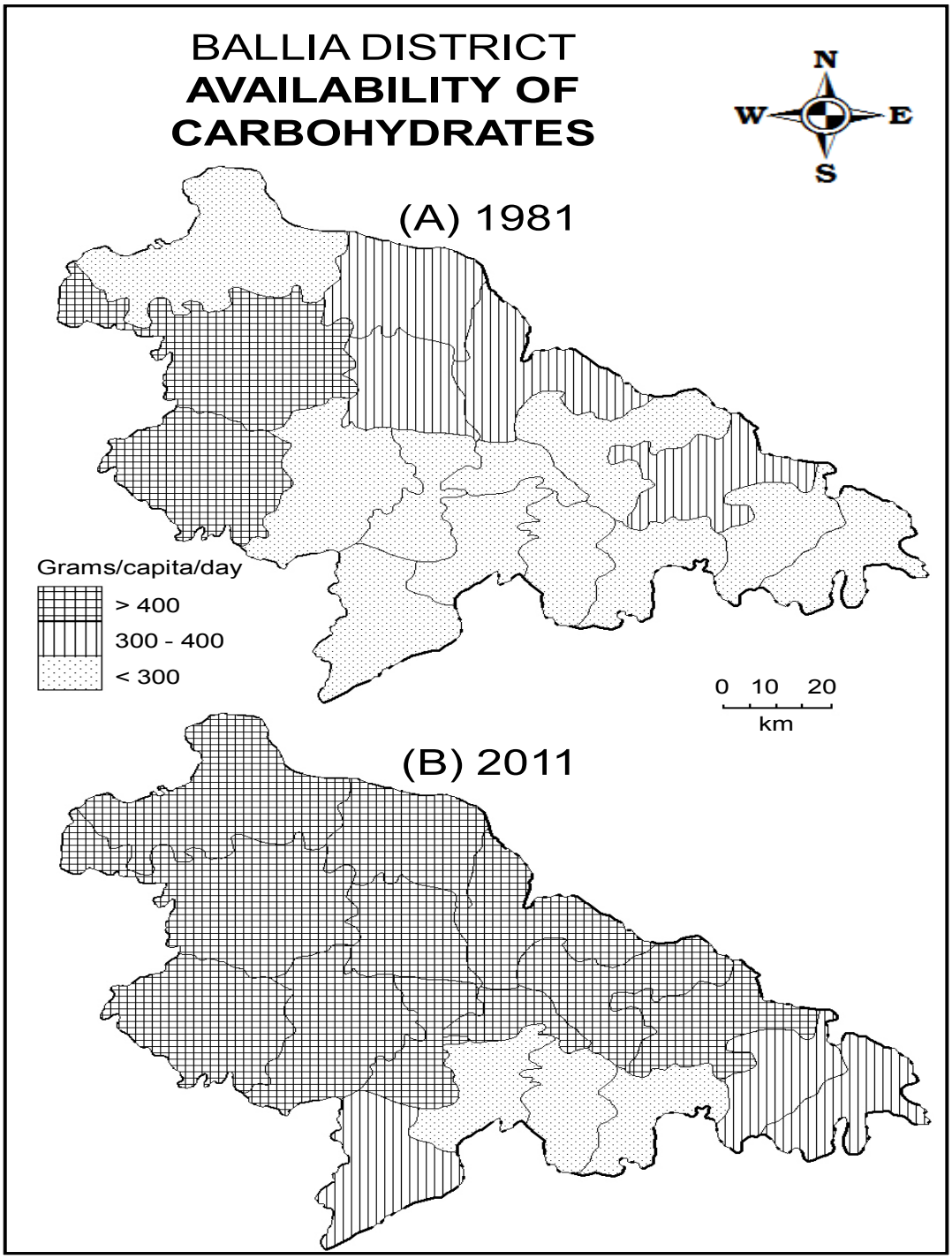
BALLIA DISTRICT
AVAILABILITY OF
CARBOHYDRATES
N
W
E
S
(A) 1981
Grams/capita/day
> 400
300 - 400
< 300
0 10 20
km
(B) 2011

Fig. 6

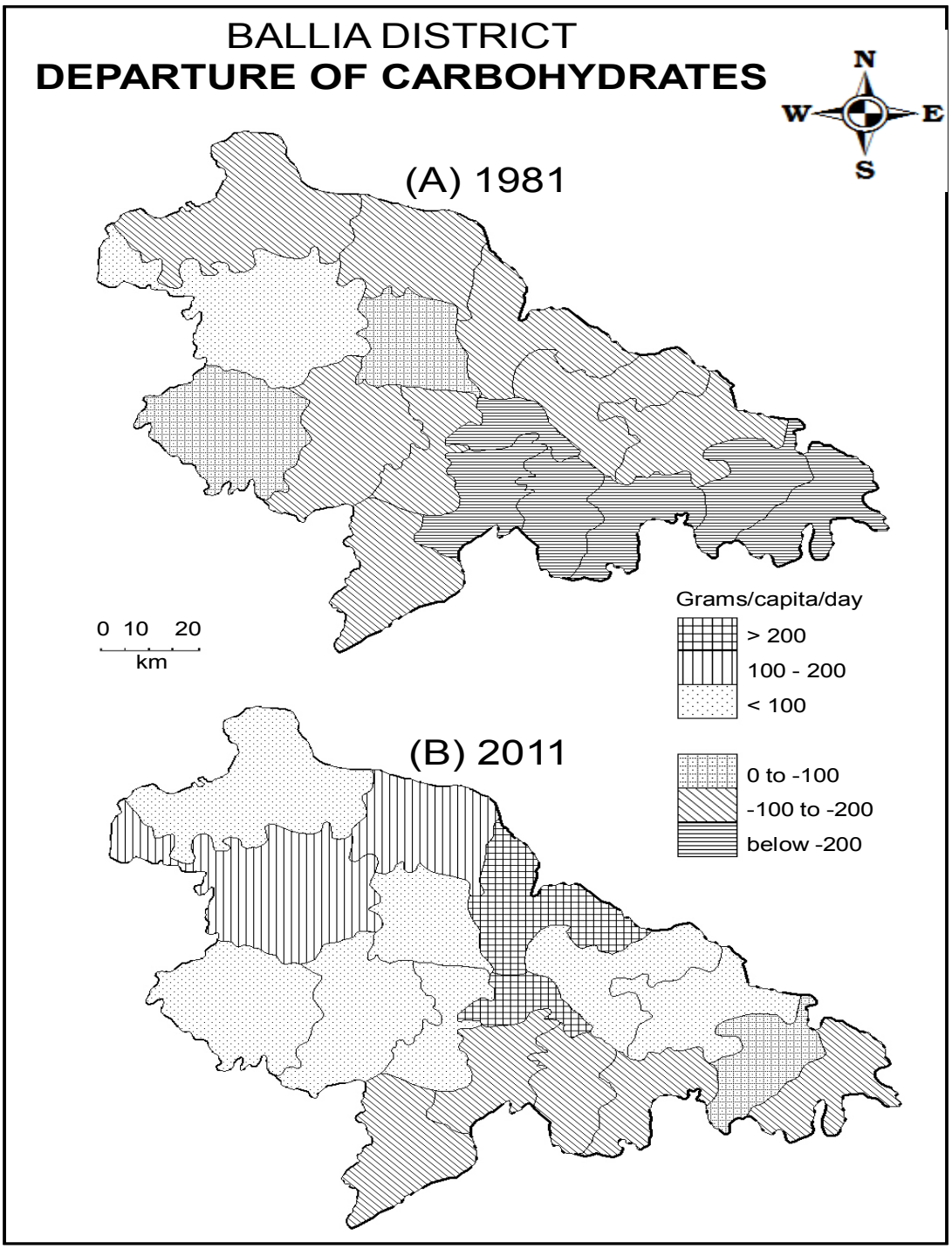
BALLIA DISTRICT
DEPARTURE OF CARBOHYDRATES
N
W
E
S
(A) 1981
0 10 20
km
Grams/capita/day
> 200
100 - 200
< 100
(B) 2011
0 to -100
-100 to -200
below -200

Fig. 7

Moderate carbohydrates availability surplus areas (100 - 200 grams/capita/ day)

No block was recorded in this category in 1981. But in 2011, Nagra and Pandah blocks came in this category.

Low carbohydrates availability surplus areas (< 100 grams/capita/day)

Due to low production of crops Nagra block was found in this category in 1981. Whereas in 2011, because of rapid growth of population seven new blocks such as Siar, Rasra, Chilkahar, Pandah, Bansdih, Reoti and Garwar embraced in this category.

High carbohydrates availability deficit areas (below -200 grams/capita/day)

In 1981, this category included six blocks namely Beruarbari, Hanumanganj, Dubahan, Belahari, Bairia and Murali Chhapara due to high concentration of population. But in 2011, no block was found in this category.

Moderate carbohydrates availability deficit areas (-100 to -200 grams/capita/ day)

Fig. 7 depicts that eight blocks such as Siar, Chilkahar, Nawnnagar, Maniar, Bansdih, Reoti, Garwar and Sohaon were found in this category in 1981. Whereas in 2011, five blocks namely Sohaon, Hanumanganj, Dubahan, Belahari and Murali Chhapara remained in this category.

Low carbohydrates availability deficit areas (0 to -100 grams/capita/day)

Only Rasra and Pandah blocks were found in this category in 1981. But in 2011, only Bairia block embraced in this category. The reason behind this is low crop production.

Conclusion

The issues pertaining to spatio-temporal variation of nutritional availability are receiving due attention of the local planners, academicians, nutritionists, health care specialists as well as policy makers. The present research study clearly point-outs the notable spatial variations in nutritional availability at block level in the study region. The findings of the study highlight that Pandah, Reoti, Garwar, Sohaon, Hanumangaj, Dubahan, Belahari, Bairia and Murali Chhapara are deficit blocks in dietary energy; Hanumanganj, Dubahan and Belahari in protein; and Sohaon, Hanumanganj, Dubahan, Belahari, Bairia nd Murali Chhapara are in deficit of carbohydrates. These blocks are required to increase production of crops to balance nutritional availability in the study area.

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Probable Imprints of Neotectonics or Recent Crustal Movements in Bansloi River Basin, Rajmahal Volcanic Province, Jharkhand, India

Manjari Bhattacharji

The probable imprints of neotectonics on the shape and drainage characteristics of the Bansloi river basin, located in the southern portion of the Rajmahal hills, is the subject matter of enquiry in this article. The asymmetric cross section and the series of prominent convexity and concavity of the main and tributary basins have been attributed to the dynamics of regional tectonics (specifically the evolution of Himalayas to its north) on the river systems of the area. The formation of a centripetal drainage site at the lowest reach of the Bansloi due to its sudden northerly turn despite the eastward dip and topographic tilt of the area is another imprint of the neotectonic movement in the area. The sudden northerly turn of the Bansloi appears to have captured the lowest reach of the Torai river, the only left bank tributary of Bansloi, thereby lending a tributary status to this erstwhile independent main river.

Keywords : Neotectonics, Response of fluvial system, Tertiary uplift, Low relief

Introduction

The surface exposures of the Rajmahal Volcanic Province (RVP) in the state of Jharkhand, eastern India , is traversed by three major west to east flowing rivers. From north to south, they are the Gumani, Torai and Bansloi (Fig. 2). The shapes of these river basins are strikingly different from each other and each of them appears to be an independent structural unit, despite homogeneity in the underlying geological formation composed of the Rajmahal traps. The present article deals with the detailed discussion of the structural and tectonic implications of the drainage features of the Bansloi basin.

The Study Area

The study area i.e. the Bansloi river basin lies in the southern portion of the surface exposures of the Rajmahal Volcanic Province occurring in the form of the Rajmahal Hills (24° - 25°15'N; 87°29' - 87°45'E). It is a continental Flood Basalt Province (CFBP) of Early Cretaceous Age at the rifted margin of the Indian Peninsular Shield (Mcdougall and McElhinny, 1970; Duncan, 1992).

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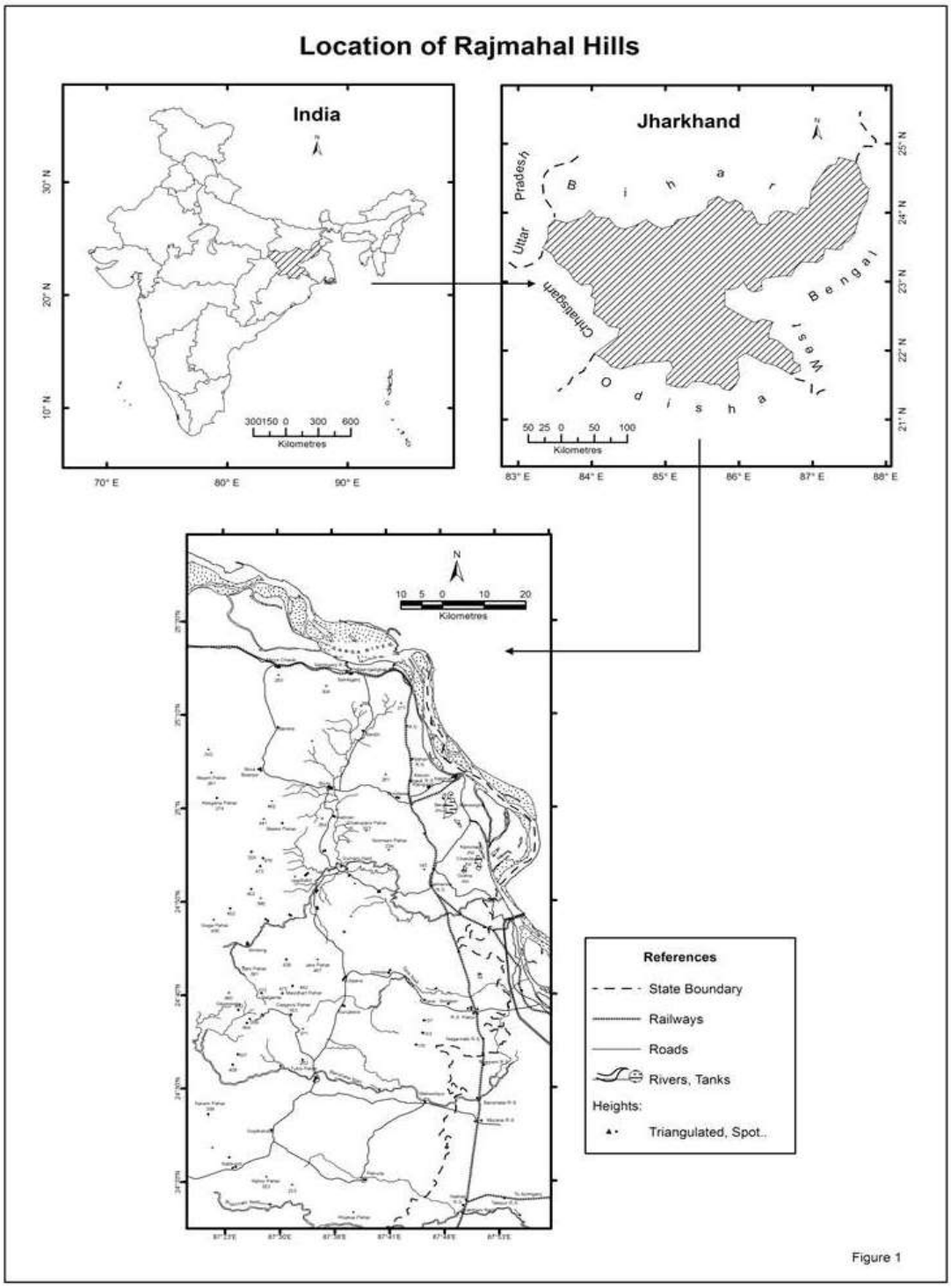

Location of Rajmahal Hills
India
Jharkhand
Kilometres
References
State Boundary
Railways
Roads
Rivers, Tanks
Heights:
Triangulated, Spot..
Figure 1

Location

The study area is located in the Pakur district of Jharkhand, (erstwhile state of Bihar) eastern India (Fig 1). It can be approached by Sahibganj Loop Line of Eastern Railway from Kolkata (West Bengal) located at a distance of about 300 Kms to its east-southeast and also from Bhagalpur of Bihar lying at its northwestern corner. The principal town and railway station is Sahibganj in the north-central margin of the hill and Barharwa in east-central margin of the hill (Fig.1).

Neotectonics

Neotectonics, attributed to Obruchev (1948), refers to the study of the processes and effects of the movement of the earth's crust that have occurred in the Late Cainozoic (Neogene) period. Some geologists use it in a temporally restrictive way by referring to Post Miocene or just quaternary movements. Some other authors have used the synonym of 'active tectonics', while others considered the start of the 'neotectonic' from the Middle Miocene (Pavlides, 1989; Becker, 1993; Markovic *et al.*, 1996 and Cloetingh *et al.,* 2002). According to Mörner (S-10691) the use of the term 'neotectonics' should be restricted to phenomena of the last 2.5-3.0 million years with its first phase represented by the general tectonic reorganization that took place during the relatively short period of 3.0-2.5 My ago. There were also subsequent periods that seem to represent periods of more generally intensified tectonic activity, viz. at around 1.6 and 0.8 My. He further suggests that at any rate, we are now able to identify the 3.0-2.5 My period as a period of considerable tectonic activity more or less all over the globe, marking the onset of a new tectonic phase in Earth's evolution; the neotectonic period.

However, there has been a disagreement as to how far back in time 'geologically recent' is, with the common meaning being that 'neotectonic' is the youngest, not yet finished stage in earth tectonics. A general agreement has been emerging that the actual time frame may be individual from each geological environment and it must be set back in time sufficiently far, to fully understand the current tectonic activity (Koster, 2005). Pavlides (1989), however, suggested, 'neotectonic' is the study of young tectonic events, which have occurred or are still occurring in a given region after its orogeny or after its last significant tectonic set-up. In the present century it is commonly referred to as Recent Crustal Movements (Thomas & Goudie, 2006:334-335).

Neotectonics and Drainage Characteristics

Neotectonic controls on drainage characteristics 'involve response of fluvial system to ongoing tectonic activity' because the impact of these recurrent 'recent crustal movements' easily impact the softer surface materials and surface river courses.. Response of fluvial systems to even 'modest tectonic movements' are therefore more pronounced and conspicuous in areas of minimal relief with very low steam gradients such as the study area.. 'This is partly because only a very slight tilt of the land-surface, perhaps by only a fraction of a degree, is necessary to cause drainage reversal. Another factor is that a river with a very low gradient, especially when it also has a small discharge will be incapable of a rate of down cutting sufficient to maintain its original course (Summerfield,1992: 405;411).

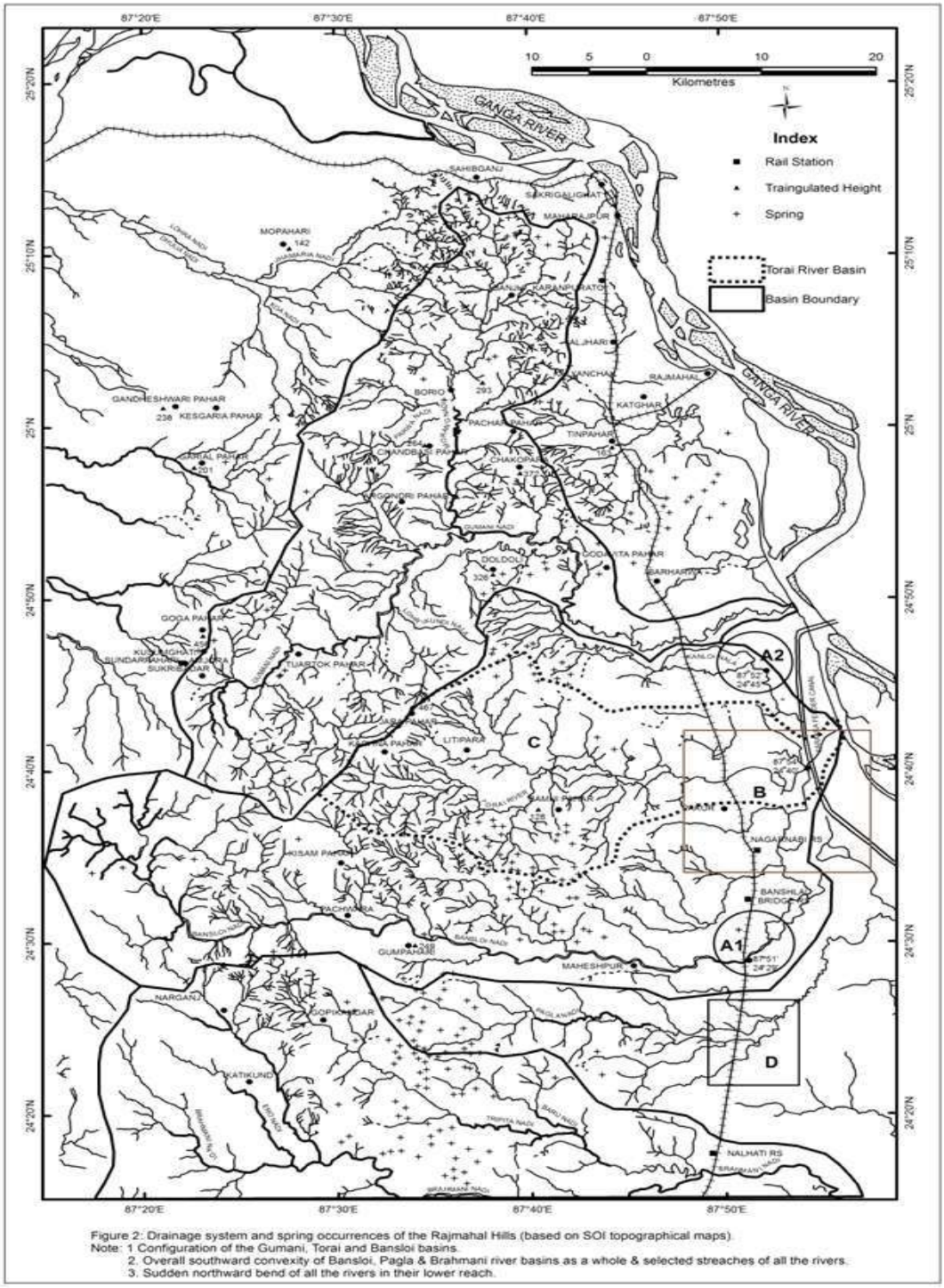


Figure 2: Drainage system and spring occurrences of the Rajmahal Hills (based on SOI topographical maps).
Note: 1 Configuration of the Gumani, Torai and Bansloi basins.
2. Overall southward convexity of Bansloi, Pagla & Brahmani river basins as a whole & selected streaches of all the rivers.
3. Sudden northward bend of all the rivers in their lower reach.

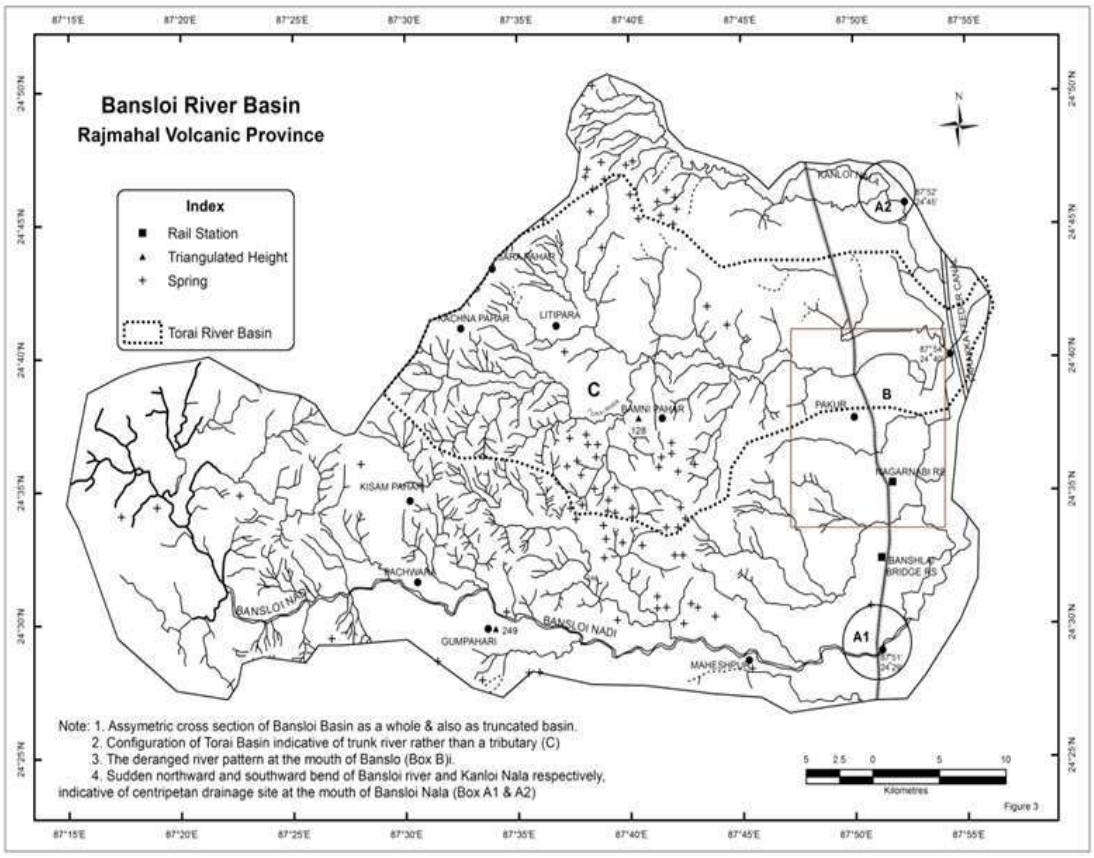
Alluvial channels in particular 'are sensitive to variations in discharge and sediment load characteristics. 'Active faulting can have dramatic impact on fluvial systems ,yet slower vertical deformations can lead to more subtle, but significant adjustments in channel morphology that include local development of braiding or meanders, creation of ponds or marshes, accumulation of alluvial fills and widening or narrowing of channel reaches. Deformation of fluvial channels can take many forms, but the primary effect is usually either a local reduction or increase in channel gradient, or lateral tilting of the channel leading to channel aggradation and incision.

Neotectonics and its impact is however not restricted to active crustal areas like plate margins, but they are found in ancient intra-plate landscapes like Australia. The evidences include surface-breaking fault ruptures and tectonic derangement of the major fluvial systems in the Murray-Darling Basin over the last few millions of years. The proposed defeat of the ancestral Murray River some 3 million years ago and consequent damming of a major continental drainage by an uplift of no more than 100-200 m implies an extraordinarily susceptible natural system, prior to the onset of human impact. The neo tectonic intra plate record of the IAP (Indo Australian Plate) is also reflected in southeast Australia. Here the ongoing record of neotectonic activity is consistent with the historical seismicity (Sandiford, 2003, Sandiford, 2003a).

The Relevance of Geotectonic or Recent Crustal Movements in the Study Area

The definition of Neotectonics used in this paper is that of Thomas & Goudie (2006:334-335). Therefore it has been used interchangeably with the term 'Recent Crustal Movements' and 'active tectonic control' (Summerfield, 1992:405).

Imprints of neotectonic activity, specifically pertaining to the post Himalayan Phase, in the region are many. The formation of the Rajmahal Garo-Gap in the pliocene (5.2 - 1.62 M yr BP : Alam, 1989, Khan, 1991) or Pliestocene (1.65 - 0.01 My BP ; Auden, 1949,1972) and the extensive flow of the Rajmahal Formation, that lie over the stable shelf-zone of the Bengal basin to the east of RVP, are cases in point. The latter i.e. the Rajmahal Formation over the stable shelf-zone of the Bengal basin is a testimony of the post cretaceous down-throw of a north south trending fault probably activated by the active tectonic movements along the 'hinge zone at a depth of about 15,500 ft that shows a conspicuous basin ward flexure' (Sengupta, 1966: 1008; 1001). In fact "throughout the tertiary era, the Bihar, West Bengal, Shillong, Mikir and Assam Valley area(all these are genetically linked to the RVP) was a slowly sinking shelf accumulating a moderate amount of sediment. On the southeastern slopes of this shelf, there were a number of normal faults trending NE-SW and down-throwing to the SE…Movement along these normal faults persisted at least until the Miocene,as the geosynclinal area continued to sink more rapidly than the shelf area"(Evans,1964:92-93). Not only faults, the area also bears the effect of the sequences of uplift of 'an early Tertiary peneplain to its south and southwest'. This peneplain has been envisaged to be represented by the Netarhat and other nearby plateaus, residuals above the Ranchi plateau and RH. The last mentioned unit, i.e. RH, marks the north-eastern corner of the said peneplain



(Dunn, 1939:141). Two phases of uplift of the southern part of this peneplain has been envisaged. The first phase is pre-Tertiary and the second is of middle or late Tertiary age. Both the phases of uplift resulted in a northward or north-eastward tilt of the plateau from Hazaribagh. The upwarp was abrupt on the eastern side. Phases of uplift to the south continue to the present day (Dunn, 1939). These are perhaps related to the uplift of the Himalaya, but the nature of the uplift is vastly different.

Apart from the structural configuration that makes the area prone to active tectonics, the geomorphic characteristics of the area characterized by an eroded rolling upland in the upper reaches and a depositional plain with a characteristic low relief in the lower reaches also renders it susceptible to the geomorphic impact of neo-tectonics.

The Ganga floodplain on which the river Bansloi debouches into, is inherently characterized by frequent, rather annual, changes of river courses. It would be pertinent to mention here that changes in the course of alluvial rivers occur due to several reasons, chief among them being the natural cyclical oscillation of river courses arising out of the floodplain dynamics of river sedimentation. Therefore to straightaway attribute certain anomalous floodplain and drainage features to

neotectonism would be rather farfetched and redundant as well. However, in the present case the probable impact of neotectonism appears to hold sway given its fault and rift dominated regional structural configuration at the rifted Peninsular shield margin (Mukhopadhyay et al., 1986).

The Bansloi River Basin: A description

The river Bansloi, has its source in the south- western boundary of the RH and flows through Amrapara and Maheshpur and then turns north and falls into the Ganga near Krishnapur, a little to the north of Dhulian. In its lower reach the river is known as the Baghmari Nadi. Torai is its important left bank tributary and joins the main river before the Farakka feeder canal crosses the latter.

The basin has an asymmetric cross section. Along its right bank the basin boundary runs almost along the river channel. There are no tributaries joining it on this side in its middle and lower reaches while only a few join its upper reach. It is convex to the south and is approximately saucer-shaped. Several series of prominent convexity and concavity is noticeable in several river basins of the region. Even the Torai Basin (discussed below in section 5.1 detail), displays this asymmetric cross section with a prominent convexity to the south.

It would be pertinent to summarise here that the feature of southern convexity and northern concavity bears a semblance of parallelism with that of the Himalayas indicating thereby the probable imprint of the dynamics of regional tectonic (specifically the evolution of Himalayas to its north) on the river systems of the area.

Another noticeable feature of the Bansloi basin that strikes even a casual observer is the case of the Torai River, the single left bank tributary of river Bansloi.

Torai River : A Tributary or a Trunk River?

River Torai rises in the southern end of the western boundary of the RH and joins river Bansloi at 24°46':87°53', about 4 Kms before its outfall into the Farakka Feeder canal. The river itself and its basin as a whole, presents several interesting features. From its size and extent, it appears to have been an independent trunk river with a probable original outfall into the Ganga. This inference is based on the fact that the greater extent of the course of this river runs parallel to river Bansloi (Fig.3) and debouches into it a few kms before its outfall into the Ganga at 87°54':24°40'(a site that marks the lowest reach of the river). Consequently, the length of the 'combined flow' of Bansloi and Torai is very small or rather almost indiscernible (Note Box A in Fig.3). This is a noticeable observation and it appears that the tributary status of river Torai is an effect of neotectonics (Gregory and Schumm, 1989:41), in the lower reach of river Bansloi.

The probable independent entity of the Torai basin appears to be attested to, by the direction of flow of the tributaries of the Bansloi and Torai rivers too. The tributaries to the former flow from northwest to southeast probably in keeping with the eastward regional tilt, while those to the latter flow either from north or from south. Easterly flow of tributaries to the Torai river prevail only in the eastern foothill of the southern part of RH (along the western boundary). These features probably

suggest a subsidence in the middle reach of the Torai basin on a very local scale, causing the tributaries to directly flow northward or southward into the central part of the basin.

Nature of the Probable Impact of Neo Tectonics

Neotectonic movement in the region in the form of pre-Tertiary and late Tertiary uplift of the south and southwest' of RH seems to have particularly affected the lowest reach of River Bansloi probably causing a localized subsidence near its confluence with the Ganga.

The net effect of this event resulted in the creation of a site of centripetal and a deranged drainage network. This episode appears to have affected the lowest reach of several other rivers flowing through this area. Principally noticeable in this regard are the Torai river and the Kanloi nala (Note Box B in Fig.3). The northward turn of the Bansloi at 24°37':87°54' must have captured the lowest reach of the Torai river, thereby lending a tributary status to this river. The sudden southeastward elbow bend of Kanloi Nala at 24°46':87°53' which joins the lower reach of Bansloi River about 2 kms before its outfall into the Farakka Feeder canal is also a case in point. Singh (1969) also inferred downstream tilting of Torai and Bansloi rivers on the basis of a study of the drainage pattern.

Other signatures of neotectonics or active tectonics in the basin include the abrupt variations in the direction of flow of Torai at selected stretches, despite the eastward regional tilt of the area. These possibly bear indications of the ongoing tectonic movements in the region. Eastward flow of the river prevails over a short distance only, just after its descent from the hills. Careful observations reveal abrupt changes in the river characteristics upstream and downstream from Hiranpur. In the former, it flows through a broad meander while in the latter it flows through very closely spaced meanders with Yazoo streams on either banks. This could be a result of the change in local structural character (e.g. joints/faults spacings etc.) or a fault in the area upstream and downstream of Hiranpur as well as neotectonic movements. Several such arcuate faults have been interpreted on the basis of regularity in the pattern of topographic features (Bhattacharji, 1996:17).The probable influence of such local structural features (e.g. joints/fault spacings etc.) is perceptible in the abrupt changes in the micro landscape features of the region too. Field inspection at one of the sites of abrupt changes in the channel pattern within short distances and the presence of short straight segments in between closely spaced meanders near Torai settlement has revealed the presence of deeply incised meanders. These features bear clear testimony to the active tectonics within this region. Similar evidences of river entrenchment in response to uplifts are also found in the Pearl river (Gregory and Schumm, 1989:51).

The drainage pattern at the headwater zone of river Torai is radial. The watershed of Torai and Bansloi rivers is very inconspicuous too (Fig. 3); indicative of the possibility of its subsequent breach and consequent river capture by the competing stream. The radial drainage pattern appears to suggest a domal structure at this site. It is interesting to note

that this site roughly coincides with the Central Gravity High (CGH) reported by Mukhopadhyay et al., (1986: 358) on the basis of the bouger anomaly map of the Rajmahal hills and adjacent areas. It opens out southward, and is terminated in the north by the east-west trending gravity anomalies of the Gangetic foredeep. The CGH attains its peak amplitude over the shield edge along the western margin of the Rajmahal volcanics. It has an average wavelength of 100 km in an east-west direction and extends beyond the metamorphic Gondwana boundary along the western margin of the Rajmahal Hills.

Conclusion

Abrupt variations and anomalies in flood plain and channel configuration of water courses (direction, pattern and confluence of streams) and concomitant micro- landscapes in the Banlsoi basin are striking. This is more so because many of these features do not conform to the eastward regional dip and topographic tilt of the traps over which they flow. Recurrent variations of the stream characteristics in terms of sudden bends, meanders ,braids and incised stretches are difficult to account for, without recourse to the probable effects of the regional and local faults and the probable active micro scale fracture patterns that presumably abound here (Bhattacharji, 1996).Since the observed river and drainage patterns are non-conformable to the eastward step-fault dominated regional structure of the area at the macro or micro scales (Ghosal, 1986; Sengupta, 1966, Gaonkar,) it is summarised that the anomalies have been superposed over the region through neotectonic activity.

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Health Dimensions of Human Well-being : An Exploration of Linkages and Major Issues

Ravi S. Singh and Satheesh Chothodi

Well-being is central to human existence. Its study is over half-a-decade old and has got enriched philosophically and empirically as indicated by the present state of discourse. It is very important issue for societies like India where a visible rural-urban gap is found in every respect. Improved state of human development is an indication of positive social transformation and better well-being state of individuals. Human well-being is a multi dimensional concept, which varies in space and time. The present paper attempts brief analysis of varied dimensions of well-being with special reference to health. The analyses and discussions are primarily based on published literature and secondary data sources.

Keywords: Capability, Development, Health, Rural, Well-being.

Introduction

The term 'development' is undergoing paradigm shift in its meaning, implementation and targets since 1950s (cf. Singh, 2008). Rapid changes in the world economic scenarios, especially since the 1990s (popularly known as 'post-liberalisation period'), the focus of international economic pool is facing a shift from known (high income group) developed economies to the upper layers of the developing world. The economic as well as non-economic states of development therefore are the focus of contemporary discussions (cf. McGillivray, 2005). Realisation by the international organisations regarding the concept of development leads to rapid investment for improving the qualities of human resource base. Though human beings are the agents, beneficiaries and adjudicators of progress, they also happen to be directly or indirectly the primary means of all production (Sen, 2003). However, there is a huge variation and inequality too in the utilisation of those means of production. Whether the accumulation of wealth as well as the resources has led to any improvement in the life of marginalised or deprived people or not is still a question confronting the world community at large. The discussions on human development (HD), quality of life (QoL) and well-being (WB) are highly relevant in this context.

Development of region largely depends on the availability and utilisation resources in that region. In contemporary times, the degree of connectivity, which facilitates import as well as exports of resources, has proved to be a

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game changer. Here, resource means, '...the aspects of biophysical environment and the portions of total stock that could be used under specific technical, economic and social conditions (Hugget, 1975 as quoted in Joshi, 2012). This definition thus includes both physical and cultural resources bases. 'Development' is a continuous process, which depends on the nature and way of utilisation of above mentioned resources. According to Thirlwall (1986), development implies change and in one sense it is used to describe the process of economic and social transformation (Choudhury, 1995). The basic objective of the development is to create and enabling environment for people to enjoy long, healthy and creative lives by reducing the gap between the haves and have-nots. It is an ultimate goal of the democratic nations including India working hard towards achieving this aim.

The objectives of development have apparently shifted from infrastructure to human development (HD) and QoL, and finally to attain the feasible level of happiness and satisfaction of individuals (cf. Singh, 2005). Though India the fourth largest economy in the world have the annual average gross domestic product (GDP) growth rate of above five percent, even after the economic depressions of 2009-2011, few of its federal states and union territories have been able to achieve better human development index (HDI) compared to many of the West European countries. But, the rural-urban differences are still continuing in terms of QoL and HDI. And, it becomes matter of concern as more than 60 percent of the Indian population still live in rural areas. The problem is further complicated due to social, cultural, and economic complexities.

If development means good change, question arises about what is good change and what sort of changes matter? Any development agenda is value laden, and not to consider good things to do is fatal. To some extent, it depends on the environment and circumstances in which an individual person lives. Since development depends on values and alternative conceptions of the good life, there is no uniform and unique answer. At the same time, there is no doubt about the fact that well-being and welfare have regional and geographical dimensions (cf. Kulkarni, 1990). The present work is an attempt to make brief appraisal of emerging issues in the development discourse and how does it add new dimensions to the conventional understanding of human well-being with special reference to health. Accordingly, the following discussions are organised into three major sections: development verses human development, human well-being, and human health with special reference to rural areas and women. Health status, availability and accessibility dimensions have been given special focus.

Development verses Human Development

Responsibility of the states is to consider their population a valued asset as human resources base. Sovereign states are trying to provide better life and opportunities to their citizens. Economic growth and development have been generally considered as physical capital accumulation and technological progress for productivity improvements (cf. Suryanarayana, 2008). However, they directly depend on the quality of the human capital. Here, man is perceived as a resource creator, its beneficiary and sometime its destroyer as well. Further man accumulates capital, exploit

resources and builds technology and institutions, which facilitate development (cf. Joshi, 2012). It is clear that human beings are the major cause and appellate of the development action. Improvements in the quality of life of the individuals have a pivotal role for a matured family, a progressive society and ultimately a developed nation.

Rapid changes in the conception of human development have been noticed in recent times. Amartya Sen's works have contributed considerably to it. Once he pointed out that 'economic growth is only one aspect of processes of economic development. It is attained through long use of human capital, at the same time the benefit of tremendous economic growth should have some positive reflections on the individual (citizens) too. So development should be based on principles of human dignity, equality and social justice and it should include socio-cultural elements, like improvement in social quality of life, elevation of moral fabric, and invoking wider community perceptions. Therefore, in the ongoing discourse on development, quality of human resource is considered most vital for the continuity of development process of a region or a state.

Drewnoski (1974) had emphasised the utility of development process. Development is process of qualitative change and quantitative growth of social and economic reality which we call either society or economy. The close inter-relationship between economic and social elements precludes any purely social and economic development. It is better not to speak of social development and economic development separately, but single processes called 'development' (Smith, 1977). Such views on development actually indicate towards human development. Human development does not mean economic growth; it reflects both social as well as economic development of each and every individual in a society. The final objective is all round improvement in the quality of life of the people. Sen (1984) have mentioned the flourishment of the intrinsically valuable capabilities – such as being able to live, escape avoidable morbidity, be well nourished, be able to read, write and communicate, take part in literacy and scientific pursuits and so forth (Clark, 2006). Both development and human development are concerned about improvement in welfare or well being.

Human Well-being

Development and its processes target widening and diversification of human capabilities. The state of well-being will remain a dream as long as state is unable to fulfil the basic needs and wants of the people through which their basic capabilities are developed. It means the availability of basic requirements is central in an individual's life. Development means a better state of affairs, with respect to who gets what, where and how (Smith, 1977). It upholds human beings from backwardness to the limelight of hopes and fulfilment of their needs and wants. Development of societies in a region or nation directly depends on the nature of well-being enjoyed by their people (see, Smith, 1977; Coates, Johnston and Knox, 1977).

The idea of development/ human development has always upheld the views of human well- being. Well-being is defined as the actual degree of satisfaction of needs and wants of a community (Knox et al., 1977) and individuals. The level of living and quality of life are clearly established as the factual circumstances of well-being. Whereas the standard of living relates to the circumstances

aspired to by the community. David Smith (1973) emphasised on distinction of economic and social well-being (Coates, Johnston and Knox, 1977). The term well-being includes various other terms such as 'level of living', 'quality of living', 'social welfare', and 'level of satisfaction'; and, it is a synthesis of physical, material, cultural and spiritual well-being (Kulkarni, 1990). But, in the present context, human well- being has multi-dimensional perspective. It is not confined within the boundaries of economic and social dimensions and includes various aspects of individual life. The present discussion tries to focus on major dimension of human well-being in the Indian rural context.

The economic backwardness has an overall negative impact on individuals and the life of their families. It not only affects the standard of living but also affects the potentiality of future generations. Compared to the individuals with high income, the (economically) poor have relatively few social resources to draw on. They have smaller social net works, less organisational involvements and less frequent contact with friends and family. Poor also have low level of physiological well-being and have negative impact on the mental health (cf. Amato and Zuo, 1992). It has been found that the states which have poor revenue generation perform badly in providing the basic necessities to their people. But in few situations state with large geographical area also face problems in improving people's living standard due to inaccessibility (Singh, 2010).

Economic realm of well-being has a direct relation with the state of overall well-being. As argued earlier, well-being of the people is possible by improving the overall standard of living and it ultimately reaches to the quality of life of individuals. According to Haas, 'well-being is concerned with all dimensions of life' (Clark, 2006). Like the issue of satisfaction in life, it is a subjective assessment to a certain extent. The domains of well-being are not confined to nor concentrated on expansion of real income and economic (status) growth, which are traditionally treated as the success of development. At the same time, it is not treated as minor indicator for its larger impact on rest of the areas of development and well-being. Beyond the economic pursuits, health, education, housing, and environment also have a notable role in determining the state of well-being of an individual (Smith, 1977; Haq 2009) with variation from local, regional to the global level. It is worthwhile note that economic status is not a major factor which decides the state of human life. For example, Sri Lanka with below modest per capita income is well ahead in life expectancy compared to many countries which are economically better (cf. Table 1).

Table 1. *Economic prosperity and life expectancy in select countries, 2013*

Country	GNP per capita (US $)	Life Expectancy at birth
China	7380	75
Sri Lanka	3400	75
Brazil	11760	74
South Africa	6800	59
Mexico	9980	58
Oman	18150	76
India	1610	66

Source: *World Mortality Report, 2013*

Subjective versus Objective Well-being

Quality of life is the quintessence of overall life of an individual. In other words, QoL

is in general the assessment of human experiences and human well-being is the actual degree of satisfaction of life. Well-being has a positive correlation with the nature of satisfaction of needs and wants of an individual. It does not mean the fulfilment of merely minimum requirements for her/his survival nor just the absence of pain, discomfort and incapacity. Rather well-being is a positive physical, social and mental state. It requires basic requirements met so that individuals have a sense of purpose that they feel able to achieve important personal goals and participate in the society (Xing and Chu, 2011). It is about the mental state or physiological well-being of an individual. How an individual is securing that mental state? This view takes the researcher to think of the perception based well-being concept. It has two dimensions and is enhanced by some particular situations and circumstances like 'supportive personal relationships, strong inclusive communities, good health, financial and personal security, rewarding employment, healthy and attractive environment' (ibid.). All the above mentioned have subjective as well as objective pursuits. The state which targets the overall well being of its citizens is always focused on improvement of physiological status too which promotes the quality of the human resource base and empowers the economic progress of the country.

QoL indeed indicates quality of people's being (existence). It is the extent to which the objective human needs are fulfilled in relation to the personal or group perceptions of subjective well-being. Human needs are the basic need for subsistence, security, affection etc. The objective pursuits of well-being are visible components which affect life and growth of the individual directly/indirectly. But, subjective well- being pursuits are the components which affect the mental state (satisfaction) of individuals. While analysing the living condition of the people, the subjective experience and attitude towards the objective dimensions of living conditions will get reflected. Analysing both subjective as well as objective aspects are essential to have a clear view of overall well-being. To a certain extent, the subjective persists are derived from the quality of objective components of life.

Veenhoven (2007) argues that in subjective well-being an individual seeks to re-evaluate wellness, which has the potentials of wider social focus, such as modernity to influence it (also see, La Placa, McNaught and Knight, 2013). Individual well-being has a close relation with the satisfaction of life domains. Subjective well-being is defined as people's own subjective experiences of surviving and developing conditions. Furthermore, it is the meeting of satisfaction, happiness and some sense of self worth. Specifically satisfaction refers to the individual's cognition and evaluation of different domains. Happiness is the positive emotion that people experience and sense of self worth means a person's target location and spiritual support of life (Xing and Chu, 2011). Evaluation of subjective well-being gives a show of his/her personal life features. But, objective well-being refers to the condition that people obtain from the natural and social systems, including the health and basic survival, economic well-being, political well-being, social well-being and cultural well-being (Coates, Johnston and Knox, 1977; Smith, 1977; Xing and Chu, 2011). In the later stages, the quality of natural living environment is incorporated as component of objective well-being and termed as

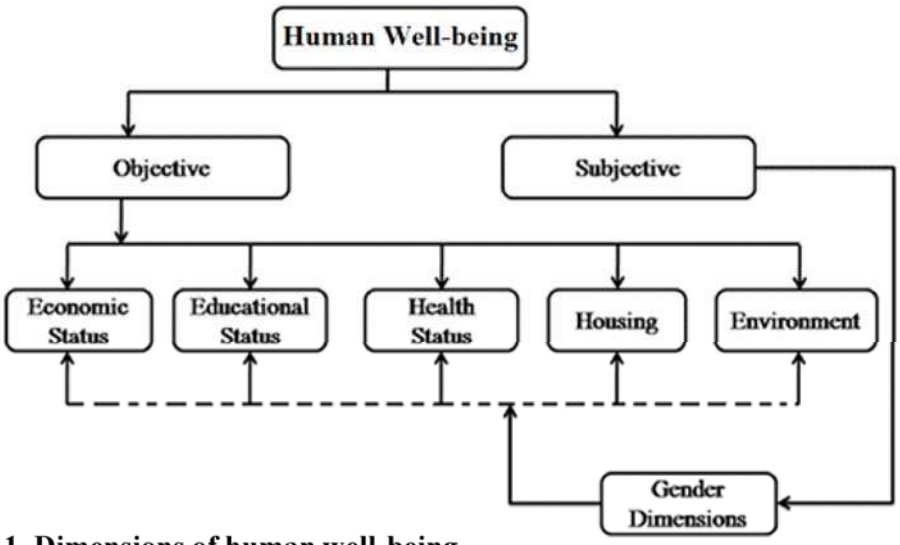

Fig. 1. Dimensions of human well-being

environmental well-being. The above mentioned details reflect the diversified yet interconnected areas which influence the well-being of an individual and society. Thus, an assessment of human well-being must include both objective and subjective indicators of life, since both captures different dimensions of well-being (Veenhoven, 2007). A combination of objective and subjective pursuits of well-being and its dimension have differences in identity and intensity in over space and time. It depends on changing scenarios of human needs and wants. Here, objective aspects concern the basic necessities and subjective aspects with the expansion of human needs and wants (cf. Fig. 1).

In this vein, it is logical to argue that well-being of an individual means situations (continuous/ regular), which widens his/her positive opportunities, expand the capabilities and can able to attain minimum required satisfaction to take forward his or her life course comfortable, healthy and happy. There are heterogeneities in the well-being domains because space and location play a key role in the day to day life and requirements of the individuals. Physiography, climate ad natural environment have a pivotal role on human life. In the modern period the existence of sovereign republics and states are based on the state of well-being of its citizens. Well-being here is lined with public policy. 'Social policy, which is implemented by the state and authorities for people are considered as the primary function of the well-being or welfare measure in a sovereign state' (Veenhoven, 2007). It emphasises the role of government about people's well-being and it enable to access its citizens the resources for the current and the future needs. The government approaches have wide variations globally as well as regionally.

The nature of well well-being is experiencing a stratified form through-out the world in recent period. It is more visible in India, especially in the social welfare policies, disinvestment policies, opportunity creation, etc.

It is because of well-being have local, regional and global dimensions in its scope as proven by various studies conducted by the United Nations (UN) and the World Bank especially after the 1990s in different parts of the world. These studies have been done considering some specific indicators appropriate for the region concerned. In India, the rural situations are quite different from the urban circumstances. Naturally, the individual well-being evaluation has differential sets of indicators for rural and urban environments as the selection of indicators should be based on geographical scale, and the territorial indicators give better results (cf. Kulkarni, 1990). For the better understanding of well-being conditions, a detailed study of all associated major components is essential. Here, we will be discussing only one dimension in detail that is human health.

Human Health

The health and health care domains of well-being have global acceptance and are major issues of discussion in India too especially in the case of rural areas. A tremendous increase in the expenditure on health (physical/ mental) and health care (public/private) prove the relevance and significance of the human capital in the modern world. The positive reflections are observed in the form of expansion of longevity (life expectancy) in the modern society. The per capita state expenditure on human health has an whopping increase of 10 to 50 times from developing to developed world during 1950s to 2014. Health care system is transformed from general medicines of early 1970s to speciality services of the early 1990s to super-speciality services of the 21st century. It is the situation in India, a developing country, which carries 1.22 billion of population.

Economic prosperity has received higher priority to improve or enrich human life. There was very little scope for promoting the human capital. But, the later concepts and emphasis on development made the world realise relevance of human qualities and the necessity of quality improvements among humans. Amartya Sen's approach of capability expansion received a worldwide acceptability in this regard and good health contribution to higher productivity and to enhance ability to convert income and resource into good living have been well appreciated (Sen, 2003).

Human well-being is a condition in which all members of the society are able to determine and meet their needs and have large range of choices to fulfil their potentials (Veenhoven, 2007). The potentiality of the human beings is considered as the ability of positive creations that is directly based on his/her physical and physiological state of health. State of health is identified as an important dimension of well-being by different scholars. Similarly, health has been defined in many ways. In 1957, the World Health Organisation (WHO) defined health as more than simply the absence of diseases and considered it rather 'a complete physical, mental and social well-being'. It was well advocated that positive health is essential for the well-being of an individual. Health is complimented by education in this context; and, both are recognised as two major components of the human capital (Suryanarayana, 2008) having a fundamental role in the (economic) growth enhancement and poverty reduction.

The WHO's definition correlates health with well-being of individuals. According to Ottawa, where the health is defined as resource

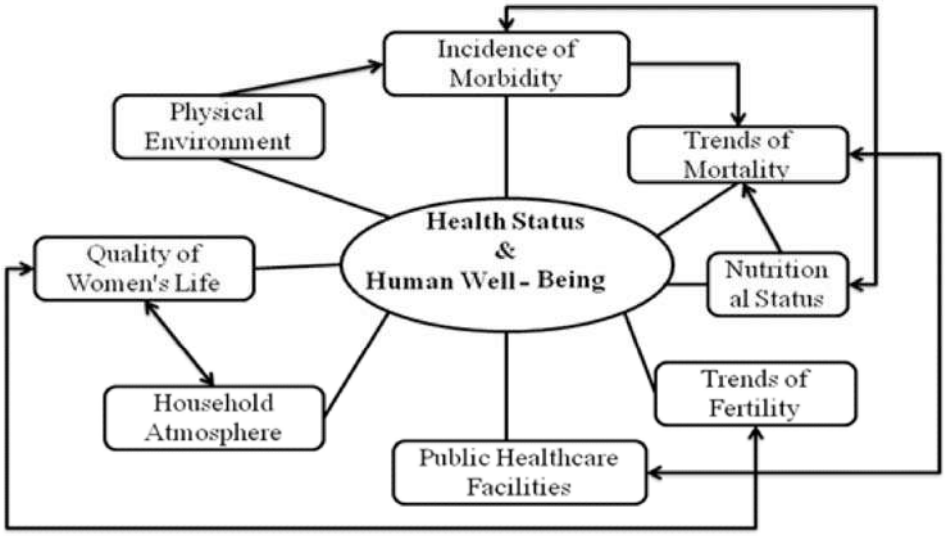

Fig. 2. Major dimensions of improved health status and human well-being

for everyday's living, that allow cope with, manage and even change our environment; alternatively health is being physically and mentally 'fit' so as to be capable of functioning effectively for the good of their wider society. Linked to this is the idea of health as personal or mental strength, fullness or energy or engaging in what we might think of as healthy behaviour or life style. Here health is identified as a major determinant of happiness (Mishra, 2006). The attainment of individual's happiness means achievement of his /her desire's (needs and wants) fulfilment.

The mental state of health is well-being's subjective perspective. Here subjective well-being is the fundamental facet of the QoL. The quality of an individual's life can be assessed externally and objectively or internally and subjectively. Health status comes under the objective stand point as far as longevity is concerned. The subjective perspective developed in the later parts of the 1950s. It had been an issue for the developed world for the reasons already discussed earlier in this paper. Subjective well-being consists of perceptions of owed interest in life, happiness and satisfaction with life and the balance of positive and negative effect (cf. Keyes, 2006). It is important to note that effectiveness and workability is the condition of physical and mental state of the people.

A wide range of aspects have significant influence on human health. Public policy and intervention of the state on health and related issues are playing a major role in the current scenario. Physical as well as non-physical aspects, from physiography and climate to the state of sanitation, are said to play pivotal role. Townsend and Davison (1982) had mentioned a strong relation of influence of socio-economic factors on human health and well-being, and identified that the dimensions and gradients have regional variations (Chowdhury, et al. 1995).

Fig. 2 explains the relationship between improved health status and human well-being

in the context of rural Indian. An evaluation of rural scenario in the recent period is very essential because more than 60% of the Indians are still rural masses. Among them a considerable section avails major health care facilities for their fruitful life. There are a number of factors which affect the physical and mental state of the individuals. It may come to the areas of objective well-being, but at the same time also compliments subjective well-being in a few ways, for example, the happiness rates of individuals. Nature and characteristics of productive population (age-group of 15-59 years) decide the trends of development in a region. Productivity of the population determines nature of expansion of individual's capabilities. As explained earlier, capabilities means of expansion of 'functions' and 'doings' of an individual (Sen, 1988). There are a number of dimensions (factors and situations), which directly or indirectly affect physical and mental state of the human beings, individually as well as collectively. Various studies have proved pivotal role of physical and mental states of the individual in her/his overall well-being (cf. Diener et al., 1999; Linssen et al., 2011; La Placa et al., 2013).

The well-being indicators are used to measure progress towards various bench marks or goals set by the international community (McGillivary, 2005). 'Health for All' in 1990, and universal access to healthcare by 2000 were the objectives of the Millennium Development Goals (MDGs). Its aims are the reduction of mortality, morbidity, birth rate, and ultimately improve the standard of living of the rural poor. The following section discusses various dimensions and indicators, which have direct impact on the health status and overall well-being of an individual and community as whole.

Incidence of Morbidity

Positive health is fundamental for individuals' happy and fruitful life. Diseases are the major problems which interrupt the well-being of the individual, family and ultimately the normal progress of a society. Morbidity shows the relative incidence(s) of diseases. Incidence of different diseases has correlation with poverty, deprivation, malnutrition and poor environmental conditions (Coates, Johnson and Knox, 1977). Burden of diseases or illness is a major issue of well-being (Fig. 3) including the incidences of communicable and non-communicable diseases.

The Indian Human Development Survey (IHDS) has identified four major types of medical issues as the following (Desai et al., 2010):

- Short term morbidity from cough, fever and diarrhoea;
- Long term morbidity from chronic diseases ranging from asthma to cancer;
- Disabilities that prevent normal daily functioning; and,
- Maternal medical care as well as self-reported overall health of women.

The economic, social and physical dimensions of the impact of diseases on individuals are beyond imagination. They affect the productivity of an individual as well as the household concerned. Thus, it plays important role in economic and social status and life style too. Finally it has bearing upon the healthy functioning of societies and nations.

Short term morbidity is due to communicable and infectious diseases. It accounts for substantial loss of time from usual activities. In many of the Central African

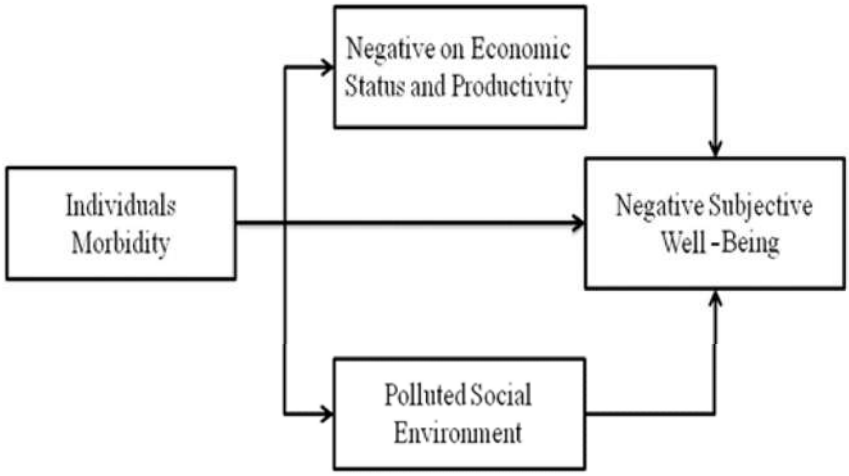

Fig. 3. Morbidity and human well-being

countries and in few cases in the Empowered Action Group (EAG) states of India, it is a matter of mortality. Long term morbidity of individuals is disastrous for their family and society in general. It has long lasting social and economic impacts. Long term illness is not so prevalent in the countries like India. It affects the old age population more. That is why the well-being of the aged population becomes crucial in this situation.

Disability is another health problem with considerable social and economic implications. Disabilities like blindness, deafness or inability to walk impose enormous burden on some individuals. They are quite equally distributed across classes and castes in India. However, the disabled are slightly concentrated among the poor and less educated sections (Desai et al., 2010).

The maternal health in case of women, especially mothers, is directly related to status of education of the individual and her family members. The anaemic condition of the mother has a negative impact on her and her infant's health. Poor and illiterate mothers are more likely to have serious maternal medical problems; but, in India, the important variation is more geographical than social (Desai et al., 2010). The nature and type of diseases affecting an individual directly impacts his/her overall well-being. The scoring of self-reported health is a major measurement issue. The morbidity rates are higher for the rich than for the poor households. Although, households do not uniformly determine the level of individual diseases, poverty is a cause and consequence of ill health universally (cf. Suryanarayana, 2008). The absence of diseases is the state of maximum satisfaction for an individual.

Mortality Trends

The permanent disappearance from life is otherwise called mortality. The trends and pattern of mortality of an area/region is a major indicator of the human development dimension. The communicable and non-communicable diseases are too important among the reasons behind deaths and nature of illness with respect

Table 2. *Average nutritional requirements: The Indian scenario*

Energy/Nutrient		Requirement	
		Amount	Unit
Energy		2400.0	calories
Protein		60.0	g
Fat		60.0	g
Carbohydrates		600.0	g
Minerals	(i) Calcium	900.0	mg
	(ii) Iron	30.0	mg
Vitamin	Vitamin A (Carotene)	2400.0	IU
	Vitamin B_1 (Thiamin)	1.2	mg
	Vitamin B_2 (Riboflavin)	1.4	mg
	Vitamin B_6 (Nicain)	14.5	mg
	Vitamin C	40.0	mg

Source: Mishra, 2006

to age-group and gender. Its pattern varies in space and time as well as across social groups.

It is essential to examine the causes of deaths. In India, rural areas report more deaths due to communicable, maternal, prenatal and poor nutritional conditions (GOI, 2003). Mortality in various age-groups is significant because mortality up to the age group of 69 have large scale negative impacts the general human resource base of and economic generation in an area. In few situations, the trends of mortality have direct relation with nutritional status, morbidity, and availability of and accessibility to healthcare facilities.

Nutritional Status

Food is essential for the survival of living beings including man. Nutritious food intake is essential for good health and smooth functioning of the human body. Nutrition in general sense means the process of providing or obtaining the food necessary for health and growth. Nutritional status is directly correlated with the levels of health, educational achievement and economic development of an entire community (Coates, Johnson and Knox, 1977). A number of diseases are reportedly related to malnutrition.

To provide body with energy and keep it healthy, various nutrients are needed for growth and repair which the food taken must contain. These are carbohydrates, proteins, fats, minerals (like iron, calcium etc.) and important vitamins (cf. Table 2). The proper intake of these is possible by preparing and following a diet chart. There are two possible states of nutrition: first is malnutrition – a state in which the amount of various nutrients is not adequate; and, the second is under-nutrition – inadequacy of the aggregate quantity of nutrients. And, an extreme degree of under-nutrition is termed as 'starvation' (Ayyar, 1976). Malnutrition has been proven to be harmful to the future economic productivity of the individuals. According to Selowsky and Taylor (1974) malnutrition affects the distribution of real income and increases inequalities. In such

cases, amount of food could be used as catalytic agent for development in poor countries (Coates, Johnson and Knox, 1977).

Rural India is the basket of food and the country is self-sufficient in food production. But, there are regional variations in dietary habit and nutritional status in the country. The poor people are unable to purchase their daily food requirement due to poor purchasing power. The daily food intake is measured in terms of the weight of different constituent of food stuff; but, it does not provide an accurate estimate of the quantity of available food. This problem gets further complicated due to variation in nutritional value of the food available and accessible (cf. Mishra, 2006). Consumption of less nutritive food is common in the rural areas of India especially among the females. The problem is compounded by poor maternity health care degrading the health status of females.

Fertility Trends

Fertility is directly related with the maternal care and health status of the females. Fertility, with increased access and utilisation of family planning measures, facilitates the decline of family size, improved birth spacing and delayed child bearing (Chowdhury et al., 1995). Age of the mother at the time of the birth of first child has significant impact upon her health and future life. In many cases, the decision regarding number of children is determined by the educational status of parents, especially the mother. Improvements in child survival, as a result of healthcare provided by the Primary Healthcare Centre (PHCs), other private health care services, nutrition, education, reduction in the desire and need of 'replacement', etc. Decreasing trend in infant mortality rate, which lengthens the interval between births, has improved the health status of mothers.

Declines in fertility occur to permit required investment in the nurturing of the children. Studies have proved that improved female educational status and active family planning programme induce the spectacular decline of fertility in many part of the world (Daily and Ehrlich, 1996).

Household Atmosphere

Economic status plays a pivotal role in the livelihood status of the individuals in a family. It has direct relation with the purchasing power. People's purchasing power indicates household infrastructure and their quality, consumption pattern of the households, education and professional skills of the females, hygiene and the public participation. The priorities, level and structure of households expenditure ('household budget') decide the strength and future of individuals as well as the family to a certain extent. Household expenditure, are the result of budget limitations at one hand and choices based on needs, demand, preferences etc. on the other, may be regarded as manifestation of economic and social inequalities as well as cultural differences and social distinctions. The purchasing power depends on the ratio of productive and dependent members of the family.

Household atmosphere is not only income based but also connected with subjective issues. It is based on the health of the individual household member as revealed by some earlier studies. Marriage raises the level of happiness. According to Frey and Sutzer (2002), married people have higher subjective well-being than those who are single, divorced, separated or

widowed. Marriage provides additional source of self-esteem, support and companionship (Blanchflower and Oswald, 2004; Diener et al., 2003). The family members, especially children among them, have an influence on the family atmosphere and the aspirations in terms of number of children. But, a few studies show that income has negative correlation with number of children (Easterlin, 2003). Positive household environment is essential for the fruitful life of the individuals and is highly dependent on economic, educational and material life of the family members.

Quality of Women's Life

Healthy family is the basis of a healthy society. The general awareness level and educational status of women play an important role in health and well-being at different levels. Various studies have pointed out that educational status of females directly affects nutritional status, infant mortality rates, morbidity and biological disorders in the family.

Empirical investigations have proved that basic professional education results into grater self- confidence and ability to claim their basic human rights, relationship with rest of the world, broadening of the women's social networks, increasing their self-assertiveness and encourage their venture beyond the confines of household (Chowdhury et al., 1995). If the decision making rights are in the hands of women, it may decrease the burden of health problems and result into positive impact in the family. The economic assistance to female increases the human capital of women and thus leads to lessening gender disparities in terms of poverty, health and well-being (ibid.). The consumption of nutritious food by pregnant women, duration of breast feeding of the female infants, nutritional support to adolescent girls and use of birth control measures, and improvement in hygiene through the use of sanitary napkins/pads clearly reflect improved status and well-being of females as far as health is concerned.

Physical Environment

It is widely accepted that good environmental conditions are required for better health status and improved well-being. The local environment is a part of living conditions that cannot be changed but can be modified in a positive manner. The physical environment directly affects individual's health. Studies prove that complaints regarding physical environment are generally of four types: noise pollution, air pollution, lack of access to green areas, and (poor) water quality. As discussed earlier, better household and socio-economic conditions are also required for the better health condition. Hygiene environment is essential for the healthy atmosphere and it has straight link with overall well- being. The availability of safe drinking water and its availability duration, and the condition and use of toilet facilities by each household have significant importance in this regard.

The environmental quality of an area is largely decided by the quality of water and water bodies. The nature of contamination and the presence of (bacterial) toxic and algal blooms in the water are harmful for human health. The trend and pattern of morbidity in an area give clear view of the local environmental status. The use of water purifiers and other facilities are accessible by higher income groups. But, the low income groups are highly vulnerable to the environmental hazards and disasters. Human activities like use of land

in agriculture, particularly the intensive nature of agriculture leads to land pollution through extensive use of chemical fertilisers and pesticides. Deep irrigation leads to soil-leaching and through which soil nutrients are lost. Large scale use of modern technology and industrialisation further deteriorate local environment resulting into higher prevalence of diseases due to variety of allergies like asthma. Better physical environment promotes healthy living conditions and positive attitude among the individuals.

Availability and Accessibility to Healthcare Facilities

Availing and accessing better health care facilities is highly essential for human well-being. A health care system is comprised of various elements such as infrastructure, human resources, data system and financial system. Most of the developing states have substantial investments in this sector. The Indian rural poor have high dependency on the public health care system. A better quality health care system in rural areas is highly necessary for the improvement of subjective well-being of the rural masses.

Accessibility, affordability and efficiency of public health services depend on distribution and functionality of the infrastructure. Analyses of the pattern of above mentioned factors are the part of the well-being status evaluation. Poor infrastructure generally leads to poor quality of services, which in turn not only waste the resources but it is dangerous to health and welfare of patients and society at a large. Poor suffer more if the government services are not functional or are of poor quality as they do not have any other choice (Mavalankar et al., 2005)

Conclusion

Improved standards of living of the individuals enrich the quality of human resource and that enhances the productivity of a state. Health status is an indicator of QoL. But, its dimensions vary regionally. It is not an independent variable in the context of well-being. In many circumstances, it depends on rest of the associated variables. It is clear from the above discussion that economic status have imprint on the health status of both an individual and her/his family. It has direct connection with food habits, household atmosphere and the nature and status of the medical care.

The different dimensions of health status influencing well-being of people vary spatially as well as temporally. They also tend to vary from rural to urban, and from the developing to the developed states. Better educational status of individuals and the improved health care potentials of a society increase the well-being state of individuals. Good health is an achievement in itself and also contributes to higher productivity and enhanced ability to convert income and resources into a good living.

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Analysis of Poverty among Scheduled Castes (SCs) of District Ghazipur, U.P. : A Multi-dimensional Perspective

Ajay Raj Mridul and Anand Prasad Mishra

Poverty is one of the most complex and multi- dimensional social phenomenon that affects the all sphere of human life. The Prevailing discrimination, segregation and exploitation have evolved the nature and extent of poverty. The social formation as phenomenon on space has great significance in geographical studies which became challenging task for poverty analysis in unequal societies. The multi layers in social hierarchy are mainly represented by caste system which has many faces in its social structure. Poverty in these social organizations have varying nature in its magnitude and extent. In this context the prevalence of poverty in scheduled castes (SCs) has vital importance for understanding the mechanism of poverty in Indian society. The present paper is an attempt by authors to incorporate the various dimensions of Scheduled castes (SCs) poverty those are responsible for the overall deprivation of this particular social group. The paper also tries to establish theoretical debate based on ground reality about the Scheduled Castes (SCs) poverty on the base of different historical roots.

Key Words: Scheduled Castes Poverty, Multidimensional Poverty, Social Poverty.

Introduction

The Indian society is highly stratified and hierarchical in character. ''The stratified and hierarchical nature of Indian society involves institutional processes that economically and socially exclude, discriminate, isolate, and deprive some groups on the basis of characteristics like caste, ethnicity or religious background. These groups constitute a vast section of India's population and include low caste untouchables, tribals, nomadic, semi-nomadic, and de-notified tribes, (or ex-criminal tribes)" (Thorat, 2004). Prominent among these social and religious minority groups of the Scheduled castes (SCs) or low castes untouchables have greater attention of the scholar because these castes groups are the important part of Indian Hindu society and also have the close relationships with other upper and dominant castes. Through obtained facts in Indian history this particular group has worked as the prime source of the labour and played an important role in the wealth generation and also provide the services for the society. The Scheduled castes (SCs) practiced minimal rights in the society because

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of the denial in social and economic space and total exclusion by the educational attainment. The isolation in society and without rights Scheduled Castes(SCs) have failed to acquire the proper resources and skills those are the necessary to get opportunities and fulfillment of dignity in life.

Poverty analysis has many ways for the explanation. The poverty, especially castes based study is complex and multi- dimensional in nature. Scheduled castes (SCs) poverty has vital importance for the understanding the core problems of poverty, basically in context to Indian scenario. Scheduled castes as a social group built the hard and complex nature of the poverty because this particular community has facing the problem of poverty since long time in Indian history. Scheduled Castes (SCs) have close connection in production society but have excluded by the social development. The exclusion by the social structure has posed on this particular community not only unequal social arrangement but religious, cultural, political ideology of the society has quite versioned through whole history. Exclusion of any particular community in society has evolved negative effects on processes of social and economic development. Scheduled Castes (SCs) are facing the problem of poverty through long spell of Indian history. So poverty in Scheduled Castes (SCs) have historical roots in society those are underlined as the most backward community on the basis of socio-economic, cultural and political development. "Exclusion and immense deprivation of the Scheduled Castes (SCs)are closely associated with the denial of property rights, civil rights, and lack of access to education (except in provision of services to the castes above them). Over a period of time due to their physical and social segregation from the rest of the Hindu society, the extent of deprivation became more intense, and was further entrenched through the institution of untouchability. It is this institutionalized exclusion of the Scheduled Castes (SCs), from access to economic rights, civil rights and human development, which has caused severe poverty and deprivation among them" (Thorat, 2004).

After the independence various programmes have launched by the government for the development of the SCs, like redistribution of land resources, education, house building, employment and money support, self- employment etc. but by the failure of the governance and corruptions the situation remain static for a long time. Low educational status of the SCs people is also responsible for the under development of the SC, because illiterate people do not get proper knowledge and awareness those are helpful for the taking advantages and development. In recognition to their unique problems the government of India has consistently developed policies for the economic, social and political empowerment of Scheduled Castes (SCs). 'Positive interventions', 'affirmative measures', and accompanying policy processes were initiated for an encompassing empowerment of these social groups over half a century ago. Though these policies have brought some positive change, however, the process of transformation has been extremely slow and inadequate to minimize the handicaps and disabilities of the past and in reducing the gaps between them and the rest of the Indian society. This social group continues to suffer from a high degree of poverty and social and economic deprivation" (Thorat, 2004).

Contemporary debates on poverty

considered it as a complex issues and it can never be understand through unidirectional income approach. The scaling of poverty on the basis of selective parameters are not rational towards the problem and its solution. It needs an integrated approach in a multi-dimensional perspective. The theorization of poverty and its root causes are the major aspects for policy makers and social scientist. The spatial pattern and its social structure in Indian society have shaped the poverty of SCs population in a very complex and specific way. The unfolding discourses on SCs poverty required fresh understanding and strategies for policy making processes. The multi- dimensional approach is suitable for analysis of SCs poverty. The present paper is an attempt in this direction.

Objective of the study

1. To analyse the incidence of poverty in general and among Scheduled Castes (SCs) in particular and also the factors contributing to it;

2. Explore the different dimensions of the Scheduled Castes poverty.

Data base and Methodology

The present study is based on the primary data. The primary data has been obtained through field survey by selecting one village of the each block of the district based on distance from district headquarter. Total 16 sample villages have been taken situated in different 16 blocks and survey work completed during November 2013 to February 2014. The sample households have been taken of SCs: STs: OBCs: General in ratio of 2:1:1:1. From each village total 25 households considered for survey, (10 SCs, and 5 STs, OBCs and General households). The selection of villages precisely demonstrated the presentation of SCs population. The sample study of the villages also considered the size and value of SCs population. In continuation to this, for the detailed analysis of multiple poverty in the study area aggregate data have been taken and arrangement of data finalized by the help of simple statistical technique. The data have also arranged in tables and some diagrammes are also made for the better understanding. In this paper attempt have made to compare some crucial dimensions of multiple poverty like social, economic, political and cultural poverty by social groups. The paper closely concerned with the prevailing situation of the poverty and factors which are contributing the poverty and have playing the significant role in shaping the poverty situation in study area.

The obtained data from field study in sample villages have been computed for various components of poverty. The computed data have 16 villages information with 14 variables of poverty among SCs population. Based on these data and basic households facility (Table.2) multi- dimensions of poverty (Table. 3) have been studied.

Study area

Ghazipur district extends between 25^0 19' North to 25^0 25' North latitude and 83^0 4' East to 83^0 58' East, longitude in the eastern part of the Uttar Pradesh covering an area of 3,337 km^2 and total population of the area is 3615515 persons according to census 2011. In its total population 1852623 are males and 1762892 are females. The district is one of the dense populated areas in the eastern Uttar Pradesh with density of 1071 persons per km^2. The district has a sex ratio of 952 (females per thousand males) and literacy rate of 71.78 per cent with 82.80 per cent male and 60.30 per

Table 1. *Category wise distribution of Sample households*

Villages	Blocks	Category of households				
		General	OBCs	SCs	STs	Total
Atrauli	Ghazipur	5	5	10	5	25
Belhari	Saidpur	5	5	10	5	25
BharatPur	Sadat	5	5	10	2	22
Chakiya	Zamania	5	5	10	5	25
Chanwar	Mardah	5	5	10	5	25
FirozpurKalan	Muhammadabad	5	5	10	5	25
Gahmar	Bhadaura	5	5	10	5	25
Guraini	Manihari	5	5	10	5	25
Imalia	Devkali	5	5	10	2	22
KatyaLahang	Kashimabad	5	5	10	4	24
Kodri	Birno	5	5	10	5	25
KushmhiKalan	Karanda	5	5	10	5	25
Makhanpur	Jakhanian	5	5	10	5	25
SherpurKalan	Bhawarkol	5	5	10	5	25
Suhwal	Revatipur	5	5	10	5	25
Tarwadih	Barachawar	5	5	10	5	25
	Total	80	80	160	73	393

Source: Based on personal survey (November, 2013 to February, 2014).

cent female literacy as per census 2011, Administratively, Ghazipur district divided into fiveTahsils, 16 Development blocks, 23 Police Stations 193 Nyay -Panchayats, and 1280 Gram Sabhas covering 3364 villages. Agriculture is main economic activity of the district. Out of total working population 78.20 per cent is engaged in agriculture they serve 80.10 per cent of total agricultural land and grow wheat and rice as main crops, covering 72.77 per cent of total cropped area of the district. Sugarcane and pulses are the other crops of the district. The district is enriched with agricultural resources and potential for socio-economic development. Industrially, the district is backward, only few and medium scale industries came up recently in district.

Scheduled Castes Poverty

"Substantial scholarly literature on caste ('jati') in India that spans disciplines ranging from history to sociology and from anthropology to economics. These literature spirited debates about whether caste is an ancient Indian institution, or largely an outgrowth of colonial rule; whether caste is primarily a religious and ritual phenomenon, or it has important economic functions or causes; whether it is a holdover that is in decline in today's India, or is a meaningful feature of present day social structure; whether castes are ordered hierarchically or are mainly horizontal groupings; whether caste is best conceptualised as a kind of familialism, or a pseudo-ethnicity,

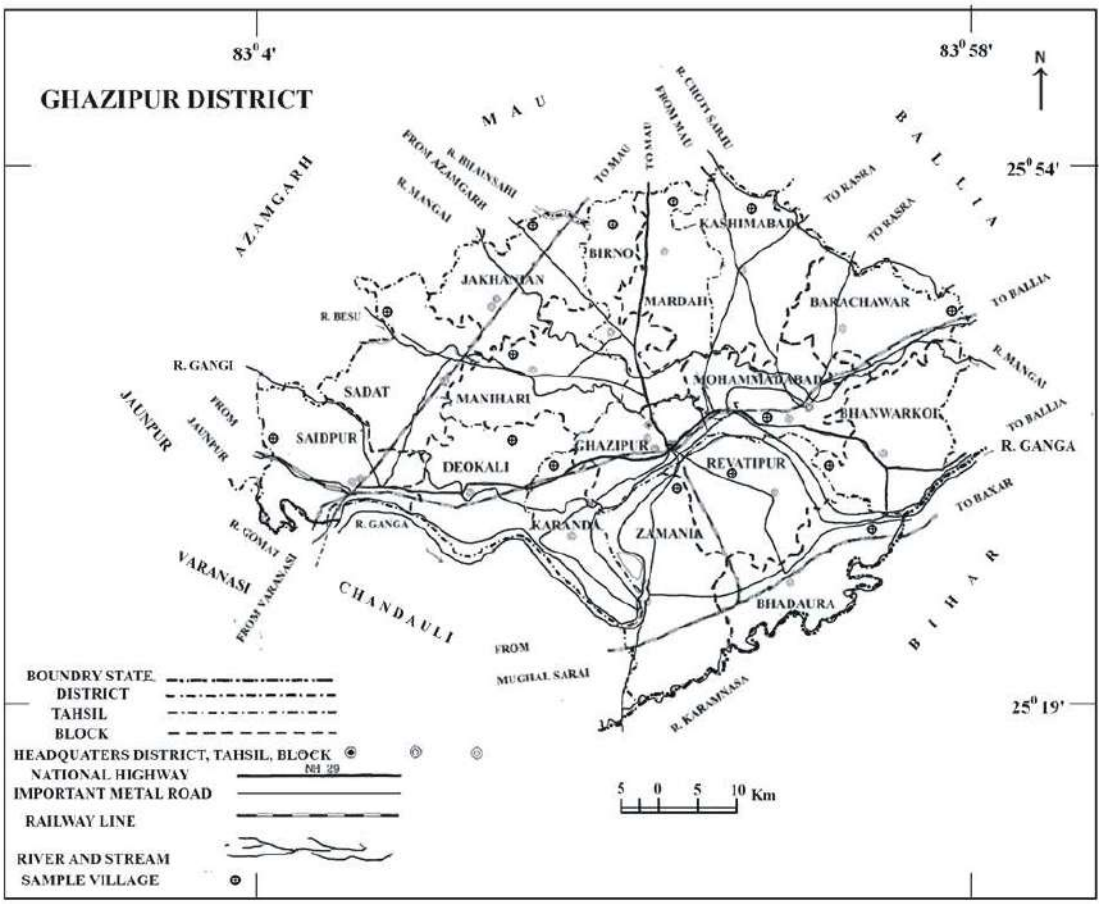


Fig. 1. Location and Extent

or an occupationally based grouping, or a system of patronage" (Overviews of this larger literature include Bayly 1999; Deshpande 2005; Dudley-Jenkins 2003; Mendelsohn and Vicziany 1998; Searle- Chatterjee and Sharma 1994; Srinivas 1996; Sharma 1999). "This theorisation implies that the caste system involves the negation of not only equality and freedom, but also of basic human rights, particularly of the low caste 'untouchables', impeding personal development. The principles of equality and freedom are not the governing principles of the caste system. Unlike many other societies, the caste system does not recognise the individual and his/her distinctiveness as the centre of the social purpose. In fact, for the purpose of rights and duties, the unit of Hindu society is not the individual (Even the family is not regarded as a unit in Hindu society, except for the purposes of marriage and inheritance). The primary unit in Hindu society is caste, and hence, the rights and privileges (or the lack of them) of an individual are on account of him/her being a member of a particular caste" (Ambedkar, 1987).

The scheduled castes (SCs) are facing the problem of multi- dimensional poverty because of these castes system are the deprived and excluded them in the society and practicing a long time poverty problems. 'In this context the two forms of exclusion have significant for explanation, namely,

a. **Living mode exclusion**, which denies recognition and accommodation of life style that a group would choose to have; and

b.**Participation exclusion**, involving denial of social, political and economic opportunities for development to groups which are discriminated against' (Thorat et. al, 2007).

"The above two defined characteristics of social exclusion are particularly relevant. First, deprivation is multi- dimensional, that is, there is denial of equal opportunity in multiple spheres. Second, it is embedded in the societal relations and societal institutions the processes through which individuals or groups are wholly or partially excluded from full participation in the society in which they live" (Haan, 1997).

The dimensions of the SCspoverty are very complex and relevant for the study of multi- dimensional nature of poverty that may be opened new discourses on poverty problems.The continuous falling in trap of poverty of the Scheduled Castes(SCs) people consisted multi rooted problem in build social structure and also it covers the major aspects of the human poverty. The social dimension of the Scheduled castes (SCs)can never explained through evaluating present situation rather its historical connection in processes of Indian social formation. "In India, exclusion revolves around the societal interrelations and institutions that exclude, discriminate, isolate and deprive some groups on the basis of their identity like caste and ethnicity" (Thorat& Louis, 2003). "Historically, the caste system has regulated the social and economic life of the people in India" (Thorat, 2003). "The nature of exclusion revolving around the caste system particularly needs to be understood and conceptualised. It is this castebased exclusion which has formed the basis for various anti- discriminatory policies in India" (Thorat, 2004).

The SCs belong to lower ladder of Indian social hierarchy those were mostly suffered by neglected entitlements a long back and become the most deprived section of society without its dignity and identity. The absence of social rights among SCs compelled them to led their life in inhuman condition. Actually, SCs poverty narrated their history with full of struggle for survival, dignity and identity. The root problems of social poverty and its history posed various methodological challenges before social science researches that how pre- decided social and cultural values have impacted the individual dignity and social status of SCs population? The SCs social barriers made on basis of the castes hierarchy that bounds human works and rights and put forward towards existence of poverty among SCs. The negative consequences of their historically rooted cumulative effects have deprived SCs population as most poverty stricken social group. The political power and its achievements are also useful for maintaining standard of life. The social awareness and political engagement is the key for the development and its prevalence in social groups are shaping the nature of development and deprivation. These processes of awareness and participation in

political decision making processes have ensured better quality of life and fight against discrimination and poverty. The poverty among SCs is best case for study in its social and cultural background. Its historical roots and political economy may give some insights towards the problem.

"This is, indeed, an extreme position for a social scientist to take. It is highly improbable that "structural conditions" would have no effect on socialization practices. It implies that a group can have a "design for living" that is "importantly inconsistent with the actualization of this cultural design." Second, Valentine appears to hold some idiosyncratic ideas about socialization. Cultural elements are not merely transmitted by the conscious intent of the agents of socialization but are also manifestations of the structure of the family and the wider social arena" (Parker andKleiner, 1970).Culture is very closed by the people and it rooted in every dimension in human life especially in traditional society. In case of traditional social structure the society, religion and culture have the fabrical connection and seems in each other. So in case of Indian society it is very difficult to draw a line between both two. Cultural practices controlled the morality of sanctions of the particular community or social group and it reflects the closed relations by the nature and society. It is accidental and quite unfortunate for the Scheduled Castes (SCs) that in evil and unscientifically organized society very little part of the social benefits made for them. The continuous cultural practices and isolated situations in the society fall SCs in disadvantaged life condition. Scheduled Castes (SCs) are following the evil customs and traditions by a long time of Indian history very cleverly posed by the upper dominants castes for own benefits. The social life of the SCs was in the hand of the upper Castes because they have the controlled on the religion and not only they were controller but also built the social rules and religious rituals in own favour and benefits. The cultural practices give the healthy psychological conditions and support to the followers for the cope with problems in better way. The cultural practices is the key for the inspirations and the heavy feelings about the own development. The SCs are practicing the evil customs and rituals that fall them in subcultural poverty conditions.

The various aspects of economic poverty are quite visible among the Scheduled Castes (SCs). The prevailed historical exclusion in society and uneven distribution of the resources are the key factors those are responsible for the low income conditions among the Scheduled Castes. In absence of proper employment this particular social group is showing the more economic poverty. "We also find that the root cause of unemployment and undernourishment is inequality in the initial distribution of land ownership. This suggests that land reform (in the sense of reducing the inequality of the initial land distribution) is an efficacious means of eradicating unemployment and under nourishment. Because increased employment raises aggregate output, this result directly contradicts the routinely cited equity-efficiency trade-off" (Ray and. Streufert, 1993).These discourses on SCs poverty are significant for analysis of problems at micro level agrarian economy. The present paper is an attempt to study the issues in light of above mentioned

Table 2. *Basic Households Facility of Study Area*

Social Groups	Total	House Type			Kitchen		Toilet		Bathroom			Gas connection	
		Kaccha (%)	Pakka (%)	Semi Pakka (%)	Have (%)	Not have (%)	Have (%)	Not have (%)	Proper (%)	without roof (%)	Not have (%)	Have (%)	Not have (%)
General	80	0.00	83.75	16.25	47.50	52.50	53.75	46.25	45.00	26.25	28.75	33.75	66.25
OBCs	80	21.25	51.25	27.50	5.00	95.00	12.50	87.50	10.00	16.30	73.80	5.00	95.00
SCs	160	39.37	25.63	35.00	8.12	91.88	8.12	91.88	5.63	12.50	81.88	2.50	97.50
STs	73	49.32	23.28	27.40	4.11	95.89	5.48	94.52	2.74	6.85	90.41	4.11	95.89
Total	393	29.52	42.24	28.24	14.76	85.24	17.81	82.19	13.99	15.01	70.99	9.67	90.33

Source: Based on personal survey, (November, 2013 to February, 2014)

debate.

Spatial Explanation

The basic facilities at household level are the most important element for poverty explanations and it represents the quality of life attained by individual. Table 2 reveals status of basic facilities at the households level and showing the variations within the different social groups. The General as a social group has shown better basic facilitiesas compared to other social group. The house type is symbol of social dignity especially in feudal agrarian society. Table2shows that 29.52 per cent Kaccha houses (General 0.00 per cent, OBCs 21.25 per cent SCs 39.37 per cent and STs 49.32 per cent), 42.24 per cent Pakka (General 83.75 per cent, OBCs 51.25 per cent, SCs 25.63 per cent and STs 23.28 per cent) and 28.24 per cent Semi Pakka houses (General 16.25 per cent, OBCs 27.50 per cent, SCs 35.00 per cent and STs 27.40 per cent) have been found in sample villages. This ground reality reflects that General social group has enjoyed better house facilities in study area while OBCs and SCs/STs social groups deprived from such facilities.Out of total 393 surveyed households only 14.76 per cent have separate room for cooking which further highlighted the better condition in General Castes (47.50 per cent) and followed by pattern of castes hierarchy from OBCs to SCs/STs i.e. 5.00 per cent in OBCs, 8.13 per cent in SCs and 4.11 per cent STs. The availability of toilet and bathroom facility in lower social groups like SCs/STs reveals severe condition of hygiene. Only 17.81 per cent SCs/STs households have toilet facility which observed for General castes 53.75 per cent and for OBCs 12.50 per cent. Bathroom facility for sample villages population shown its inefficiency (29.01 per cent)and spatial variation across the social groups and it varies from 45.00 per cent to 2.74 per cent i.e. General (45.00 per cent), OBCs (10.00 per cent), SCs (5.63 per cent) to STs (2.74 per cent). The availability of latrine and bath room facility among SCs/STs population reveals poor status in comparision to other social group. The cooking facility among different social groups represents the inequality and nature of prevalence of socio- cultural deprivation of

poverty. The traditional fuel for cooking like crop residue, cow dunk cake and woods etc. have been used by lower strata of social group, while upper strata fulfill their cooking needs from modern LPG connection. The lower income group compelled to puts into modern sources of fuel and suffered from poverty.Table 2 reveals that only 9.67 per cent population of sample villages has LPG connection and out of which only 2.50 per cent SCs used LPG.

Multiple dimensions of Poverty among Scheduled Castes (SCs):

The table 3 depicts nature and extent of poverty within different social groups. Literacy among social groups are the symbol of development and cultural betterment that contribute for understanding of poverty and its eradication programmes. Table 3 reveals that 73.41 per cent people of sample villages are literate and its socio- spatial variation gives insights about the multiple nature of poverty. The highest literacy found in General (93.27 per cent) followed by OBCs (74.15 per cent) and STs (55.5 per cent) and SCs (67.39 per cent). The spatial dimension of poverty among social groups are represented by the prevailing nature of untouchability for SCs population. The inhuman culture of untouchability is a serious challenge for any civilization and society. This particular thinking exists in society since long back on the basis of the purity and pollution theory based on Brahmanical thoughts. The processes of cultural practices deprived most of the SCs population to acquire suitable social, economic and cultural space in a developing society.After independence various steps have been taken by the government to abolish untouchability and declared it as unconstitutional. However, it prevailed in study area in a bigger way.Table 3 reveals that 63.36 per cent respondent have their believe that untouchability prevailed in study area and affect the social harmony and creates background for social and cultural poverty. In case of SCs respondent this situation reported 65.00 per cent which furthering the process of multiple poverty among SCs population.The social fraternity and equality express by the social relations with and within castes is another important factor for poverty in SCs population in study area. The invitation at the social function like marriages, religious, functions have shown the socio-cultural status of person in a society. Table 3 reveals that General (98.75 per cent) and OBCs (97.50 per cent) population have enjoyed functions and invited by each other at social gatherings. The SCs population (68.75 per cent) have only invited by upper social groups in a socio- religious functions. On this account, the invitation by the SCs to other social groups i.e. General and OBCs has been found at lower level (58.75 per cent). This ground reality in study area confirmed about the prevalence of untouchability among the masses. These prevailing nature of social customs reveals that the pattern of poverty is quite social rather economic. In context to landholding, the upper castes have dominant position and enjoyed maximum share of land resources. The SCs/ STs population are maximum landless and these chunk of population constitute workforce and worked as agricultural labourers. This spatial pattern of socio- economic conditions depicts that most of the reality has upper castes biasness and also mostly charecterised by social

segregation.

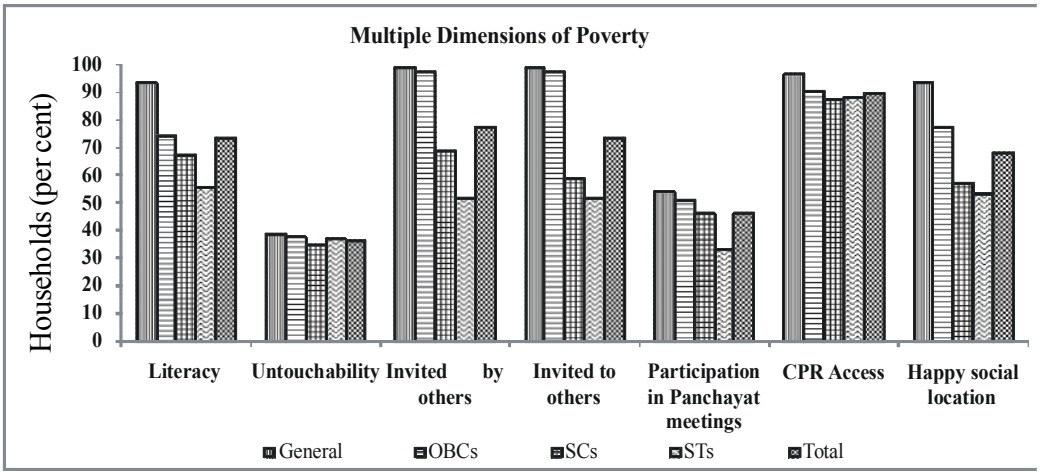
Table3 also shows pattern of participation in panchayat meetings and total 46.31 per cent respondent have attend the panchayat meetings in which General (53.75 per cent) and OBCs (51.25 per cent) have attend the regular panchayat meetings but its percentage share for SCs (46.25 per cent) and STs (32.88 per cent) are lower which explain about low rate of participation in decision making bodies. The low participation in panchayat meetings by the SCs shows low political awareness for their fundamental rights. The accessibility to the common property resources shows social rights of the people and these communities deprived from resources and have its lower reach for SCs/STs population. The common property resources (CPRs) are the most important in case of rural areas. The table3 shows that only 87.50 per cent SCs have their accessibility to CPRswhich have been shown for General (96.25 per cent) and OBCs (90.00 per cent). The table 3 also shows the data about social happiness status based on its social location.The happiness index based on social location represents the level of justification, and acceptance by various social group. The 93.75 per cent General and 77.50 per cent OBCs have accepted that they are happy by their own social location while on other hand only 57.50 per cent (SCs) and 53.42 per cent (STs) population satisfied with their social position. Noticeable more than 40.00 per cent SCs/STs population dissatisfied by with their social position. It is quite true about the Indian social hierarchy that only upper castes (General) have the maximum social rights which gave them benefits in society. The lower social positioning of SCs/STs population deprived them from various ongoing processes of socio- economic progresses.

The economic inequality is mostly rooted in uneven distribution of resources especially land resources. Land is the prime source for the income and livelihood in agrarian society. Table 3 shows that ownership of agricultural land is quite uneven among different social groups. The General (92.25 per cent) have the maximum ownership of the agricultural land

Table 3. *Multiple dimensions of poverty by social groups*

Social Groups	Total	Literacy (%)	Untouch ability (%)	Invited by others (%)	Invited to others (%)	Partici-pation in Panchayat meetings (%)	CPRs Access (%)	Happy by social location (₹)	Average Monthly Income	Agricultural land Have (%)	Have Not (%)
General	80	93.27	61.25	98.75	98.75	53.75	96.25	93.75	3162.06	92.50	7.50
OBCs	80	74.15	62.50	97.50	97.50	51.25	90.00	77.50	1533.25	55.00	45.00
SCs	160	67.39	65.00	68.75	58.75	46.25	87.5	57.50	1130.48	51.25	48.75
STs	73	55.50	63.01	52.05	52.05	32.88	87.67	53.42	1168.83	38.36	61.64
Total	393	73.41	63.36	77.61	73.54	46.31	89.82	68.19	1748.66	58.02	41.98

Source: Based on personal survey, (November, 2013 to February, 2014)


Multiple Dimensions of Poverty
Households (per cent)
100
90
80
70
60
50
40
30
20
10
0
Literacy
Untouchability
Invited by others
Invited to others
Participation in Panchayat meetings
CPR Access
Happy social location
General
OBCs
SCs
STs
Total

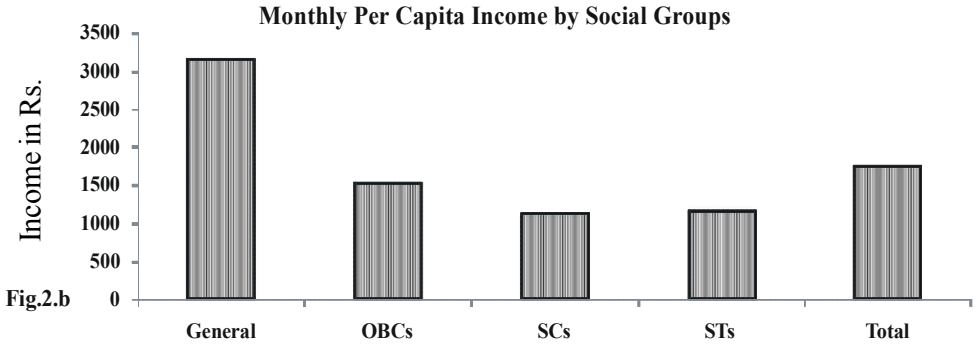

Monthly Per Capita Income by Social Groups
Income in Rs.
3500
3000
2500
2000
1500
1000
500
0
General
OBCs
SCs
STs
Total

Fig.2.b

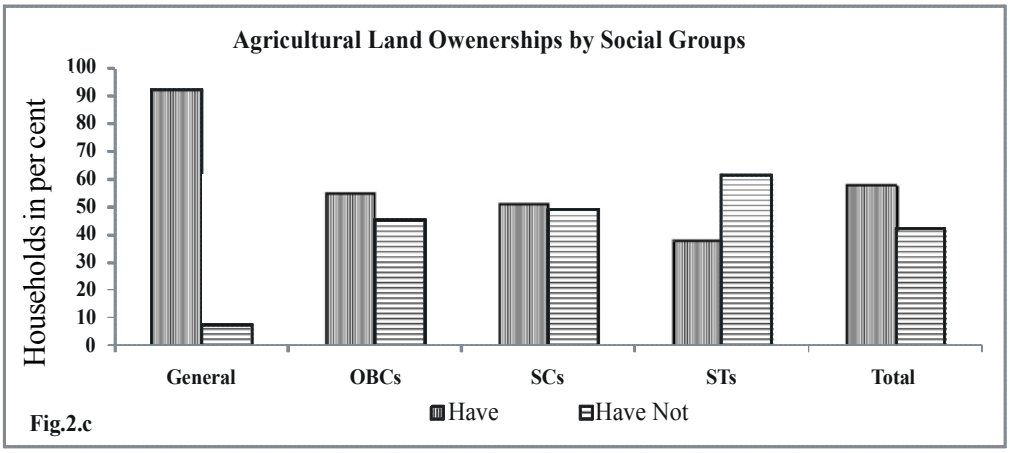

Agricultural Land Owenerships by Social Groups
Households in per cent
100
90
80
70
60
50
40
30
20
10
0
General
OBCs
SCs
STs
Total
Have
Have Not

Fig.2.c

and only 8.75 per cent are landless. In other social groups like OBCs (55.00 per cent), SCs (51.25 per cent) and STs (38.36 per cent) have lower ownership on land resources. More than 50.00 per cent SCs/STs population are landless that constitute major chunk of poverty. Table 3 also depicts, average monthly per capita income and average income for sample study which comes to ₹1748.66, and also have its level of variation for different social groups. The income pattern for various social groups, such as General (3162.06) OBCs (1533.25) and SCs (1130.48) have been also explained the prevailing nature of income variation across the social groups. All these above mentioned component explained and justified about the spatial pattern of multiple poverty among SCs population.

Conclusion

Through detailed analysis of data on poverty it observed that SCs are the most deprived social group after the STs. Scheduled Castes (SCs) are suffering from multiple derivational processes and their living standards command over resources and share in all sphere of development are minimum and below justified norms. The poverty in SCs population is representing the core of social exclusion that occurred in study area through castes hierarchy, social determinants, low level of political awareness, cultural practices like untouchability, lower access to common property resources (CPRs) etc. It also reveals the spatial dynamics in study area. On the basis of field observation it may be concluded that SCs population are the most deprived social groups, and its processes of marginalization come to social surface from social and cultural discriminatory practices and minimum level of modern knowledge and awareness. The social segregation is maximum for SCs population and the inheritance of social and cultural attitude prepared constraints for awareness against unconstitutional practices of untouchability. The highest level of untouchability, 65.00 per cent among SCs population justified the role of cultural dimension in poverty. The CPRs and happiness index of study area has further explained about the prevalence of multiple nature of poverty among SCs population. The happiness scaling on the basis of social location has also revealed dissatisfaction among SCs/ STs population. The social location of General social group prepared background for happiness and social opportunities at level of 93.75 per cent, while it observed only 57.5 per cent for SCs groups. The spatial pattern of social location narrates the importance of social, cultural and religious parameters in poverty study. The prevailing nature of multi facets of SCs poverty needs multiple approaches both qualitative and quantitative to study the problems of deprivation in SCs in Ghazipur district of U.P. .

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Marginal Structural Changes in Peri-zone of Shimla City (H.P.)

Divya Devi and M. P. Singh

This paper stresses the necessity to study the spatio-temporal change in the city of Shimla. Rapid changes in the landuse pattern of a region have become an important concern in these days. Land use changes produced by human and natural phenomena play a major role in global as well as at regional scale patterns of the earth system. Understanding the physical complexities of various scales, from individual buildings, plots, street blocks and the street patterns that make up the structure of towns helps us to understand the way in which town have grown and developed. The city is a dynamic organism, constantly in process of evolution. The evolution involves both a modification of long established functions and the addition of new functions.

The urban sprawl or expansion often encroaches upon agricultural or productive forestland; neither of which can resist the momentum of urbanization. City growth is an indicator of development, the change in landuse pattern from rural to urban is monitored to estimate population, predict and plan direction of urban sprawl for developers. It resulted in the establishment of many new business centers and growth of existing ones. The Key element for mapping rural to urban land use change is the ability to discriminate between rural uses (farming, pasture, forest) and urban use (residential, commercial, recreational). In Shimla town many residential, industrial and transport centers, government offices, agencies, research and development institutes, educational centers, recreational facilities have sprung up. This has given fresh impetus to the overall development of the capital city.

Keywords : Peri-zone, Sprawl, Heritage, Crescent, Elysium, Bazzar, CBD (Central Business District), Victory Tunnel, Pedestrian Artery, Secretariat, Vice Regal Lodge, Garbage.

Introduction

The city was first explored by British during colonial period in the first half of 19th century. Undulating terrain of Himalaya never supported dense settlements of large scale commercial investment. In 1966, with reorganization of territory into Punjab, Haryana and Himachal Pradesh, Shimla become the capital of Himachal Pradesh. The formation of a capital has been instrumental in the unprecedented growth of population due to sudden migration of people from surrounding areas. Morphology of a town includes various functional zones, the impact of site on buildings

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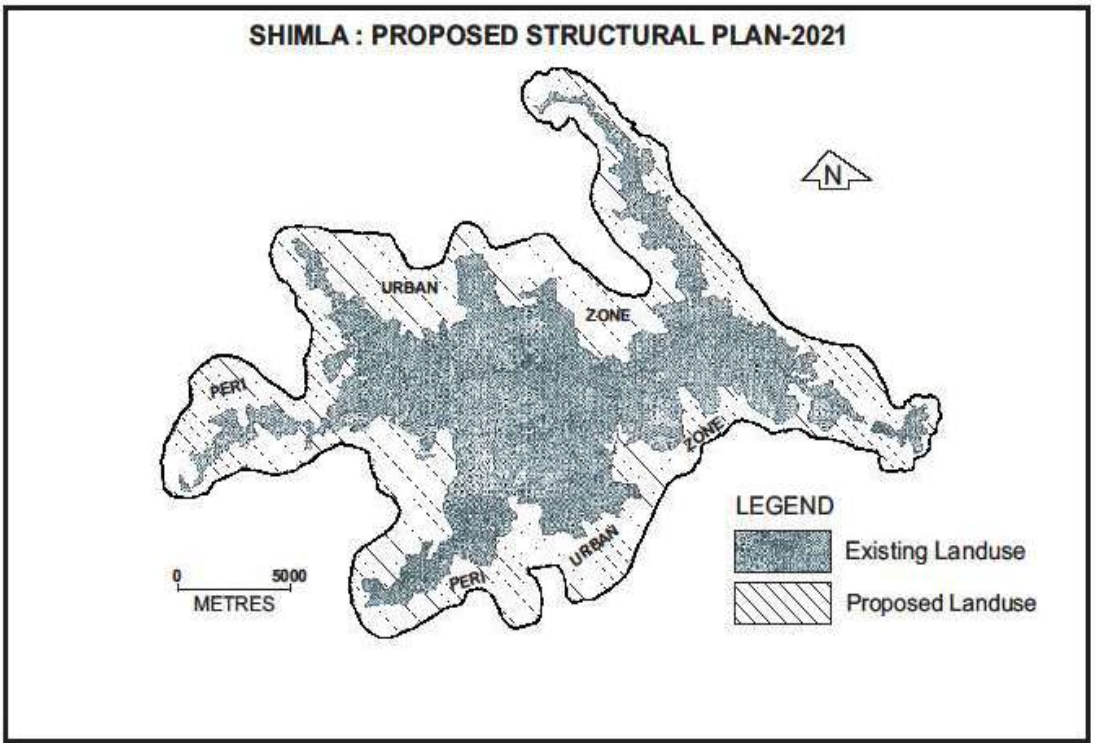

Fig. 1

and functional zones, factors on the size of town. The effect of culture and human customs on the site and the reciprocal situation of various functional zones and pattern of urban landuse.

The influences which the city escorts on the social and economic structure of the different functional character are found concentrated at different places. According to Dickinson, "The use which can pay the highest rent at a particular place occupies the land." There is encroachment over the neighbouring agricultural lands and open spaces by the urban expansion. At the same time, there is overcrowding of functions and overlapping of their zones within the city. Thus their grouping into primary and secondary functions, Dickinson calls these zones as natural areas as they are the outcome of natural process. (Singh, 1964) Such patterns of development are noticeable in Shimla too. It is the prime city of the state. Shimla, a hill Station has maintained its primacy in all decadal census conducted so far and the index of primacy has mostly been increasing. The town of Shimla attained the status of Class I town in 1999 but even before that it has been a primate city within the state. The morphology of Shimla town has been built around the two main roads – known as Mall Road and Cart Road. The city and the area around it can be divided in two different functional zones according to the morphology and to the use to which the land is put. Land available to the city is used for various purposes like building, roads, vehicles, parking, parks and open spaces. The town is facing ground-breaking landuse transformation. The

residential land use is being encroached by tourism and commercial activities. Commercial uses are clashing with institutional, transportation and tourism landuse. Unplanned and unauthorized construction is taking place. In recent time, the construction activities are not coping up with the traditional culture and heritage of the Shimla Town.

Study Area : A Prologue

This beautiful hill station lies between 31°6' North latitude of at 77°11' East longitude at an average altitude of 2310 meters above mean sea level. The highest point in Shimla at 2454 meters is the Jakhoo Hill. Shimla situated on the last traverse spur of the Central Himalayas, South of the river Sutlej. It is spread over an area of 35.34 sq.km along with its commanding position. The total population with in municipal corporation is 169578 (2011 census). In shape, it has been described as a irregular crescent. Shimla is connected to the city of Kalka by one of the longest narrow gauge railway. Shimla is approximately 118 km from Chandigarh, the nearest major city, and 365 km from New Delhi. (Fig. 1) Shimla lies in lesser Himalayas and comes in Zone-IV (High Damage Risk Zone) as per the earthquake hazard zoning of India (IS-1893). Shimla town is situated on the rocks of Jutogh group and Shimla group. Jutogh group occupies main Shimla area and extends from Annadale-Chura Bazar-Prospect Hill-Jakhoo- US Club and highland area. Lower strata of the city include limestone, conglomerate, slate and clay. The upper state includes metamorphic rocks. They are highly foliated schist. Shimla series represented by shale, slate, quartzite and local conglomerates is found in Sanjauli-Dhalli area. The existing town resembles an irregular crescent with a 9.2 km extension from one end to the other covering a total area of approximately 22 km^2. The eastern position of the town is Chotta Shimla, while the extreme western side is called Boileauganj. An outlying northern spur running at right angles to the main ridge is Elysium Hill five and half kilometers from the western end of the station are outlying hills of Jutogh. Shimla was first explored by British during colonial period in the first half of 19th century and famous as a well-known tourist destination in India. The Ridge, located at the center is a commanding site of the city with scandal point in the west, Lakkar Bazar, Library and Church in the east, along with town Hall and Goofa on the southern side. Three satellite Towns at Waknaghat, Ghandal near Ghanahatti and Fagu are proposed to be developed for spill over as well as tourist. Shimla Municipal Committee came into existence in 1851 and was responsible for establishment of Town Hall and Gaiety theatre. The city is famous for its buildings style and neo-gothic architecture dating from the colonial era. British established many architectural masterpieces such as Vice Regal Lodge, Gorton Castle, Railway Board Buildings, Gaiety Theater, Town Hall, Auckland House, Barnes Court etc. In 1871, the Government of Punjab also decided to use Shimla as its summer capital. After the partition of India in 1947, many of the Punjab government offices from Lahore in Pakistan were shifted to Shimla. In 1966, with re-organization of territory into Punjab, Haryana and Himachal Pradesh, it was decided that Shimla should become the capital of Himachal Pradesh and also the headquarter of Shimla district. Nursed and popularized by the government, the elite, the traders and the tourists, the town continued to grow in

importance and size, till today.

The city is functionally very complex. This complexity increases with the social and economic growth of the city. The set up of new functions constantly changes in pattern between various types of landuses. The location of some function takes place at certain sites, for example, the core area or the central area has the concentration of commercial functions and it is surrounded by the residential apartments. The outer area of the city is used by administrative, industrial and educational pursuits. So on the basis of functions and the nature of landuse, city can be divided into following functional areas:

Residential Area

In this Hill Station of Himachal Pradesh the major chunk of the urban land is mostly residential as it covers round about three fourth of the total built up area, followed by educational and public service areas.

Residential areas constitute a larger share in the landuse plan than any other single landuse type in Shimla Town. It plays most important part both quantitatively and qualitatively in the morphology and sustenance of the city. They occupy a very large area of the city, in comparison of business areas. Kusum L. Taneja (1971) has revealed on the basis of the study of 35 Indian cities that residential area share more than 47% of the developed area of their Indian cites. Their location, occupancy of the space, has a great variation among cities. In Shimla residential area comprised of 903.13 hectares, which works out to 61.19% of the urban area. As per 2011 census 169578 persons are residing in the Shimla urban area. Population density per km^2 is 4776.53 persons. Shimla and its climate are being preferred as prestigious location for living; whereas trend for residential development has picked up manifold during the recent decades.

The main housing area in Shimla are the core city, Shankli, Longwood, Chotta Shimla, some parts of Kaithu, Jakhoo, Kasumpti, Sanjauli, Summer Hill, New Shimla and Tutikandi. Most of the housing areas in the form of developed colonies are in the slope. The southern sunny slopes and spurs are thickly built up as compared to northern windward and cold slopes.

In Shimla town, the housing stock has increased at the decadal growth rate of 32.48 percent. Shimla city being a Class I, majority of persons are residing as single and they are engaged in services. Joint family system is very rare in the city. 94% households don't share habitable room with joint families. Although 6% households share rooms with joint families in the town. It is predicted that during the year 2021, 2031 and 2014 housing stock is likely to be 60,000, 80,000, and 1, 05,000 respectively.

Slums are also sore spots of the city morphology. Slum population is scattered in the all parts of the town. Krishna Nagar ward has a majority of slum population. It is the part of substandard housing, poverty, ill health, diverse, bad water supplies, high population density and congestion, unsanitary conditions and absence of basic amenities etc. There are 87 slum pockets alone in Shimla Town with 11,655 populations, which is 7% of the total population of the Shimla town. Instead of Krishna ward, some slum population can be seen in Kasumpti, Anadale, Sanjauli, Khalini and Kanlog wards also.

Business Area

Shimla being a capital of state is known

for administration and commercial activities, apart from tourism and institutions. In Himachal Pradesh Shimla is the only major urban center connected with rest of Himachal Pradesh. All these factors have made Shimla a goods collection and distribution center. Relevance of Shimla as a commercial centre is increasing with the increase in population and urbanization. The business area in Shimla is mainly confined on Mall Road and Lower Bazaar besides a few small patches scattered in Summer Hill, Boileauganj, Sanjauli and Lakkar Bazar. As more and more people started coming in the needs and demands of the larger population of Shimla town attracted number of shopkeepers, big and small from almost all parts of India.

In present time there is 25.22 hectares area under commercial use, which accounts to 1.71% of the urban area. The regional level trade and commence functions combined with tourism have further strengthened the economic base of this hill city. The commercial land use of the city is CBD (Central business District), Outer business centres, Main business street, Neigbouring business street, scattered shops or isolated store cluster etc.

(i) Central Business District

This is the most inner zone or core of the city, defined by the name of CBD. This is a zone, where skyscraper buildings are found in huge number. The CBD of the Shimla town is Lower Bazar and the Mall Road near Ridge. The main shopping center are concentrated in and around Lower Bazar, Middle bazaar and the Mall Road. All kinds of shops such as retail, wholesales, seasonal and service shops are present in the Lower Bazar. All main trade and common activities occurs in this area. Jewelers shops, general stores, stationery, cloth shops are present here. The people from the nearest villages always come to CBD to fulfill their daily needs of life. This CBD of Shimla town is the point of most convenient access from all parts of the city and the point of highest land values.

(ii) Outer Business Area

With the expansion of the cities, the business activities have been developed in those areas of the town, which are distantly located from the Central Business area. In such parts of the town small business centers develop for the convenience and to fulfill the needs of surrounding areas. Markets developed in Boileauganj, Chaura Maidan, Totu, Dhalli, Khalini, Chotta Shimla, BCS, Summer Hill, Sanjauli, Kasumpti areas are business center of the city. The people living in this outer area have to cover a long distance and to face many problems like traffic congestion, no proper parking facility in the CBD area, wastage of time and crowdy atmosphere. All these inconveniences have encouraged the development of outer business centers.

(iii) Main Business Street

Main Business Street developed along the side corner of the roads or other transport streets. This business area always develops on the roads which connects the Center Business Districts (C.B.D.). With the existence of the Shimla town as a capital city, many business buildings had developed on main business street e.g. in Lakar Bazar all shops from Regal to IGMC (India Gandhi Medical College), shops at BCS, Khalini on both sides of roads, in Totu Power House to Totu Chowk or Yaadgar, shops at Engine Ghar to Dhalli Tunnel and shops at Summer Hill etc. Ribbon development of shops along the arterial roads is a prime concern.

Ribbon development is making more harm than good. The construction and repair shops along the highways have posed threats for the smooth flow of traffic.

(iv) Neighboring Business Street

Some small business area are established along the roads connecting the C.B.D. with nearby villages and towns. Such types of shops also developed with new residential colonies to fulfill the daily needs of life. Such streets can be seen in New Shimla, Cemetery, Khalni, Panthaghati etc. Shops in ground floor and residences in down below and upper floor is a common feature.

(v) Scattered Shops

Scattered shops are the primary link of the commercial series. These shops are scattered in residential area, which is main characteristic of this kind of shops. These shops fulfill the demands of the people of surrounding houses. Small quantity of all daily needs of things is available in these shops. Second characteristic of shops is that people can take things on credit from these shops. According to the size of colonies 4 to 6 shops are present here and there. There shops bring their things from the business centre of that area and serves their surroundings. In Shimla town, the owner of such shops take things from the CBD of the city (Lower Bazar area) in wholesale rate and fulfill the demands of small and scattered shops.

Industrial Area

Industries play a significant role in the city economy. Infact, most of prosperous cities, today are industrial. According to Kusum L. Dutta (1971) in our country, the percentage of industrial area in some of the cities is as – 14.5 is Mumbai, 10.5 in Jaipur, 9.2 in Kolkata, 6.66 is Kanpur, 1.8 in Delhi, but in Shimla Town, total 9.00 hectare area comes under industrial use, which accounts only 0.62% under urban area. In Shimla town industries are not well developed in and around the city like other hill stations. The reason behind it is unavailability of proper infrastructure, hill terrain, long distance from other cities and high cost of transportation. The geographical conditions of the surrounding territory, modes of transportation, road arteries are not suitable for the development of industries in Shimla. Small scale and cottage industries are virtually linked with the urban economy and the needs of urban life.

The city practically had no industrial growth till late 1960's. However, the traditional small scale industries like wool spinning, weaving, basket making and metal work that use the local resources are still lingering but in vain without attaining progress. Apart from small scale industries wood working, black smithing, dying and manufacturing work, leather and food processing are other. The drivers for the majority of these industries are tourist and local people. The small scale and cottage industries have gradually come up in Sanjauli, Lalpani and Totu localities. With the development of well planned orchards and agriculture in the district and surrounding areas of Shimla town the food based industries assumed greater importance. There are only 30 units registered with a total number of 123 people engaged in various food based industries like bakeries, juice and jam, mushroom, honey processing etc.

Some workers are engaged in making of wooden toys, wooden baskets, walking sticks, fancy wooden and rulers etc. Around 40 units

and 137 workers are engaged in making wooden products. The products find ready in market mostly during the summer season when tourist's inflow is at peak. 'Lakkar Craft Bazar' is the market dealing in wood works. The city has only great potential for the establishment of cottage and small-scale environment friendly industries. Locally available raw material may be utilized and employment opportunities be generated so that economic condition of local people is improved.

Transportation Area

Transportation is quite simply the movement of goods and people from place to place. In a country of the size of India, the need for transportation facilities is very great. In times of regional famines or other calamities the need for such facilities is ever greater. Mountains are the only large tract of land which makes effects in this direction. Transportation lines serve as the arteries of the urban organism, which provide links amongst its various parts, inter-urban links and regional contact. Shimla had inexorably become an entry point for the hill states that lay beyond the decision to make a circular road reflects recognition of this fact. It provides the link to the Hindustan Tibet Road for the two new cash crops, seed potatoes and apples, which were carried on mule back. By 1940's 1000-15000 mounds of apples had to be transported from the Kotgarh area traversed by Hindustan-Tibet road. A tunnel planned to run under Gorton Castle was shifted eastwards to serve the railhead. It was named Victory Tunnel.

Road Network

At present total area under traffic and transportion use is 371.93 hectare in Shimla, which accounts to 25.20% of the urban area. Shimla is connected by road to all the major towns. The transportation network is primarily road based. Two national highways No. 22 and 88 go through Shimla city. National Highway No 22 connects Chandigarh to Shimla and National Highway No. 88 connects district Kangra (H.P.) to Shimla. The Mall is a 'Pedestrian Artery'. The main town has grown up in the form of crescent along it. The commercial control area along the Mall is hub of social life. The road is nearly 8 km. in length. The Mall road is a largest stretch of pedestrian road in the world presetting an ambience that is difficult to be seen in any other urban area. Shimla is connected to the city of Kalka by one of longest narrow gauge railway routes still operating in India. The Kalka-Shimla railway, the heritage toy train is the main attraction for the tourists. From Kalka, trains for major stations like New Delhi, Kolkata are available. Shimla local transportation is planned with the tourist as a core customer because the economy of Shimla is dependent upon the tourist activity. Commercial buses in Shimla are either run by the Himachal Pradesh Road transport corporation (HRTC) or by private transport operators. Buses are available to transport passengers to every part of Shimla city. Shimla's local transportation is concentrated in and on the vicinity of the ring road of Shimla town.The Ring Road route covers the main bus stand, lift, Chotta Shimla, Kasumpti, Sanjauli, Lakkar Bazar, Bus Stand, Victory Tunnel and Boileauganj. Shimla local transport also includes taxies. There are some restricted roads too in some parts of Shimla on which vehicles are not allowed. Himachal Pradesh tourism also runs a lift from Cart Road to the Mall (City Disaster Management Plan,

Table 1. *Landuse Pattern of Shimla : Existing and Proposed*

Landuse	Existing Landuse, 2011			Proposed Landuse for 2021		
	Area in Hectares	Percentage of Urban Area	Percentage of Planning Area	Area in Hectares	Percentage of Urban Area	Percentage of Planning Area
Residential	903.13	61.19	9.07	2124.00	68.00	21.35
Commercial	25.22	1.71	0.25	51.42	2.00	0.51
Tourism	21.7	1.47	0.22	98.00	3.00	0.98
Industry	9.00	0.62	0.09	17.00	1.00	0.17
Public and Semi Public	138.78	9.4	1.39	274.28	9.00	2.76
Parks and open spaces	6.00	0.41	0.06	32.00	1.00	0.33
Traffic & Transportation	371.93	25.20	3.75	484.93	16.00	4.87
Total	1475.76	100.00		3081.63	100.00	
Agriculture	2674.00		26.88	1119.66		16.3
Forest	5580.9		56.09	5529.37		80.5
Water bodies & undevelopable slopes	219.34		2.20	219.34		3.2
Total				6868.37		
Grand total	9950.00		100.00	9950		100.00

Source: Town and Country Planning Department Shimla, Himachal Pradesh, 2011

Shimla, 2012).

Airport

The airport is located on top of ridge at Jubberhatti, about 12 kilometers from Shimla situated at an elevation of about 5000 feet. It occupies 140 acres of land and has runway of 3800 feet length. This is just sufficient to allow operations by aircrafts of the size of the 18 seater Dornier. The airport is required to be spaded so that bigger planes can be landed on it.

Administrative Area

Nearly in all big cities, administrative functions play an important role in urban morphology. There are certain such cities like Shimla which have originated due to administrative functions and they are known for their administrative activities. Status of summer capital and cultural center had been christened since the British Regime in the first half of 18th century. It continued throughout the British Raj during 1864-1944 A.D. After Independence and Complete Statehood, it becomes permanent capital of Himachal state. The emergence of Shimla as the Summer Capital also resulted in the acquisition of several old buildings by the government for its offices.Shimla is witnessing exodus of haphazard and unplanned residential

development. As the house is a significant element of built environment and most of human pursuits of family and society are performed in the house, it has to be viewed as a planned functional, secure and aesthetic entity. Some congested locality like Cemetery, Sanjauli, Totu and Jiwanoo Colony are not giving way out even to take out the dead bodies and thus it is worst part of the tragic development. Illegal sub-divisions of land have added fuel to fire and thereby proliferation of slums. Hutments of construction workers and slums in the forest land are the worst part of Shimla's plight.

The best effort and alternative suggestions for the solution of this burning problem must be to resurvey the landuse pattern of the city and to mark the probably misused and waste lands lying within the city limits. As 903 hectares area is under residential use, therefore 1221 hectares area is the additional requirement. It is estimated that there will be requirement of 2124 hectares land at the rate 100 to 150 persons per hectare by the year 2021. No more construction shall be allowed in Central Shimla and congested pockets, like Sanjauli, Cemetry, new Shimla, City Core, Chotta Shimla and Kasumpti etc. To cope up with the housing requirements of three satellite towns have been proposed namely at Vaknaghat, Ghandal and Faug. Ghandal will fulfill the educational requirements and Fagu will cater for tourist's requirements.

Shimla was established primarily as a tourist-cum-administrative town. It is now vibrant with multifarious activities like trade, commerce, tourism, education, health, institutions, government offices, infrastructure, traffic and transportations. There are a number of commercial establishment in the town which are one of the major reasons for congestion. Being a hilly area, Shimla has narrow roads, but inspite of that encroachment of shops on both sides of road leads to a big problem for the people of Shima. It has been found that more than 65% commercial establishment are located in Central Shimla. All out efforts be made to decongest Shimla by shifting of wholesale, Grain Market and Vegetable, uncalled for non-conforming activities from the Central Shimla. There will be additional requirement of 26.54 hectares area for commercial activities by the year 2021. Therefore, 51.20 hectares has been proposed for wholesale and warehousing activities. There is a plan for disposal of commercial activities to the periphery of the planning areas. Modernized district commercial center at Ghanahatti, Shoghi and Jathia Devi on Kunihar road are proposed to be developed. Satellite town have to be developed to cope up with any more population and commercial activities required to be accommodate in the adjoining areas of Shimla.

In most of the Indian towns, traffic problem is a common feature of city structure and Shimla is no exception. In Shimla there is large number of vehicles on narrow roads and passengers are more vulnerable to the accidents. Employees in great number commute daily from their residents to office. Insufficient availability of spaces for parking is a major problem. As serious challenges are posed to Shimla, on one hand and environmentally sensitive areas in and around it, traffic and transportation networks requires serious thought and meticulous planning. The development plan envisages for by pass roads, tunnel, ropeways, development of parking lots, truck terminals, transport area and bus

terminals. As 372 hectares of land exists under this use, total requirement for traffic and transportation use therefore, works out to be 485 hectares.

Some Proposals has made by the Govt. to solve the traffic problems in the Shimla town. Totu to Kufta Dhara-Naldehra bye pass, Panthaghati-Tara Devi alternative bye pass in between existing and lower bye passes has proposed. Ghanahatti-Jubbarhatti-Shoghi bye pass measuring 15 km, escalator from Lakkar Bazar, Bus Terminal to Ridge, parking lots and elevators at strategic locations like Bemloe on Cart Road to Mall Road, Office Complex Kasumpti from Bye-Pass Kasumpti Road, Near Snowdon on Cart Road to Lakkar Bazar, four tunnels have been proposed.

Total area of 17 hectares is proposed for industrial use, out of which only 9.00 % area already exists under this use. Existing industrial activity is in the form of household manufacturing and small scale. In order to encourage local arts and crafts, to accommodate workshops and to establish necessary industries a strategic location in the vicinity of Shimla - Chandigarh National Highway-22 has been proposed. In view of premier hill station character, only eco-friendly industrial establishments are proposed to be developed in the activity zone in west of the city.

Shimla being an administrative city on one hand and tourist paradise, on the other is equipped with the multifarious institutions, government and semi government offices facilities and services. Presently, area under government an semi government offices is 65 hectares. An additional requirement for government and semi government offices works out to 7.00 hectares. The total requirement for facilities and services works out to 202 hectares. Most of the Govt./ Semi.Govt. Offices and institutions are presently located here and there in isolation of each other. The secretariat complex lacks safety and security due to national highway running through it. By passing of traffic is there for of four most necessity. The public and semi public includes educational, medical, utilities, services civic centers, socio cultural facilities, cremation grounds and other public amenities. The total area of 274.28 hectares has been proposed under this use, out of which 138.78 hectares is already existing. Only sustainable activities are proposed to be further continued. Additional load has either to be shifted to the activities Zone in the west or to satellite towns at Ghandal and Waknaghat. (Fig. 2)

The existing sources of water supply Gumma Nauti khad, Ashwani khad, Cherot nallah, Chain nallah and Dhalli catchment area are about 30 MLD. During summer season necessary measures like provision of check dams, rain water harvesting structures should be proposed for the diversion of flow from the catchment areas to the existing springs. It is estimated that garbage generation by the year 2021 is likely to be about 90 to 100 tons per day in the Shimla. Therefore it is necessary to develop suitable sites for garbage disposal & treatment at strategic locations in view of topographical and future development imperatives of Shimla. As Shimla is one of the major educational centers in Himachal Pradesh, Modernization of education in view of technological advancement is required to be ensured. Besides, this improvement schemes for other educational complexes are required to be prepared and implemented. Shimla being a capital city all kinds of health care facilities

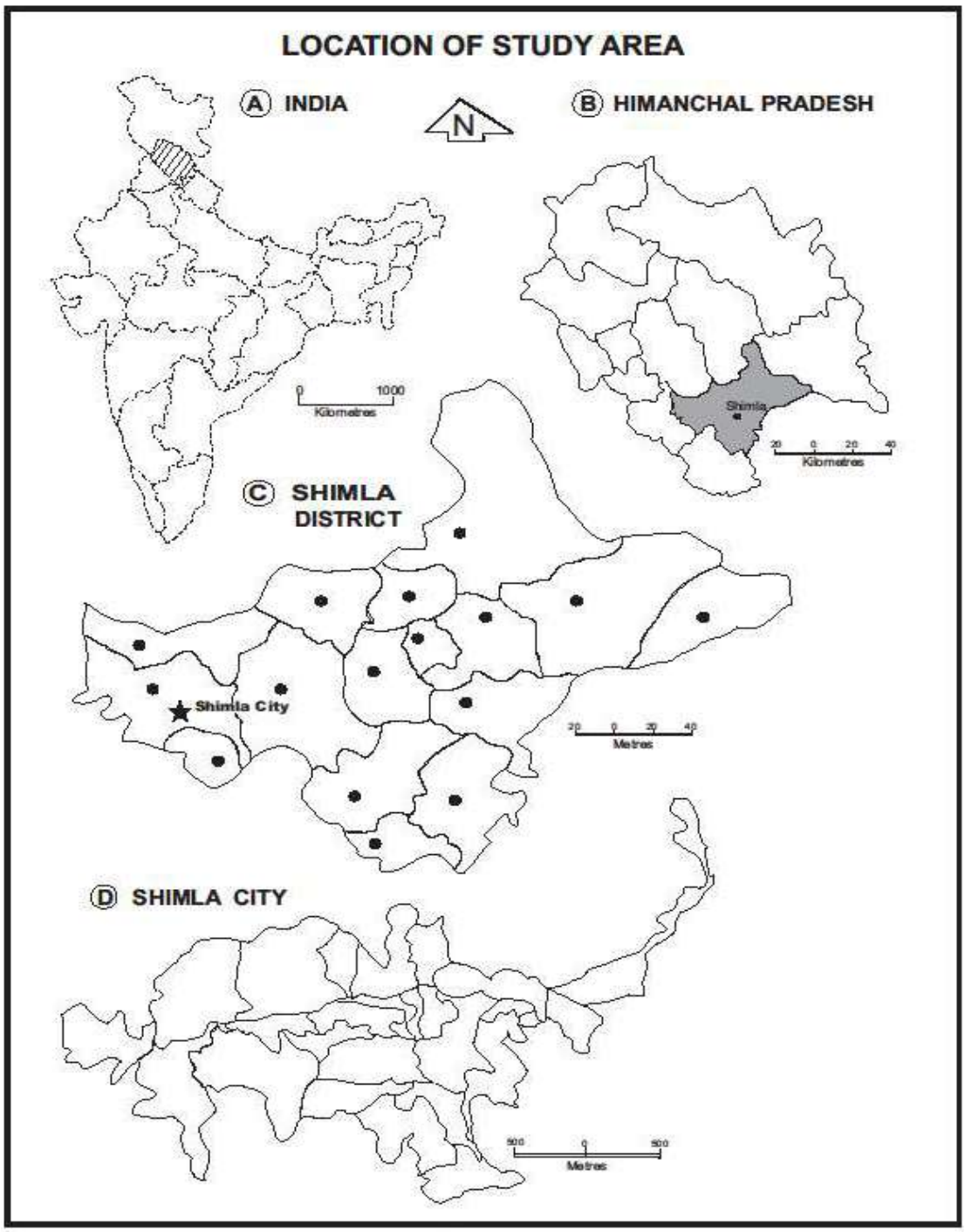
LOCATION OF STUDY AREA
A INDIA
N
B HIMANCHAL PRADESH
0 1000
Kilometres
Shimla
20 0 20 40
Kilometres
C SHIMLA DISTRICT
Shimla City
20 0 20 40
Metres
D SHIMLA CITY
500 0 500
Metres

Fig. 2

should be available in it for the city as well as regional population. Lack of proper disposal of hospital waste, is a matter of concern. It is imperative that all medical institutions at Shimla should be furnished their requirements of space for expansion and shifting of their activities as deemed fit, in view of paucity of space in existing complexes. As in Shimla planning area IGMC is only state level hospital, therefore it is proposed to increases the carrying capacity of this hospital in term of numbers of doctors and beds.

Conclusion

Out of 9950 hectares of land within Planning Area, 3081.63 hectares is earmarked under the different urban uses. The major part of the urban land is mainly residential which occupy 68.00 % of urban Area and 21.35 of the Planning Area. As we have talked earlier that main business area in Shimla town is confined on Mall Road and Lower Bazar and few small patches also found in Sanjauli, Boileauganj and Summer Hill etc. Additional 26.20% commercial area is to be required for the total Planning Area. As total urban population of the Shimla is likely to grow faster in the years ahead so more than 50% area of the existing land use is required. Today total 1475.76 Hectares area is under different landuses, additional 1605.87 Hectare area is to be required. The Planners in Shimla appear to have taken the back seat. There is no need of a grand master plan for Shimla Town, but a need of a continuous master planning is required by the Planning Departments.

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The study of the Landuse/Landcover change in Sirsa River Basin, Himachal Pradesh Using Remote Sensing Data

Narender Verma and Pratik Dash

Sirsa River Basin, a tributary of Sutlej River that flows through Himachal Pradesh and Punjab has witnessed changes in land use owing to significant growth of population and industrial expansion in Himachal Pradesh. Baddi town in Solan district has emerged as a major industrial hub in the last two decades. In the present study an attempt is made to trace the land use land cover change in the Sirsa river basin during 1989-2009 using Landsat data. Since the ultimate objective of delineating land use land cover was to study its impact on the hydrological characteristics of the study basin (not discussed in the present paper) river basin has been chosen as a unit of study and only the results of land use land cover change at the basin level have been incorporated in this paper. Landsat TM data of 1989 and 2009 and Landsat ETM+ data of 1999 have been used in this study. Supervised classification using maximum likelihood algorithm followed by post classification readjustment of classes through recode function and change detection have been performed in GIS environment. Also an accuracy assessment using Kappa coefficient has been done to assess the accuracy of the results. Significant changes in land use land cover have been observed. While on one hand there has been a significant reduction in area under dense & open forests by 16% each and barren land by 50%, built up area has sporadically increased by a whooping 1500% during period under study. The overall accuracy and kappa coefficients(k) for 2009 image are 85.19% and k= 81.77% whereas for 1989 and 1999 the corresponding values are 61.48 %, k= 52.77 and 62.22 %, k= 53.60.

Keywords: Agriculture, Built up land, Landsat, Land use, Sirsa, supervised classification

Introduction

Land, the fundamental factor of production and economic development, is dynamic in nature. Throughout the history of civilization the need and pattern of land resource utilization has changed with time. Land use is the result of complex interaction of society's cultural background, state of economic development and its physical needs with bio-physical characteristic of the earth's surface. Explosive growth of population and technological advances has brought severe

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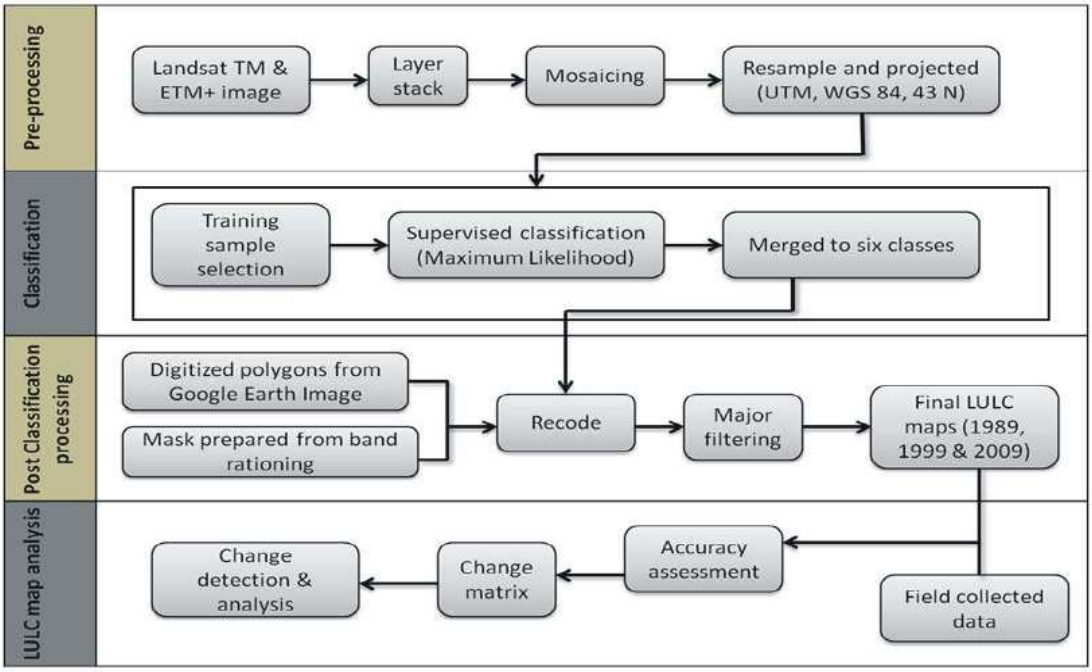

Fig-1 Methodology Flow Chart

alteration in the land use pattern throughout the world owing to rising multiple demands. In most cases, particularly in developing countries like India this alteration in land use pattern has been haphazard and unplanned causing deterioration in the quality of land. The alteration of LULC classes is not only caused by anthropogenic activities. Natural events driven by endogenetic and exogentic forces are also responsible. At an instance, forest fire, earthquake, Tsunami, flooding, ecosystem dynamics may also play a significant role in LULC dynamics.

Dynamics of land resource utilization often causes environmental degradation and imbalance.. Unplanned alteration of land cover may aggravate several environmental problems like, water logging, floods, water scarcity, soil erosion, landslides etc. For the sustainable use of land resources and to reduce its diverse effect on the environment, it is not only necessary to get knowledge about the existing land use scenario, but also the capability to monitor the dynamics of LULC resulting from anthropogenic activities and natural forces (Meyer, 1995). Conventional methods of LULC map preparation are quite difficult, time consuming and laborious. Presently, remote sensing data and GIS techniques have proven as efficient tools in LULC mapping and change detection at various spatial and temporal scales.

Sirsa River Basin, a tributary of Sutlej River that flows through Himachal Pradesh and Punjab has witnessed significant changes in land use owing to significant growth of population and industrial expansion particularly in Himachal Pradesh. Baddi town in Solan district has emerged as a major industrial hub in the last two decades.

In this paper an attempt is made to trace the land use land cover change in the Sirsa river

Table 1. *Land use/land cover classes identified in the Sirsa river basin.*

LULC category	Description
Dense Forest (DF)	Dense cover of medium to long height trees like, Sal, khair,siris, kachnar, semal, tun, dense cover of shrubs also included
Open Forest (OF)	Medium canopy cover of low to moderate height tree and shrubs like, eucalyptus, mango, ritha, tut, behera and chil
Agricultural Land (AGRI)	Close grown agricultural field of wheat, maize, paddy etc., cultivated in kharif and rabi season
Barren Land (BRN)	Non vegetated areas such as bare rocks, sandbar or areas with very little vegetation cover and grass, and abandoned land
Built-up Area (BU)	Area with permanent concentration of man made structures, such as towns, villages and rural areas, industry and other construction area, brickfield
Water Body (WTR)	Streams, ponds and artificial water storage

basin during 1989-2009 using Landsat data. Since the ultimate objective of delineating land use land cover was to study its impact on the hydrological characteristics of the study basin (not discussed in the present paper) river basin has been chosen as a unit of study and only the results of land use land cover change at the basin level have been incorporated in this paper.

Methodology

The present study is based on Landsat TM data of 1989 and 2009 and Landsat ETM+ data of 1999 acquired from Global Land Cover Facility (GLCF). Two scenes (path/row- 147/38 and 147/39) captured during the month of October were acquired for each of the time period under study. The different bands of the radiometrically and geometrically corrected images was layer stacked to form a single image, projected in UTM projection system (datum WGS 1984, 43N zone), mosaiced, and study area masked prior to image classification.

Supervised classification based on maximum likelihood algorithm was performed to delineate land use land cover classes. 100 training sets were selected on the image as training signatures for identifying different Landuse/landcover classes which were than merged into six broad landuse/land cover classes.(Table-1) through recode function.

Spectral similarity of various objects often results in erroneous classification of one class of land use into another through supervised classification. To overcome such problems hundreds of polygons covering patch of built-up area, agricultural land, barren land, etc. were digitized on google earth image, converted into AOI and within AOI, corresponding classes of 2009 LULC image were changed by recoding. Finally, to remove 'salt & paper' noise that quite often appears in digital image processing, a majority filter (3 X 3 filter) was employed for three classified images.

For the reliability and accuracy of the classified data an accuracy assessment was done in ERDAS Imagine 9.2 software. Here the data collected in field using a hand held GPS (Global Positioning System), and recorded GCPs (Ground Control Points) were used as

reference data and error matrix generated for the classified maps to calculate overall accuracy, user's and producer's accuracies and the kappa statistic. The overall accuracy is estimated by taking the ratio between sum of the major diagonal elements and the total number of pixels (*N*). The following equation is used for determination of user's accuracy, producer's accuracy and kappa coefficient (k):

$$\text{user's accuracy} = \frac{C_{ii}}{Nn_1} \quad \text{.....(Eq.1)}$$

$$\text{producer's accuracy} = \frac{C_{ii}}{Nc_1} \quad \text{.....(Eq.2)}$$

where, Nr_i is sum of any row *i* and Nc_j is sum of any column *j* in the confusion matrix.

To analyse the relative contribution of different classes to land use change a change detection analysis was performed. Change detection matrix tool in ERDAS IMAGINE 9.2 is used to estimate the transition of each of the classes to another class (from-to) for three LULC maps prepared at decadal interval (1989, 1999 and 2009). Finally, changes in LULC classes are assessed at the basin level.

Study Area

Location and Extent

The study area, Sirsa river basin, is a downstream tributary river basin of Satluj River located in western Himalaya. The Sirsa river basin, an intermontane river system, is situated in Pinjaur dun between outermost Siwalik in the southwest and sub-Himalayan mountain in the northeast. Extending from 30°49' 22" to

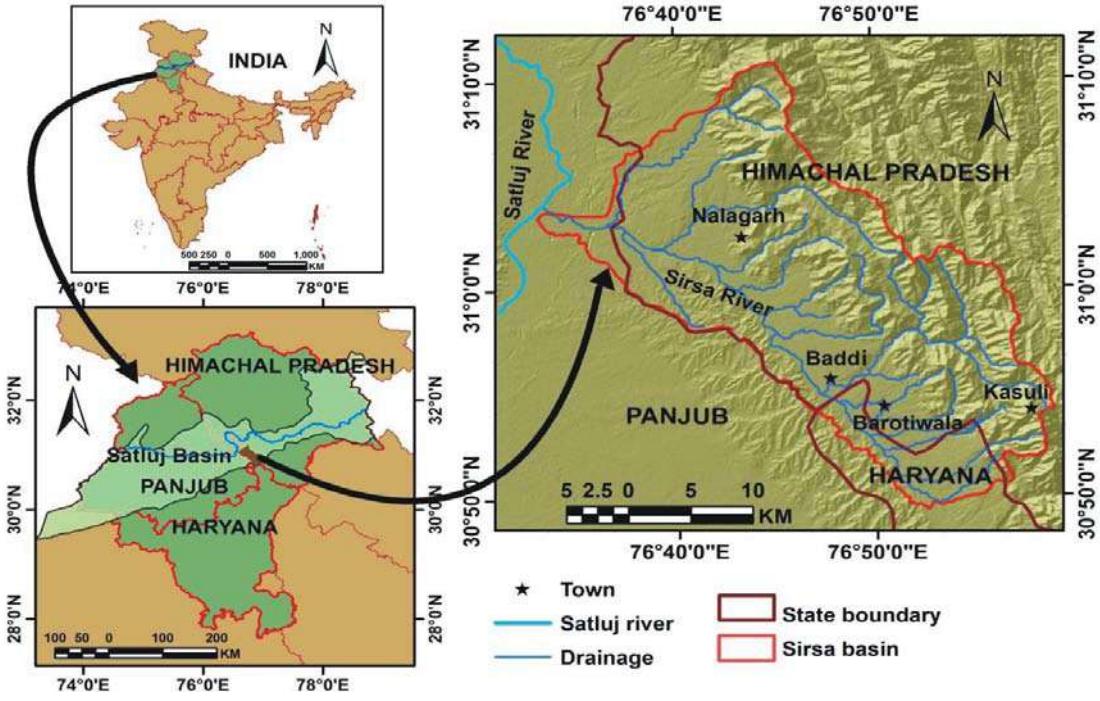

Fig-2. Location Map

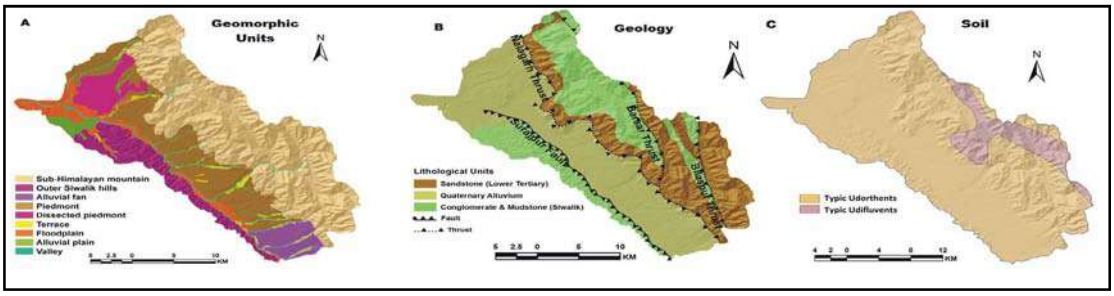

Fig 3. (a) Geomorphological (b) Geological (c) Soil Maps

31°11' 00" N latitudes and 76°32' 48" to 76°59' 22" E longitudes, the study area covers about 700 km^2. Major proportion of the basin area (85% approximately) lies in Solan District of Himachal Pradesh whereas only 11.5% and 3.5% of the basin area lies in Panchcula district of Haryana and Rupnagar district of Punjab, respectively (Fig-2). The seventh order stream-Sirsa is the main axial river of the basin that flows towards north-west.

Originating from the Kasuli–Ramshahr ranges in sub-Himalayan mountain, the Sirsa river flows along Nalagarh valley through Surajpur fault and joins Satluj River below the Bhakra dam near Rupnagar in Punjab.

Topography, Relief and Soil

Topographically the study basin is sandwiched between the sub Himalayan ranges in the north and north east and Siwaliks in the south and south west giving it a typical ridge and valley topographic character. Elevation of the basin varies between 254 and 1897 m with an average of 614 m, almost half of which is characterized by intermontane valley. The topographic features of the basin are: denudated hills, structural hills, ridge and valley topography, terraces, alluvial fan, piedmont, alluvial plain etc. The major geomorphic units (Fig- 3A) of the Sirsa basin are i) Tertiary sub-Himalayan mountain (Kasauli–Ramshahr Tertiary ranges), ii) intermontane valley, and iii) Outer Siwalik hills (Philip and Virdi, 2007; Singh & Tandon 2008, 2010; Philip et al. 2011). Geologically, the area is underlain by formations ranging in age from Quaternary to Mio-Pleistocene (Fig-3B).

The major soil type of the study basin is sandy loam (Central Ground Water Board 2007). The valley region (Dun) is dominantly covered by sandy loam soil (Fig-3C) These soils are porous, and well drained with less organic matter. Some parts (middle of north-east part of the basin) in the hilly and mountainous area is covered with loamy skeletal soil. The depth of this soil is generally shallow and dry, except in areas comprising dense vegetation.

Results and Discussion

Basin Level Changes (1989-2009)

The overall land use/cover and related changes for the whole Sirsa basin between 1989 and 2009 is summarized in Table-2. Based on Anderson's level I classification six major LULC classes viz.(a) Dense forest (b) Open forest, (c) Agricultural land, (d) Barren land, (e) Built-up area and (f) water body are identified (Fig-4).

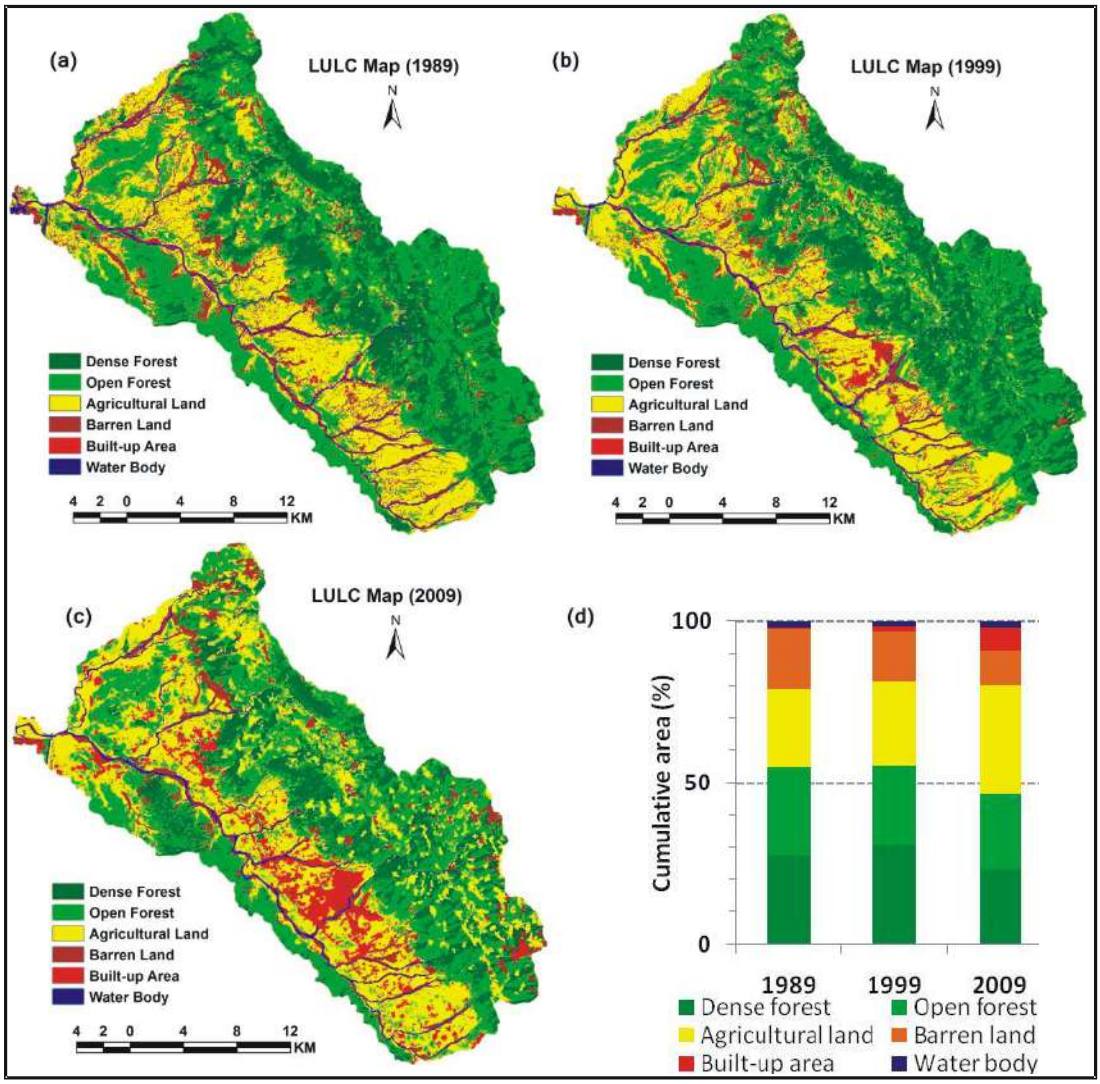

Fig-4 Land Use/ Land Cover Map (a) 1989 (b) 1999 (c) 2009 (d) Cumulative Area under various LULC (in percent)

Dense forest and open forest together constituted largest proportion of land cover during all the three years(1989,1999, 2009) accounting for more 50 percent of the total basin area in 1989 and 1999 and 46 percent in 2009. However there has been a substantial decline in area under it by approx 10 percent from 55 percent in 1989 to 45 percent in 2009. In all there was a reduction in area under both these categories by 16 percent each during 1989-2009(Table-2).

Agriculture constituted second largest proportion of area after forests accounting for 33 percent of the basin area in 2009. It has

Table 2. *Changes in LULC classes from 1989 to 2009 in Sirsa basin*

LULC	Area under each LULC class						change in Area under LULC class					
	1989		1999		2009		1989-1999		1999-2009		1989-2009	
	(KM^2)	(%)	(KM^2)	(%)	(KM^2)	(%)	(KM^2)	(%)	(KM^2)	(%)	(KM^2)	(%)
Dense Forest	185.12	27.36	206.50	30.52	155.46	22.98	21.37	11.54	-51.03	-24.71	-29.66	-16.02
Open forest	187.61	27.73	168.22	24.86	157.45	23.27	-19.39	-10.34	-10.77	-6.40	-30.17	-16.08
Agriculture	161.75	23.90	176.60	26.10	228.32	33.74	14.85	9.18	51.73	29.29	66.57	41.16
Barren land	126.69	18.72	102.68	15.18	74.78	11.05	-24.01	-18.95	-27.90	-27.17	-51.91	-40.97
Built-up	2.95	0.44	11.17	1.65	47.21	6.98	8.22	278.58	36.05	322.75	44.26	1500.43
Water body	12.51	1.85	11.48	1.70	13.40	1.98	-1.04	-8.31	1.93	16.84	0.89	7.13
Total	**676.65**	**100**	**676.65**	**100**	**676.64**	**100**						

registered a 41 percent increase next only to built up area (1500%) between 1989 and 2009. There has been an increase in agricultural area in both the decades (1989-1999 and 1999-2009) from 9.18 percent to 29.29 percent respectively. This is mainly on account of rapid expansion of cultivated area mainly along the mountain slopes through terrace farming.

Built up area, though, constituted only 6.98 percent of the basin area in 2009 has recorded the highest relative growth by more than 1500 % between 1989and 2009. Area under it has increased from a paltry 0.44 percent in 1989 to 6.98 percent in 2009. This can be attributed to the rapid growth of population and massive industrialization that has occurred in Nalagarh, Baddi and Barotiwala region of the intermontane alluvial plain.

There has not been much change in the area under water bodies which has remained stagnant at approx 2 percent of the basin area in all the three years (1989,1999 and 2009). Barren land on the other hand has recorded a decline by 40 percent between 1989-2009.

Change Detection Analysis

The overall changes and conversion in LULC classes (from-to) of the study basin (1989–2009) are presented in Table 3 and figure 5. Here the rows represent values for 1989

Table 3. *Change matrix of LULC class 'from/to' other classes in Sirsa basin from 1989 to 2009.*

LULC of 11989 (km^2)		LULC of 2009 (km^2)						
		DF	OF	AGRI	BRN	BU	WTR	**Total**
	DF	0	11.26	16.71	0.23	1.21	0.25	**29.66**
	OF	-11.26	0	38.43	-0.62	3.61	0.02	**30.17**
	AGRI	-16.71	-38.43	0	-38.33	27.05	-0.15	**-66.57**
	BRN	-0.23	0.62	38.33	0	12.06	1.12	**51.91**
	BU	-1.21	-3.61	-27.05	-12.06	0	-0.35	**-44.27**
	WTR	-0.25	-0.02	0.15	-1.12	0.35	0	**-0.89**
	Total	**-29.66**	**-30.17**	**66.57**	**-51.91**	**44.27**	**0.89**	

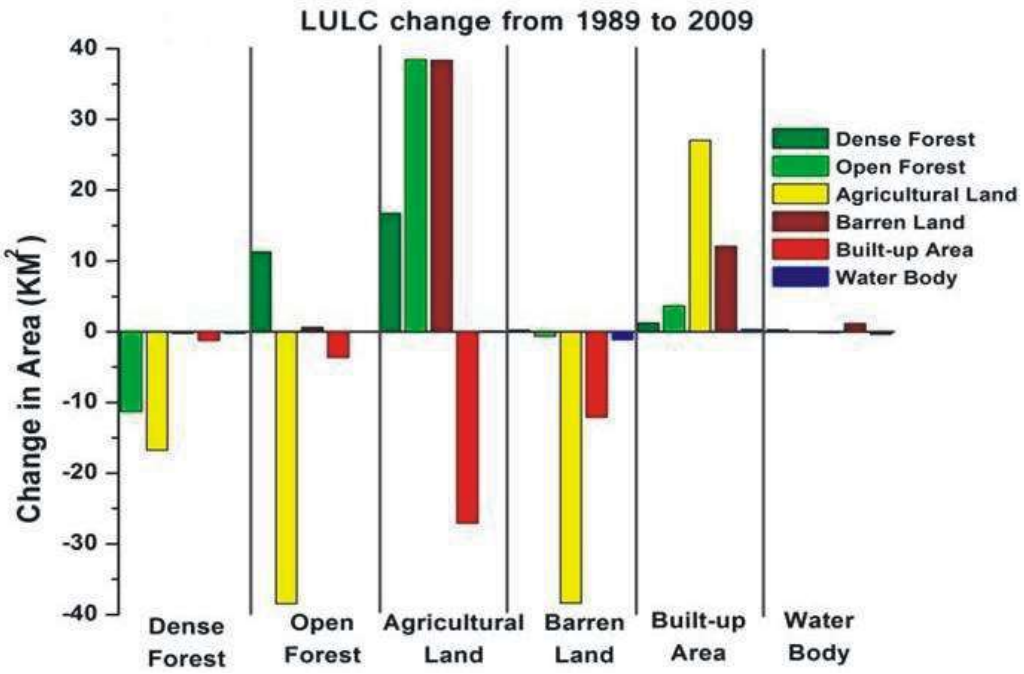

Fig 5. Land Use/ Land Cover Change from 1989-2009

and columns their corresponding values in 2009. During the past three decades area under dense forest, open forest and barren land have decreased by 29.66km^2, 30.17km^2 and 51.91Km^2 whereas area under agricultural land, built-up area and water body have increased by 66.57 km^2, 44.27 km^2 and 0.89 km^2 respectively (Table 3).

Much of the area under dense forest has been converted either into agricultural land (56.33 %) or open forest (38%), they together accounted for 94% of the total area converted. Rest 6 % is accounted for by barren land, built up land and water bodies. Similarly though, the total area lost under open forest is equal to 42.06Km^2 but a gain of 11.26Km^2 area from dense forest and 0.62Km^2 area from barren land resulted in a net loss of 30.17km^2 area under it. 91 % (38.43 km^2) area lost under open forest has been transformed into agricultural area and the remaining 9 % (3.61Km^2) into area under built up land. Likewise barren-land has been converted into agricultural land (73.83%); built up land (23.23 %), open forest (1.1%) and water bodies(1.74 %) respectively.

Built up land has gained from all the classes in 2009 as compared to 1989. Of the total of 44.27km^2 area gained maximum 27.05 Km^2 area (61.10 %) has been gained from agriculture followed by barren land (27.24%), open forest (8.1%) and dense forest (2.7%). Similarly agriculture has also gained from all classes in 2009 over 1989 except built up area to which it has lost 27.05Km^2 area (Table-3, Fig-5).

As far as water bodies are concern there

Table 4. ***Confusion matrix and accuracy measures for 2009 classified map.***

Reference	DF	OF	AGRI	BRN	BU	WTR	Nr_i	User's Accuracy
DF	**17**	2	0	0	0	0	19	89.47
OF	0	**19**	4	3	0	0	26	73.08
AGRI	0	2	**27**	0	1	0	30	90.00
BRN	0	0	6	**18**	0	0	24	75.00
BU	0	0	2	0	**26**	0	28	92.86
WTR	0	0	0	0	0	**8**	8	100.00
Nc_j	17	23	39	21	27	8	135	
Producer's accuracy	100	82.61	69.23	85.71	96.30	100	Overall accuracy = 85.19 kappa coefficient (k) = 81.77	

DF-dense forest, OF-open forest, AGRI-cropland, BRN-barren land, BU-built-up area, WTR- water

has not been any significant change during the period under analysis.

Accuracy Assessment

The ground truth data collected with GPS are used as the reference for assessing the accuracy of classification. Incorporating all LULC classes, 135 sample points were randomly collected from the field during 2011. The object/class that didn't alter during two years (2009-2011) was taken as sample point. Due to unavailability of ground reference data, same reference points were used for the accuracy assessment of the maps prepared from 1989 and 1999 images. The accuracy report of the 2009 image is presented in Table 4. The overall accuracy and kappa coefficients are 85.19% and 81.77%, respectively. Agricultural land, barren land and water body showed very high user's accuracy (90%). The user's accuracy and average producer's accuracy of six types LULC classes are also quite high (87% and 89% respectively) that indicates high efficiency of the classified image.

However the overall accuracy for 1989 and 1999 image is low, 61.48% and 62.22% respectively (Tables-5&6). This is because the classified images have been compared with ground truth data of 2011 due to non availability of reference data for both the years and during this period sporadic change particularly in area under built up land has occurred. Much of the area that was either under barren or agriculture during 1989 and 1999 has been converted into built up land by 2011 consequently pixels that ought to have been under these two categories of land use as per 1989 and 1999 scenario are classified as built up land as per the reference data of 2011. Thus major conversion of land use is primarily responsible for low accuracy in 1989 and 1999 classified data bringing down the user's accuracy to 32 percent in case of built up area. For 1989 image, accuracy of dense forest, agricultural land and barren land are comparatively high (>70%). While accuracy of dense forest, barren land and water body in 1999 image is above 70%.

Table 5. *Confusion matrix and accuracy measures for 1989 classified map.*

Reference	DF	OF	AGRI	BRN	BU	WTR	Nr_i	User's Accuracy
DF	**14**	4	0	1	0	0	19	73.68
OF	4	**14**	4	4	0	0	26	53.85
AGRI	0	2	**22**	6	9	0	30	73.33
BRN	0	3	1	**19**	0	1	24	79.17
BU	0	1	10	8	**9**	0	28	32.14
WTR	0	0	0	3	0	**5**	8	62.50
Nc_j	18	24	37	41	9	6	135	
Producer's accuracy	77.78	58.33	59.46	46.34	100.00	83.33		Overall accuracy = 61.48 kappa coefficient (k) = 52.77

DF-dense forest, OF-open forest, AGRI-cropland, BRN-barren land, BU-built-up area, WTR-water

Table 6. *Confusion matrix and accuracy measures for 1999 classified map.*

Reference	DF	OF	AGRI	BRN	BU	WTR	Nr_i	User's Accuracy
DF	**14**	5	0	0	0	0	19	73.68
OF	1	**17**	5	3	0	0	26	65.38
AGRI	1	4	**19**	6	0	0	30	63.33
BRN	0	2	2	**19**	1	0	24	79.17
BU	0	1	11	7	**9**	0	28	32.14
WTR	0	0	0	2	0	**6**	8	75.00
Nc_j	16	29	37	37	10	6	135	
Producer's accuracy	87.50	58.62	51.35	51.35	90.00	100.00		Overall accuracy = 62.22 kappa coefficient (k) = 53.60

DF-dense forest, OF-open forest, AGRI-cropland, BRN-barren land, BU-built-up area, WTR- water

Conclusions

The basic objective of the present study was to analyze the change in land use land cover pattern in Sirsa river Basin for three decades from 1989 to 2009. For this purpose multi date Landsat images were used for change detection analysis. The classified images show that there has been a sporadic change in the land use land cover pattern in the study area. On one hand the area under dense as well as open forest cover and barren land has reduced approximately by 16 percent and 50 percent respectively, area under agriculture and built up land has increased substantially. In absolute terms area under agriculture has recorded a maximum increase by approximately 66 km^2 however in relative terms area under built up land has recorded a whopping 1500 % increase. This is because proportion of area under built up land was very meager in 1989. Class

conversion (from to) between various land use classes shows that whatever area has been lost from forests and barren land has gone either to agriculture or built up area. This can be clearly attributed to the rapid expansion in population that has aggravated the need for expansion of settlement, further industrialization in and around Baddi Town which is now one of the largest industrial hubs of Himachal Pradesh is also responsible for bringing about this pattern of change. The results obtained through digital image processing using supervised classification based on maximum likelihood classifier and post classification process are fairly accurate as can be discerned from the accuracy assessment report of 2009 in which the overall accuracy is 85 percent and Kappa coefficient is 81.77 however the same cannot be said for 1989and 1999 results wherein the accuracy is on a lower side. This is mainly on account of lack of reference data for these years due to which reference data obtained in 2011 was used and during this period massive change in the LULC occurred in the study basin that scaled down the accuracy. This reiterates the fact that for any objective accuracy assessment of classified image the reference data should always be taken within the same time span during which image has been acquired. Further the viability of remote sensing as a potent tool for change detection analysis is yet again emphatically brought out from the present study.

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Delimitation of Channel Migration Zones in the Rapti River Basin, Middle Ganga Plains

Narendra Kumar Rana

Channel migration is an important geomorphological process in the floodplain area. The rapid shifting of rivers has not only complicated the flood problems but also undermined engineering structures and pose constant threat to public infrastructure. In these areas risk minimization through channel migration zoning forms the core of river management programme. The present study on river Rapti analysed historical information and field data to interpret past and present channel conditions in order to predict future channel behaviour and areas at risk of channel movements. River Rapti is a foothill-fed river originating from the Siwalik hill areas of Nepal and draining the interfan areas between the Gandak and the Ghaghra. The river is known for its frequent channel movement. Several studies based on conventional and historical data confirmed its unpredictable channel behavior. This study delineated boundary of the channel migration zone (CMZ) with the help of geospatial data ranging a period of over 70 years and limited field survey. The CMZ is the cumulating product of the Historical Migration Zone, the Avulsion Hazard Zone, the Erosion Hazard Area and the Disconnected Migration Area. The river Rapti being a foothill-fed river exhibit spatial variations in channel migration throughout its course. Several broad patches of CMZ are observed along its lower course where there is concentration of human settlements, economic activities and infrastructure. The study found that constant channel migration is undermining various engineering structures, eroding valuable and productive agricultural land and enhancing vulnerability of the floodplain dwellers. The study further recommended that site suitability analysis should be undertaken prior to construction of any engineering structures including public infrastructure.

Keywords: Channel Migration Zone, Erosion Hazard Area, Goespatial Data, Neotectonic Activity.

Introduction

Most of the rivers in the Gangetic plains experience severe channel erosion; the situation is alarming in the middle and lower Ganga Plains. Extremely low gradient with alluvial bedding and fluctuation in river discharge are some of the important factors that facilitate severe channel movements and erosion in those areas. Flooding during the high discharge period and lateral erosion during low discharge period are the most dominant fluvial hazards of this region (Singh and Awasthi, 2011). Extensive

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Table 1 : *Characteristics of satellite data used*

Sensor	Characteristics	Path/ Row	Date of Acquisition	Source
LANDSAT-1 Multi	Spatial Resolution-57m	153/41	25-02- 1975	GLCF image
Spectral Sensor	Spectral Resolution-8 bits	153/42	14-02- 1977	library
(MSS)	No. of band-4	154/41	05-11- 1975	
LANDSAT-1	Spatial Resolution-28m	142/41	07-11- 1989	GLCF image
Thematic Mapper	Spectral Resolution-8 bits	142/42	10-11- 1990	library
(TM)	No. of band-4	143/41	17-11- 1990	
LANDSAT-7	Spatial Resolution-23.5m	142/41	13-12- 1999	GLCF image
Enhanced Thematic	Spectral Resolution-8 bits	142/42	04-02- 2000	library
Mapper (ETM+)	No. of band-4	143/41	17-10- 1999	
RESOURCESAT-1	Spatial Resolution-23.5m	102/052	25-11- 2003	NRSC,
IRS-6	Spectral Resolution-7 bits	102/53	25-11- 2003	Hyderabad
LISS-III	No. of band-4			
LIS-IV				

studies have been carried out on flooding, but not much attention has been paid to the phenomenon of lateral erosion. Fluvial dynamics in the Gangetic plains were initially reported by Shilling Field in 1893 (cited in Gole and Chitale, 1966) through his work on the migration of the Kosi river and followed up by several workers (Mookerjea, 1961; Gole and Chitale, 1966; Arogy, Swamy, 1971; Wells and Dorr, 1987; Agarwal and Bhoj, 1992). Reasons suggested for the large scale migration of the Kosi are many, including the general braided nature of the river, conical delta building, sediment deposition, rise of the bed levels and severe flooding, tectonic influence including subsidence and finally large scale auto cyclic and stochastic processes (Sinha et al., 2005). Similar studies on Gandak (Mohindra et al., 1992), Burhi Gandak, Baghmati and Kamla-Balan (Phillip et al., 1989; Phillip and Gupta, 1993; Sinha 1996; Jain and Sinha 2003, 2004) have demonstrated fluvial dynamics of the region. In addition to these studies on channel movements of the river Ganga around Kanpur by (Hegde et al., 1989) and the Ghaghra, Sarda and Rapti by Tangri (1986) and Chandra (1993) demonstrated their instability. Important works on changes in the course of the river Rapti and its impact on human settlement (Singh, 1996), its association with historic flood events (Singh, 1975), erosion and associated land ownership conflicts (Kayastha and Yadav 1977-78) and dynamic instability and morphology (Rana, 2005; Rana and Singh, 2012) revealed that the river is more dynamic in its entire-course and shifted towards east in response to neotectonic activity.

The main objective of the present study is to map the Channel Migration Zones (CMZ) i.e. the area where a stream or river is susceptible to channel erosion and to predict areas at risk for future channel erosion due to fluvial processes. This paper helps in evaluation of river stability and identification of potential river hazards, specially erosion and inundation and their impact on public infrastructure.

Data used and methods

The present study delineated boundary of the channel migration zone (CMZ) with the help of conventional data (Topographical Sheet Nos. 63J/13, 14, 63N/1, 2, 5, 6, 7, 9, 10 and 11 on a scale 1:50,000 published by Survey of India, 1920-21) and geospatial data ranging a period of over 80 years and limited field survey (Table-1). It also interpreted past and current channel conditions and predicted future channel behaviour and vulnerable areas to erosion hazard. The CMZ is the cumulating product of the Historical Migration Zone, the Avulsion Hazard Zone, the Erosion Hazard Area and the Disconnected Migration Area.

The historical migration Zone (HMZ) is the area that the channel has occupied over the course of the historical record and is delineated by outermost extent of channel locations plotted over that time. The rates and direction of channel movement over time are measured by comparing channel positions by overlaying mapped and photographed channel positions from 1921 to 2008. It is easily and accurately accomplished with GIS platform. The topographic sheet of 1921 and 1969 prepared by Survey of India (SOI) was taken as the base map. All other vector boundaries derived from maps and satellite imageries with different scales were imported into GIS and registered to the control points (15 to 20) were taken to geo-reference each set of photographs to the common base. The active channel was taken as the standard definition for river bank location and digitization of the active channel for different time periods was undertaken within the Arc GIS 9.8 frame work. Finally, all those channels were superimposed to depict the HMZ.

The Avulsion Hazard zone (AHZ) includes the areas of the river landscape, such as secondary channels, relict channels and swales that are at risk of channel occupation outside the HMZ. The Erosion Hazard Area (EHA) delineates the areas outside of the HMZ and AHZ which may be susceptible to bank erosion from (i) stream flow and/or (ii) mass wasting that has been initiated by current fluvial processes and/or be initiated in the future. In most of the reaches, alluvial terrace bank with a vertical slope of unconsolidated material is found to be unstable while the river erodes its. Similarly the geologic hazards posed by mass wasting that are initiated by channel processes are also taken into account. Areas where the river may necessarily have migrated in the historical record are included in the Erosion Setback delineation (ES). It takes into account likelihood of the river may migrate there in the future, especially within the design live of the CMZ i.e. 500years. The extent of the ES is determined by using estimates of the rate of erosion that will occur over the design live of the CMZ.

The main objective of delineating the Disconnected Migration Area (DMA) is to indicate the impact of man-made structure (i.e. earthen levees to provide flood protection, rock revetments to constrain rivers etc.) by delineating the areas in which they prevent channel migration. DMAs provide a spatial context for the degree of human encroachment that has occurred within a CMZ, as well as how much aquatic and riparian habitat has been lost and how much of it could potentially be recovered. In this study DMA is delineated with the help of physical surveying of the area accompanied with existing toposheet and google earth maps. Mapping the earthen levees, roads, rail roads, bridges, embankments are

Table 2: *Hydrological characteristics of the Rapti River*

Sl. No.	Features	Characteristics	Source
1.	River Type	Foot-hill fed	Jain, V. and Sinha, R. (2003)
2.	Total basin area (India)	237455 Km2	
3.	Av. Sediment Load (mt/year)	15.6	Chandra, S. (1993)
4.	Sediment Yield (10^3t/year/km^2)	0.78	
5.	Total length of River (km)	3965	
6.	Bankful Discharge (cumecs)	2500	Kale, V.S. (1998)
7.	Channel width (m)	240	
8.	Channel mean depth (m)	4.7	
9.	w/d ratio	51	
10.	Mean channel slope (cm/km)	19	

taken into account.

Accordingly, delineation of the CMZ is the cumulative product of historical analysis and field interpretations, characterized by the following equation:

CMZ = HMZ + AHZ + EHA – DMA

(EHA = ES + GS)

Study Area

River Rapti is an important tributary of river Ghaghra which is a major tributary of the Ganga. After originating in the Siwalik foothills of the Nepal Himalayas, river Rapti drains the Gangetic alluvial plain, where it attains base level of erosion. Consequently, the deepening of the river channel replaced by channel widening. Precisely after flowing through Nepal for 152 km., it enters Eastern Uttar Pradesh near Kundwa village of Bahraich district (District Gazetteer, Bahraich, 1988). It flows through the districts of Bahraich, Balrampur, Srawasti, Basti and Gorakhpur and joins the Ghaghra on its left bank near Barhaj town of Deoria district. The area of Rapti river basin is 25793 km^2. The Rapti is identified to be foothills fed river. It derives enormous amount of sediment from the foothills of Nepal Siwaliks and also from within the plains and a large proportion is re-deposited in the plains after local reworking (Jain and Sinha, 2003). The river is fed by numerous tributaries and affluents. Those of the northern or left bank originated from Siwalik and *Bhabar* region. Those on the south represent merely old beds of the river. Important left bank tributaries of the Rapti are, Burhi Rapti, Ghonghi, Kain and Rohin. The Bhakla, Ami and Taraina are the noted right bank tributaries (Fig.1).The basin consists geologically two distinct portions; the great Indo-Gangetic trough and the Himalaya's foothill region of the Siwalik. The Indo-Gangetic trough portion consists entirely of the alluvium, a composition of sand, silt and clay in varying proportions. In respect of their geological age, these deposits correspond with two main divisions of the quarternary era; the Pleistocene and the recent. The alluvium is found in two broad groups, i.e. the older alluvium known as *"Bhangar",* the age of which is estimated as middle Pleistocene and the newer alluvium (*Khadar*) which is more recent and undergoing formations by aggradational work of the rivers.

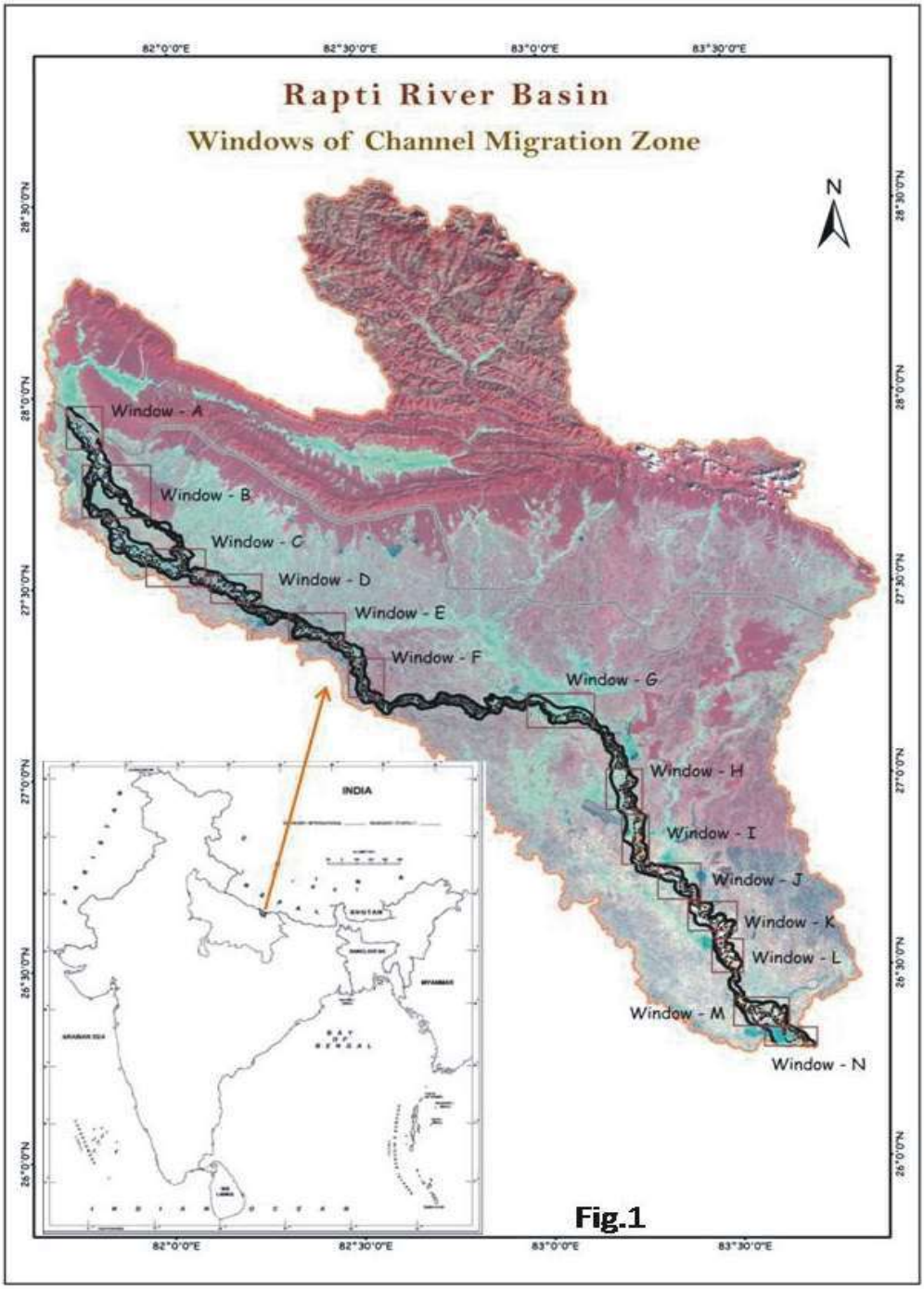


Fig.1 Location of Rapti river basin

Table 3 : *Windows of Channel Migration Zone*

River regime	Representative windows	Characteristics of the flow regime
Upper Course	Window A	River Rapti enters India after flowing through Nepal. Here it leaves the Siwalik range and enters the plains.
	Window E	Flow direction changes downstream of this section. Balrampur is the nearest gauging station.
	Window F	Flow direction north-south.
Middle Course	Window G and Window I	Confluence point of Rapti and Budhi Rapti. Bansi is the upstream gauging station and Regauli is the downstream gauging station.
Lower Course	Window J	Confluence point of Rapti and Rohin. Bardghat is the nearest gauging station.
	Window M	Broad floodplains, downstream of the confluence with river Ami. Marked with paleo channels and ox-bow lakes
	Window N	Confluence point with river Ghaghra.

Some hydrological characteristics of river Rapti are given in the table-2.

Window-wise study of Channel Migration Zone

Channel Migration zone for the entire course of the river Rapti is delimited with the help of techniques and data sources as mentioned earlier. The CMZ of Rapti shows spatial variation in terms of patterns of channel changes, rate of channel changes and total area occupied by the channel in its historical record. For the sake of better understanding and proper interpretation, the entire CMZ of the river regime has been divided into 14 windows (Fig.1). In the present study only 8 windows from representative cross section of the river regime are selected for interpretations and detail analysis.

These windows have been selected for detailed study following the location of important gauging stations of CWC, spatial characteristics channel behaviour in the zoning model and repeated field observations. A detailed description of these windows and our understanding of the causative factors are presented here.

The Upper Regime

The upper regime of the basin is confined in between India and Nepal border (entry point of Rapti in India near Kakardhari G/D site) up to Halaur near Quadrabad. Average elevation of this part is 90 m with a minimum of 62 m and maximum of 132m. Other basin characteristics are given in table no. 4. Immediately after leaving its upper catchment area near Siwalik, the river Rapti enters into the plains and exhibits typical alluvial and floodplains features. The channel is marked by extensive meandering, active and inactive chute bars and flood chute channels. The total

Table 4 : *Basin characteristics of Upper Rapti river regime*

Upper Regime	River length-200 km.	Elevation: Maximum- 132m. , Minimum- 95m					
From	Lat. 27°55'	Long. 81°45'			Elevation- 132 m.		
To	Lat. 27°11'	Long. 82°34'			Elevation- 96 m		
Bank width (observation point)		1	2	3	4	5	Average
Convex/Concave Bank (in m)		825	572	805	867	558	725.4
Straight Bank (in m)		317	196	225	140	139	203.4

distance of the river flowing in this regime is about 200 km., having flow direction from north-west to south-east. The longitudinal profile of the river shows that the river has maximum slope of 0.8% and average of 0.1% as it descends from maximum elevation of 132 m to a minimum of 96m. The average width of the river in relatively straight channel is 203 m, where as in case of meandering channel it is 725m. Kakardhari and Bhinga are two gauging stations of this regime.

A representative window of this regime is depicted in fig. no.1, (A), (B) and (C). The Rapti river channel in this section has shown enormous changes increase in length and width of the river indicates development of meandering loops and shifting of rivers channel from north-east to north-west direction. Maximum temporal fluctuation of 5.8 km is reported near the Indo-Nepal border. Thus the HMZ is broader one. It has maximum stretch of 5.8 km to a minimum of 2.2 km. However,

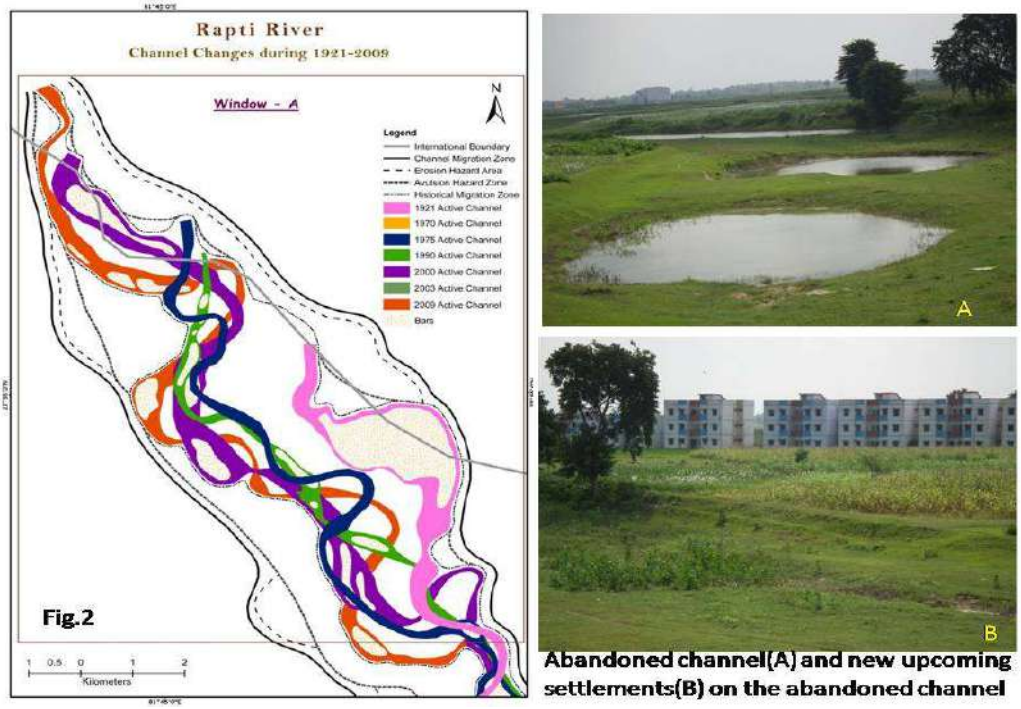


Table 5 : *Basin characteristics of Middle Rapti river regime*

Middle Regime	From Hallaur to confluence with Burhi Rapti					
	River length: 91.2 Km.		Flow Direction: West to East			
From	Lat. 27°12'	Long. 82°34'	Maximum		Elevation- 89 m	
To	Lat. 27°9'	Long. 83°5'	Minimum		Elevation- 84 m	
Bank width (observation point)	1	2	3	4	5	Average
Convex/Concave Bank (in m)	244	213	168	295	311	246.2
Straight Bank (in m)	134	158	181	139	90	140.4

the cross-section shows that the river has a broad zone of Avulsion Hazard Zone (AHZ) along the Indo-Nepal boarder. It is mainly because of major avulsions in the near past and large oscillation movement of the river (Fig.2). Originally the river had a different course (see the course of river in 1921) in this zone, but later on its abandoned its original course and shifted towards west. The main tributary is still carrying water during flood season when the river has high flow. Now the river bed is being gradually encroached upon to make the paleo-channels a series of disconnected pools (Fig.2.A). The delineated CMZ is relatively broad in this regime, having a maximum of 6.2 km. and a minimum of 3 km width. This broad zone is attributed to low gradient, lesser volume of water and presence of inter-fan areas.

Middle Regime

The middle regime of the Rapti river extends from an elevation of 89m near Hallauer (near Quardrabad) upto its confluence point with Burhi Rapti (elevation 84m). Total length of the river in this regime is about 90km, having flow direction from west to east. The river is relatively stable one having maximum width of 158 m. (average 140 m) near straight channel and 311m (average 246 m) near meandering loop. The stability is probably due to the large volume of water that Rapti gets from its principal tributary the Burhi Rapti, and the presence of fault line which confines the river channel.

Windows no. G and I are the representative observation sites of this regime. One of the major constraints of this section of the river is unavailability of past data. The channel movement during 1975-2009 shows that the river meandering loops are restricted to a relatively narrow zone. Six representative cross sections of the river were studied. The observed data on HMZ indicated that the river has a very narrow stretch of about 2 km. of wide valley on an average with a maximum of 4.4km. Similarly the AHZ also follows the same trend (table-4). The CMZ revealed that this regime has a general stretch with width of 3.5km (Fig.3).

Lower Regime

The lower regime of the river Rapti starts from the confluence point with Burhi Rapti and ends at its meeting point with Ghaghra. The total length of the river in this regime is 29 km. The elevation of this region is 74m. The river shows extensive meandering with flow direction from north to south-east. The lower regime is marked with chain of embankments along both sides of the bank width of the river from representative sites are measured along relatively straight (stable) points and

Table 6 : *Basin characteristics of Lower Rapti river regime*

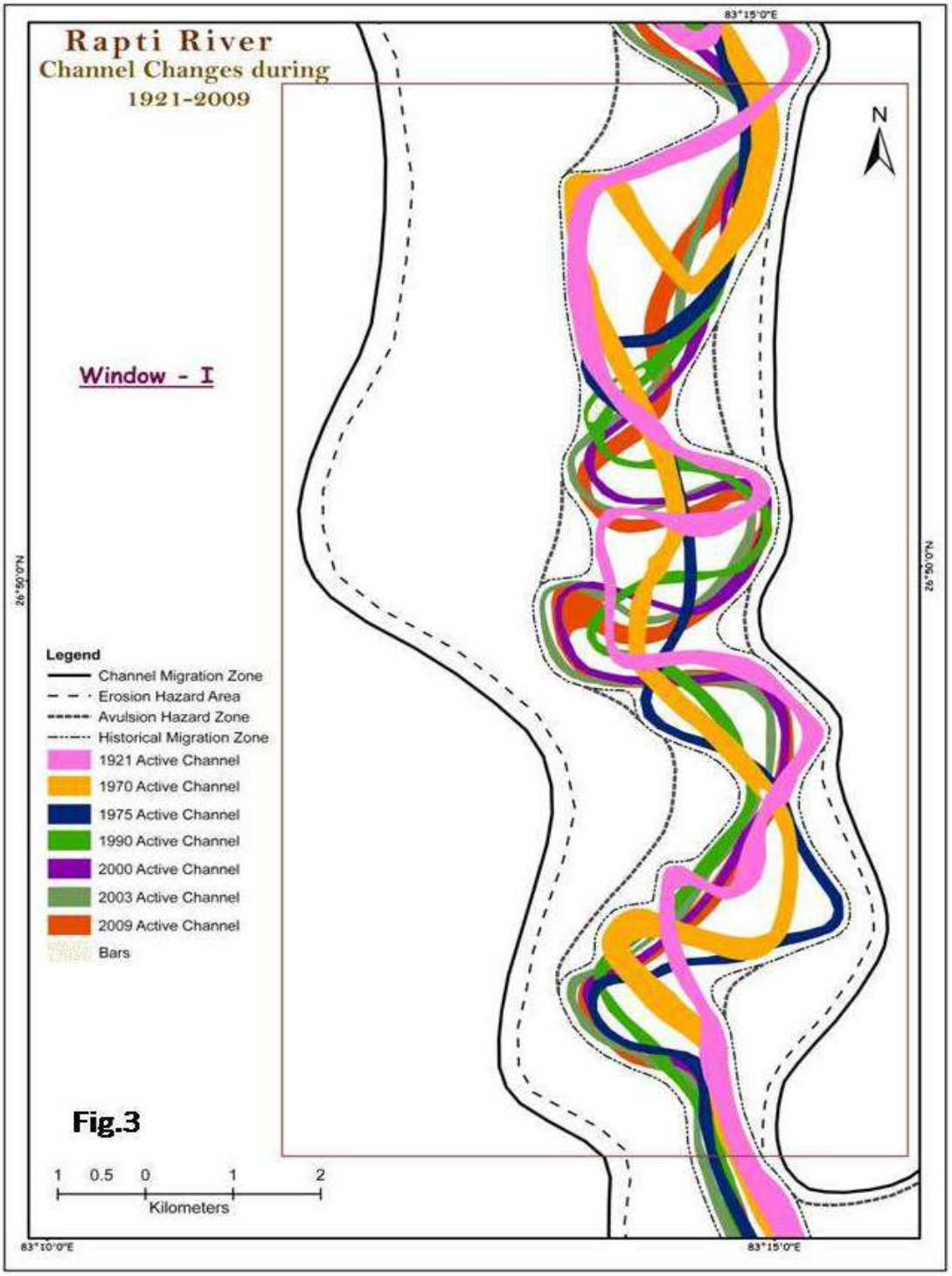
Lower Regime	From confluence with Burhi Rapti to meeting point with Ghaghara						
	River length: 219 Km.		Flow Direction: North to South-east				
From	Lat. 27°11'	Long. 83°5'	Maximum		Elevation- 84 m		
To	Lat. 26° 17'	Long. 83°40'	Minimum		Elevation- 69 m		
Bank width (observation point)	1	2	3	4	5	6	Average
Convex/Concave Bank (in m)	694	673	320	235	295	252	411.50
Straight Bank (in m)	317	196	225	140	139	137	203.71

meandering points. The average bank width along the concave/convese points was measured to be 411m where as in straight bank it was found to be 203m.

The HMZ, AHZ and CMZ of lower regime of the river Rapti is analysed with the help of representative windows. Four representative windows (windows J, M, N and P) are selected and 9 observation points are measured to interpret its characteristics. The observed data from these observation points indicate that the average length of the HMZ is 2.75 km. This lower value is probably due to embankments along the river which makes the river relatively confined one. However presence of numerous oxbow lakes and other abandoned river channels have widened its Avulsion Hazard Zone (AHZ) and Erosion Hazard Area and thereby its Channel Migration Zone (CMZ). The average length of the CMZ is calculated to be approximately 4 km (Fig.4).

Discussion

Active meandering river on alluvial landscape are some of the most dynamic and sensitive parts of the landscape. The present investigation tries to answer some important questions relating to mechanisms of change in dynamic river reaches, the extent to which changes are propagated both upstream and downstream and the time scale and variability of change. These question are important because the answer have implication for understanding river movement, management of rivers along with habitat management, conservation of diversity; and for understanding the evolution of river channels and floodplains. The study observed that most of the bends are active and involved in migrating growth and lobbing. They are marked with extensive bars and riffles. The bends exhibit different spatio-temporal patterns on rate of erosion. The channel changes are erosion driven. However at few places, gradual amplification of channel bends intensified with major flood events is the main reason of channel migration. The delineated CMZ indicated that the river is nearly stable along the middle regime, where as active both upstream and downstream. The CMZ is very broad in the lower regime mostly due to the large volume of water accompanied with heavy sediment load and low gradient. The frequent migration of river initiated with large flood events and erosion, presence of extensive paleo channels, abandoned channels and ox-bow lakes both along the upper and lower regime are responsible for delineation of a broad CMZ. Dynamic nature of the river is evident from the relative changes in river position over time. The river Rapti is gradually oscillating its


Rapti River
Channel Changes during
1921-2009
Window - I
N
Legend
Channel Migration Zone
Erosion Hazard Area
Avulsion Hazard Zone
Historical Migration Zone
1921 Active Channel
1970 Active Channel
1975 Active Channel
1990 Active Channel
2000 Active Channel
2003 Active Channel
2009 Active Channel
Bars
Fig.3
1 0.5 0 1 2
Kilometers
83°10'0"E
83°15'0"E
26°50'0"N
26°45'0"N

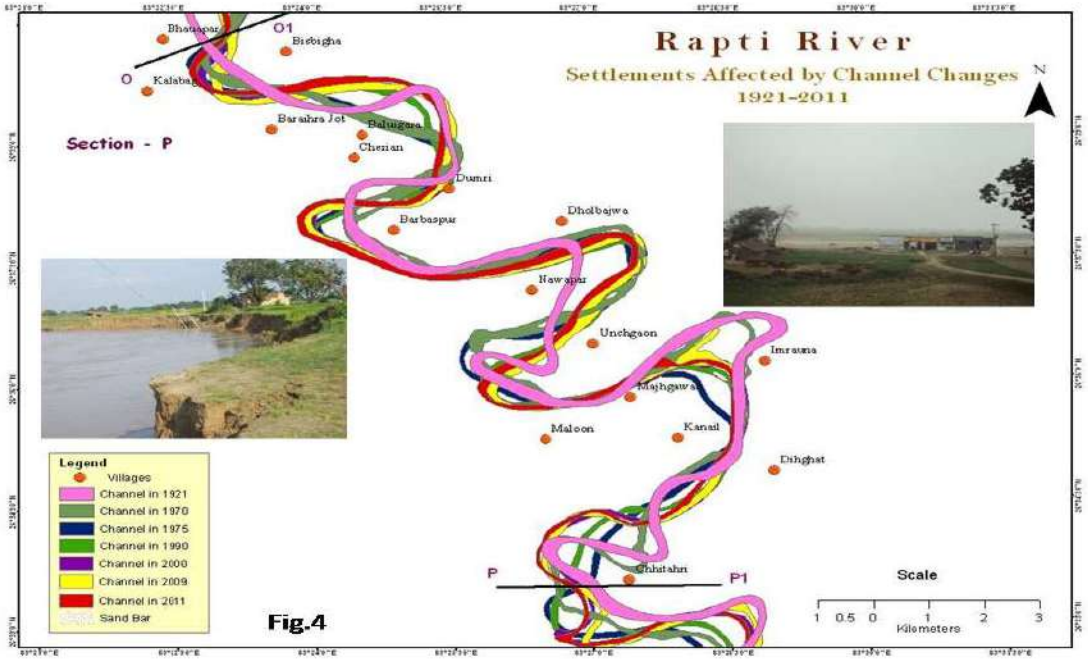


Fig.4

course, generally new and active bends through gradual erosion and deposition. However, there are some locations where the river is behaving in a stable manner. Location of these stable channels needs further proper assessment for river management. The study along the middle regime is constrained by availability of past data. However, it may be presumed and verified from different studies that the river is probably flowing in a west-east trend fault line. Thus the HMZ as well CMZ is observed and delineated to be relatively narrow one. Their study observed that lateral erosion is an independent fluvial hazard that operates during low discharge period. Low degree of compaction due to the presence of sandy and silty facies in the river valley deposits, mass movement, palaeo current pattern, and fracture initiates and enhances the lateral erosion. There is a marked spatial variation in channel movements and lateral erosion.

Conclusion

Channel migration is an important geomorphological process in the floodplains area. The rapid shifting of river has not only complicated the flood problems but also undermined engineering structures and pose constant threat to public utility. In this regard risk minimization through channel migration zoning forms the core of river management programme. The present study on river Rapti analysed historical information and field data to interpret past and present channel conditions in order to predict future channel behaviour and areas at risk of channel movements. River Rapti is a foothill-fed river originating from the Siwalik hill areas of the Nepal and draining the interfan areas between the Gandak and the Ghaghra. The river is known for its rapid channel migration. Several studies based on conventional and historical data confirmed its unpredictable channel behavior. The present study delineated boundary of the channel migration zone (CMZ) with the help of

geospatial data ranging a period of over 70 years and limited field survey. The river Rapti being a foothill-fed river exhibits spatial variations in channel migration throughout its courses. Several broad patches of CMZ are observed on its upper and middle course where as in middle course it becomes narrower towards south with minor exceptions. The study found that for better public utility management i.e. various engineering structures, roads, schools etc. prefeasibility study or site suitability study along these channel migration zones is a must.

Acknowledgements

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Ravines Erosion Problem in Dhaulpur District, Rajasthan, India

Rani Singh

In India vast tracks of lands (20.17% of total geographical area) exists as wastelands. In Thar Desert region of Rajasthan, land degradation is occurring at an increasing rate. The region contains more than 2lacs sq. kms of arid land has a fast growing human population and increasing livestock number, all of which accelerate damage to fragile arid landscape. Soil and gully erosion have caused major environmental disasters worldwide. Many urban and rural communities have been severely affected, while the sustainability of the total landscape has been threatened. The present study juxtaposes the view of land degradation with the increase in wasteland especially focused on gullies/ravenous land, in eastern most part of Rajasthan where whole economy is dependent on agriculture. Here, land degradation is a dominant problem. Over 40% area is affected by various categories of wasteland. Gully and ravine erosion is severe problem along the river Chambal (only perennial river in state), which has a calamitous effect on the agro-economical activities of the area. In addition to this, salinity and degradation of forest are other problems causing degradation of land. Government officials and committees should be constituted at village level to undertake wasteland developmental planning with the involvement of village, block and district level officials and are also required to assist the farmers. Yes, efforts are needed for bringing out sustainable management planning that provides the clear insight into the real need of our people.

Keywords : Landscape, Gully, Degradation, sustainability, Wastelands, agro-economic

Introduction

Land degradation will remain an important global issue for the 21st century because of its adverse impact on agronomic productivity, the environment and its effect on food security and the quality of life, which ultimately has resulted in wastelands (Chatturvedi, 1986). Land on India suffers from varying degrees and types of degradation, stemming mainly from unstable use and inappropriate management practice. It manifest chiefly in the form of water erosion followed by wind erosion, bio-physical and chemical deterioration. Gully erosion due to river channel trenching is problem that threatens vast tracts of the world's agricultural land. About 65 per cent of the global population, comprising of farmers derives its living directly from the soil. There are no natural resources more important than soil resources.

The Chambal regions of Rajasthan are widely known for ravines and are glaring

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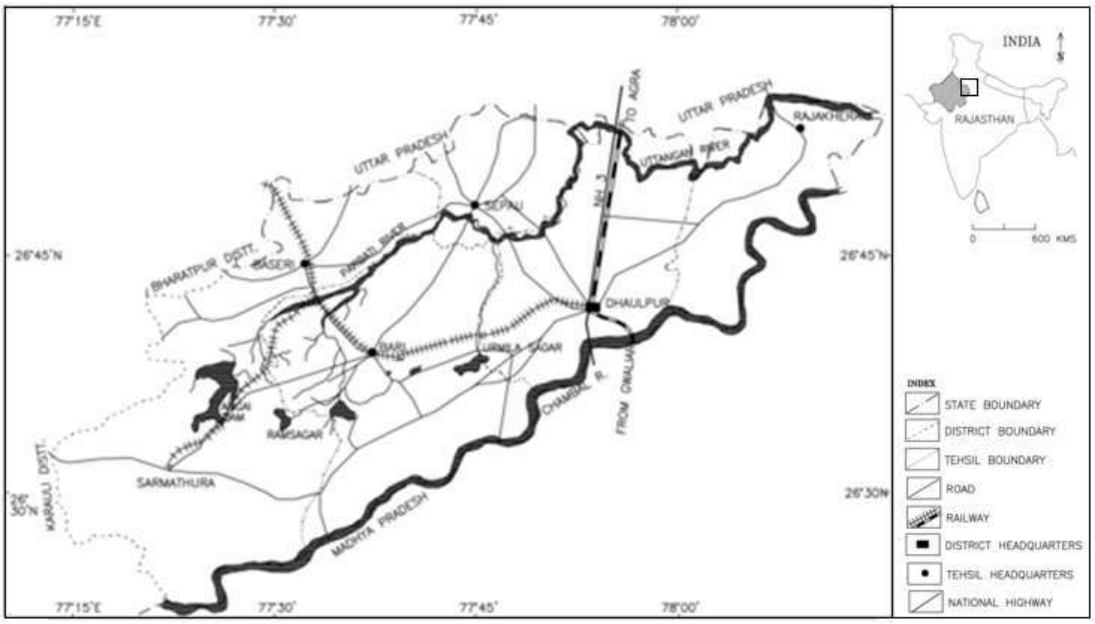

Figure 1 : Study area

examples for soil degradation due to water erosion (Shafi, 1986) .However, only scattered information are available on the ravenous and adjoining table lands. Under these landscapes, soil undergoes various changes due to accelerated erosion processes. Land use induced erosion affects soil physical and chemical properties especially soil aggregates, SOC and nutrient availability (Foster et al., 2003; Han et al., 2010).

Further, Agricultural growth of an area is basically depends upon its soil and climatic conditions. The type of soil is the most important factor that supports agricultural growth and hence it must be investigated from various angles in order to get the better yield. The type of soil formed depends upon the parent material. The information and knowledge of soils of the state which could be gained through the study of their physical and chemical properties and their geographical distribution pattern, is an essential prerequisite for their proper utilization, management and conservation. It also helps in proper selection of crops and better land use.

The study area is situated in the district of Bhind and Morena of Madhya Pradesh (Figure1) and falls between 260 342 - 260 472 latitude and 780 302 – 780 452 longitude. The climate of study area may be characterized by a hot summer and general dryness except the monsoon season. The normal maximum temperature received during the month of May is 42.100 C and minimum during the month of January is 7.10C. Nearly one third of the Madhya Pradesh state area is covered with tropical forests ranging between the rivers Chambal in the north and Godavari in the south. To the east of Chambal, the area has rocky surface and thick forest (Bhalla, 2001).The main river systems are the Chambal, Betwa, Sindh, Narmada, Tapti, Mahanadi and Indrâvati

that drain the state. In the study area Chambal is the main river and Kunwari is its tributary.

Study area

Database and Methodology

The study in based on the primary and the secondary sources of data. Vast amount of data collected at various levels for the spatio-temporal pattern, trends and variations of wastelands of the district has been tabulated, analysed and transfer med with the help by descriptive statistic techniques like arithmetic mean etc. Field survey carried out for the sample villages and computed. Chemical data collected from groundwater department. Five sample villages have been selected from each tehsil by using stratified sampling method.

Comparison of wasteland pattern in India, Rajasthan and Dhaulpur district

The most serious problem facing the country is increase in wastelands and deterioration in the quality of arable land and natural systems. In India nearly $1/6^{th}$ of the gross crop area is under wastelands. Like India, the state of Rajasthan has more than $1/3^{rd}$ of its total area under variety of wastelands. In India about 22.27% of its total area is wasteland whereas in Rajasthan it is about 31.70% caused due to improper or non-optimum land use. The wasteland of the study area is 43.50%. Most of the area is occupied by Chambal ravines. Ravines comprises of intricate rework of gullies along the rivers in the alluvial. In, the present study, the classification of wastelands has been done on the wasteland classification proposed by the NRSA, 2003. The district occupies highest percentage of gullied/ ravenous land, degraded forest in comparison to the country and state. Maximum concentration of wasteland is found in the south and south-eastern part of the study area. Approximately, half of wasteland of the district is concentrated in only three tehsils viz. Baseri, Bari and Rajakhera (Figure 2).

Gullied / Ravenous land

There are many types of soil erosion but the earth scientists are largely concern with the relatively geological erosion and accelerated erosion (Singh, 1987). The gullied \ ravenous land swallows the fertile land and has been reducing the agriculture land. Geological erosion is the rate at which the land would normally be eroded without disturbance though human activity (Mathur, 1976). Accelerated erosion is the increased rate of the erosion that often arises when man alters the ecosystem by various land use practices. Ravine erosion is really the problem of accelerated erosion (Khan, 1950). On the contrary; ravine begins along the river sides and encroaches upon the catchments area by headward growth. Hence, ravine is said to be a form produced by river action and gully as the function of catchments area.

Gully erosion is considered as the severest form of erosion. A narrow deep gash formed as a result of localized and concentrated run off by running water is called gully. Very deep (>9m) and wide gullies with steep sides are known a 'ravines' (Yadav, 1986).All gullies and ravines contribute considerably to soil erosion. Run- off is maximum; slopes are steep and gullies are of varying depth, few meters to 100 meters or more. The ravines are classified as shallow, medium and deep based on the gully depth, bed width and area. Ravines have a very adverse effect on the agro-economical. Such types of problems are mainly confined along the river Chambal.

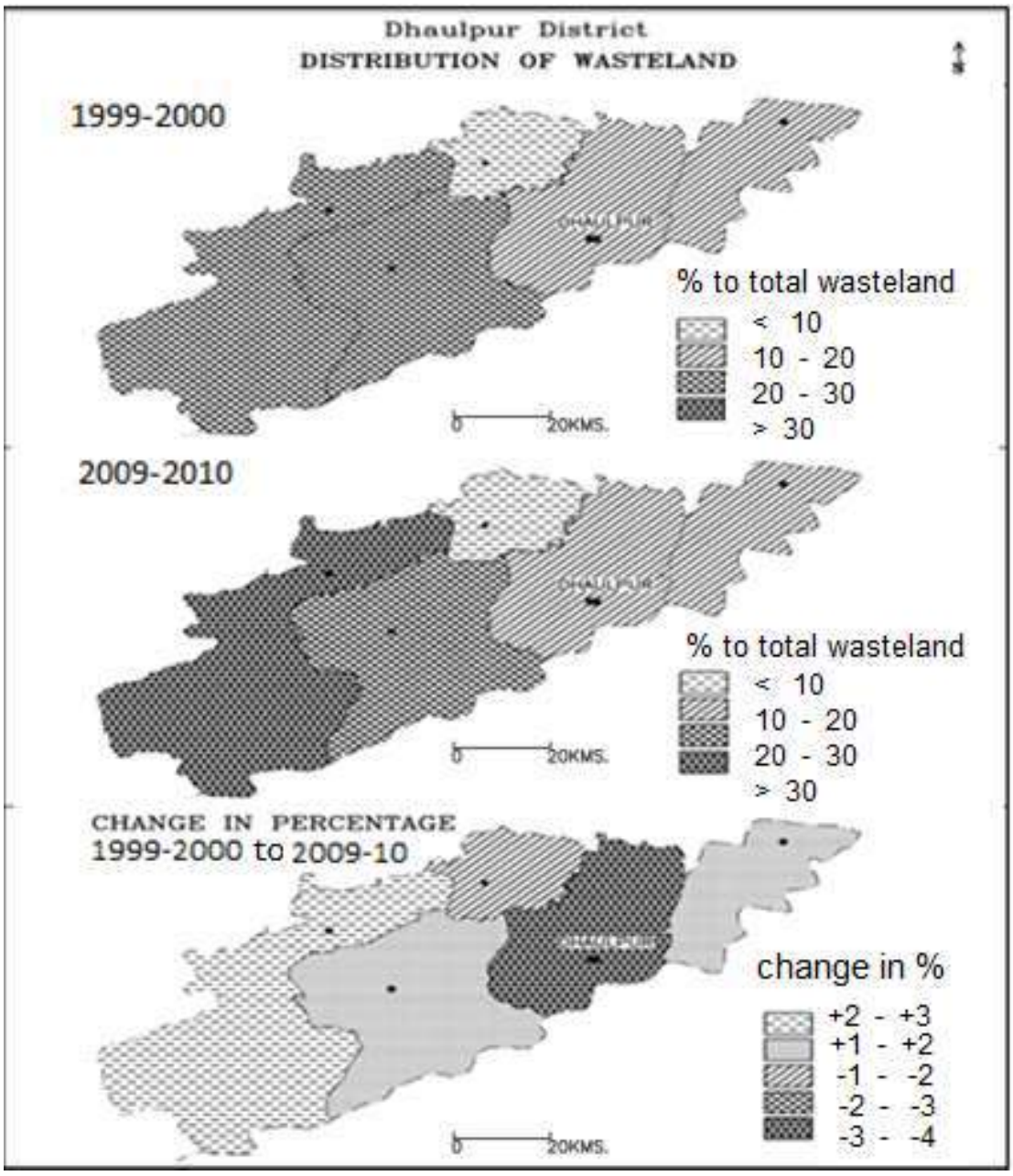

Figure2.

Classification of Gullied/Ravenous land

For gullied/ravenous land control reclamation, classification of ravines is necessary. Tajwani and Ahuja (1956) have classified ravine lands into four classes on the basis of their form head characteristics, length

Table 1. *Classification of Ravines and Gullies*

Particulars of the ravines	Description of symbol of the gully / ravine (mt.) G-1	G-2	G-3	G-4
Depth in meters bed which meter side slope in percent	Upto 1 Upto 18 varies	1-3 Not less than 18 varies	3-9 18 Uniformly slopping bet. 6-12	More than 9 varies slopping more than 12 steep

and width as below.

In the study area, gullies land is dominant in Baseri tehsil, mostly along the Chambal river. The northern bank of river Chambal shows an intrically connected ravenous zone which can be seen extending for a maximum distance of 9 km from the river bed by small streamlets. It forms a George near Damoth showing a fall of 100 m. The main tributary of Chambal flowing in the district is the Parbati river, which flows parallel to Chambal and joins river Gambhir at the district boundary also form ravenous land. The strong evidence of such land features can be seen in 1: 50000 topographical sheets of study area. It is observed during the field study that the depth of gully / ravine depends on the soil and depth of river channel. It can be said there is a positive relationship between thickness of soil depth or ravines and channel.

Inspite of peneplained area of south eastern part of the study area, tehsils of the part have gullied / ravenous land along the Chambal and its tributaries. It is observed during the field survey that more water erosion is in the areas of southern and eastern part of the study area (Ministry of Environment and Forests ,1987).The development of ravines also take place though shallow holes. Sharma (1976) has intensively studied this area and has distinguished four stages of ravine growth viz.

Table 2. *Distribution of wasteland categories in 1999-2000 to 2009-10*

Tehsils	1999-2000 (% to total area under the category)						2009-10 (% to total area under the category)					
	gullied/ ravenous land	degraded pasture/ grazing land	degraded forest	land with or without scrub	fallow land	barren/ rocky land	gullied/ ravenous land	degraded pasture/ grazing land	degraded forest	land with or without scrub	fallow land	barren/ rocky land
Baseri	39.21	11.89	24.12	25.05	29.52	43.28	41.12	17.88	26.82	24.61	29.89	40.06
Bari	28.80	24.58	15.21	37.57	35.68	32.23	32.65	32.12	15.40	38.66	30.91	33.90
Sepau	8.21	10.98	13.67	6.96	5.47	2.11	4.20	12.70	11.58	5.35	6.76	3.24
Dhaulpur	16.92	33.65	19.60	21.37	18.51	9.98	10.95	24.93	19.76	17.90	13.14	11.02
Rajakhera	12.87	21.76	30.35	11.01	14.60	13.01	16.27	13.34	30.01	15.02	19.37	13.48
Total	37.65	9.01	26.76	17.98	11.65	10.89	40.73	10.47	20.45	14.87	8.60	10.43

Table 3. *Showing percentage change from 1999-2000 to 2009-10*

Tehsils	% change (1999-2000 to 2009-10)					
	gullied / ravenous land	degraded pasture/ grazing land	degraded forest	land with or without scrub	fallow land	barren/ rocky land
Baseri	+ 2.01	+ 6.87	+ 0.80	- 1.56	+ 1.99	- 3.67
Bari	+ 2.67	+ 7.54	+ 0.19	+ 0.49	- 4.75	+ 1.69
Sepau	- 3.05	+ 1.83	- 2.18	- 0.62	+ 1.62	+ 0.18
Dhaulpur	- 4.97	- 7.13	+ 0.78	- 3.47	- 5.34	+ 0.56
Rajakhera	+ 4.40	- 8.24	+ 0.35	+ 4.01	+ 4.79	+ 0.58
Total	+ 9.08	+ 0.06	- 4.98	- 2.76	- 2.33	+ 1.97

shallow hole stage, tunneling stage, collapsing stage and recession stage. In this area gullies / ravines of G1, G2 and G3 categories having linear, bulbous, and compound and trellies shape are found. Most of the gullied/ ravines have semi- circular head characteristics. On the basis of the NRSA classification scheme, six type of wasteland categories have been found. Study area has occupies the maximum land under gullied /ravenous land which is 40.73% out of six categories (Table 1).

Figure 3A, shows that south-eastern, eastern part and north-eastern part of the study areas has maximum area under this category. Among all the categories of wasteland in different tehsils, gullied /ravenous land being the maximum percentage. More than 50% wasteland of the district is concentrated in three tehsils, viz. Baseri, Bari and Rajakhera. Highly concentrated zones lie in the north-eastern part

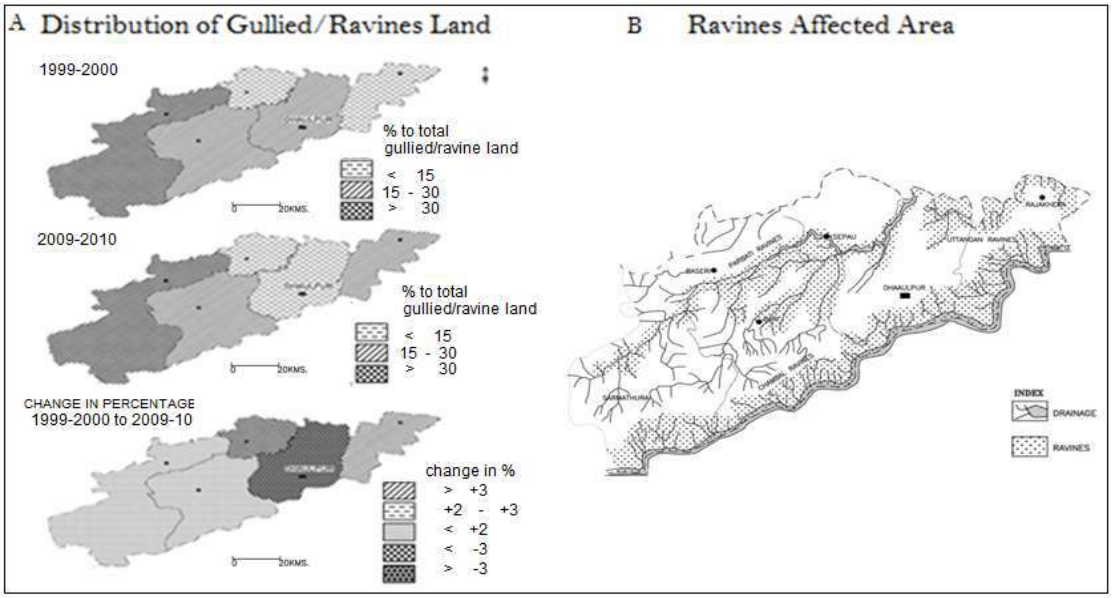

Figure 3

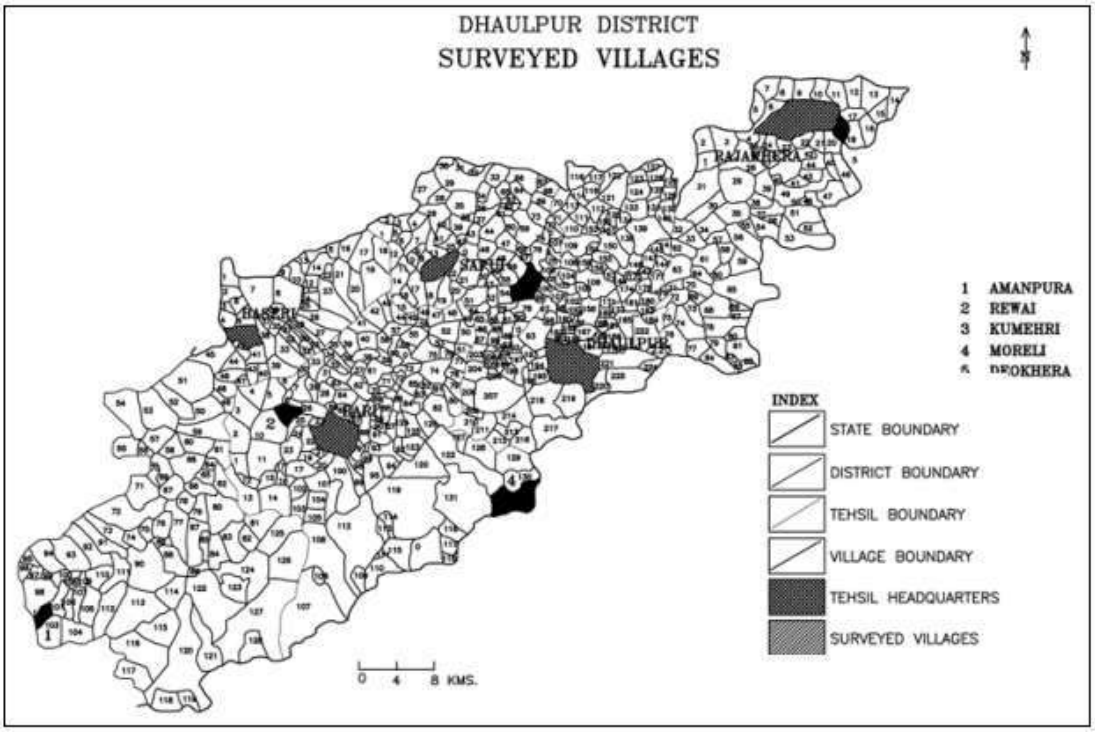

Figure 4

and south-eastern part of the study area, specifically along the Chambal river (Figure 3B). Because of the increase in ravenous land, the agricultural land has been continuously getting converted into badland.

Analysis of Sample Villages

Five sample villages have been selected for the study namely – Amanpura, Rewai, Kumheri, Moroli, Deokhera (Figure 4). The villages along the river Chambal are highly dissected by ravines, which creates social problem too. The ravines are eating into the social life of the villages. For villagers, it's now a problem to get their children married. Amanpura village, Ratanbasai village has split into four new segments. The streets and roads have been destroyed and it takes a tough walk across three kilometers to cover all segments of the old village.

Distribution of various wasteland types at villages level is structured on the basis of maps and information collected during the field work personal interaction with the villages' development officer. It has been found on the basis of studies that gully/ravenous land has been increased in almost all the sample villages. Relatively high proportion of total wasteland has been found in the villages that are in southern part. Very high proportion of gully erosion has been found in Moroli, Deokhera and Rewai villages due to Chambal ravines, which extends from north-east in a regular belt.

Salinity

The groundwater is mostly characterized

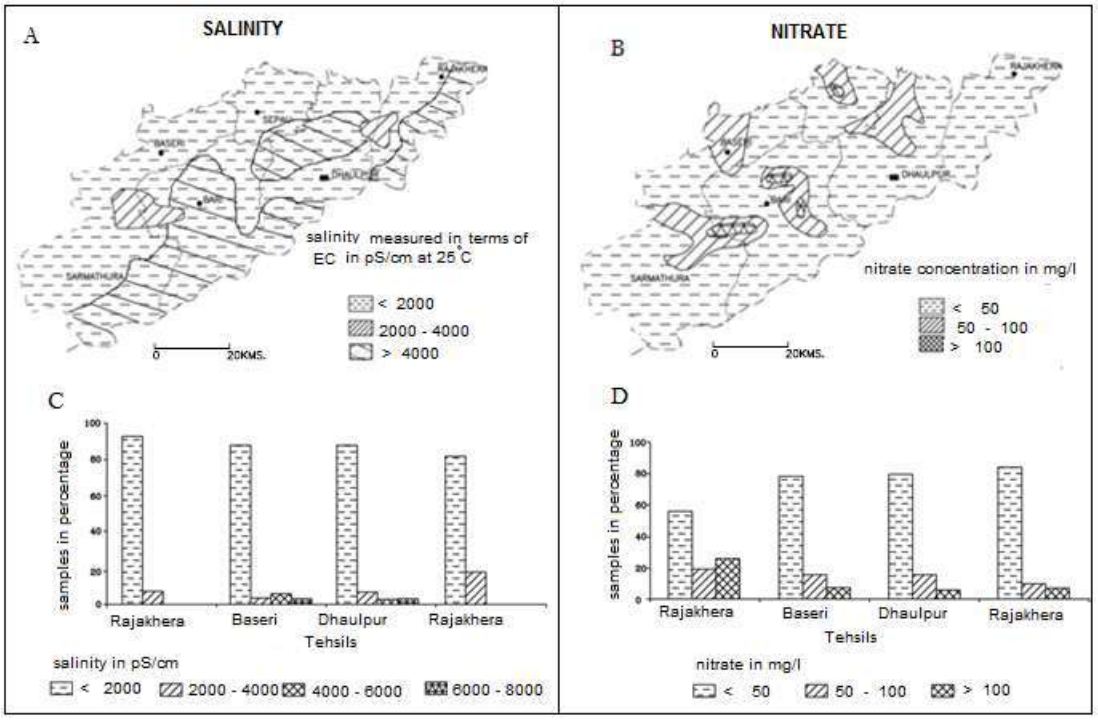

Figure 5

by fresh to slightly saline type as viewed from the maps of salinity. (Figure 5 A). Fresh to slightly saline water having electrical conductivity values below 200 µs/cm is found in entire district except a few patches in Bari, Baseri, Dhaulpur and Rajakhera tehsils. Medium Salinity water of the range 2000 – 4000 µs/cm is found in western and central part of Baseri tehsil. Water samples with EC rank between 4000 – 6000 µs/cm are found in Baseri and Dhaulpur tehsils of the district. 76.4% groundwater of the district is characterized by bicarbonate type of water in which 52% is characterized as calcium – magnesium type of water whereas 24.4% is Sodium bicarbonate in nature having electrical conductivity (EC) values generally less than 1000 µs/m at 25°C. The mixed type of water constitutes 12.6% of the ground water in the district in which 8.6% is of sodium dominating and 4% is having higher values of calcium and magnesium. Normally, these samples are having EC values between 1000 – 3000 µs/cm and even more. Thus, these samples are more mineralized than fresh bicarbonate type of water. Only 11% samples fall in chloride type of water in which 6.3% samples are having calcium – magnesium and rest having sodium as predominating cation.

The bar diagram of EC of ground Shows that water of 0 – 2000 µs/cm change is available in 93% samples of Bari tehsil, 88% in Baseri tehsil, 88% in Dhaulpur tehsil and 52% Rajakhera tehsil.(Figure 5 C) Similarily, the meet range of medium salinity of water i.e. 2000 – 4000 is represented by 7% in Bari tehsil, 3% in Baseri, 6% in Dhaulpur and 18% in Rajakhera tehsil. The groundwater of high to very high salinity i.e. 4000 µs/cm and above is

occurring in very few places and represented 9% and 6% respectively in Baseri and Dhaulpur tehsil of the district. The bar diagram (Fig. 5 D) shows different ranges of nitrate concentration in ground water 56%, 78%, 79% and 83% groundwater in the tehsil Bari, Baseri, Dhaulpur and Rajakhera respectively, represents good quality of water having nitrate concentration upto 50 mg/l shows other ranges of nitrate i.e. 50-100mg/l Similarly, the bar diagram also 15% and 10% respectively in above tehsils. The higher nitrate values above 100 mg/L are mostly found in Bari tehsil (25%) followed by Baseri and Rahakhera tehsils (7% each) and Dhaulpur tehsils (6%). The maximum value of nitrate is observed in Dhaulpur tehsil.

The nitrate distribution depicts that higher concentration of nitrate (>100 mg/L) is observed in central part of Bari and Baseri tehsils. However, the high nitrate Groundwater occurs only in scattered patches (Fig 5 B).The total hardness (TH) in water gives an idea for its use in domestic and industrial purposes. The groundwater is categorized into soft and hard water on the basis of total hardness value (Ahmed,2012).The district is mostly characterized by soft and moderately hard water having hardness values ranging between 0 -300 and 300 – 600 mg/L. 34.7 % groundwater are having values between 0 -300 and 54 % groundwater are having hardness between 300 – 600 mg /L. Only 11 % of groundwater has hardness above 600 mg/L. The maximum hardness in groundwater is observed in Dhaulpur tehsil while the minimum value is observed in Rajakhera tehsil. The map showing isoconductivity lines reveals that ground water in almost all parts of the district is available for irrigation as its values are less than 2000 us/ cm. waters of the village with higher EC of the range 4000 and above may be considered unsuitable for irrigation on the heavy textured soils of the district. The drinking water in the area is assessed on the permissible values of salinity below 400 µs/cm, nitrate below 100 mg/l fluoride below 1.5mg/L. An integrated map based upon the said values shows some patches of unsuitable water quality which are mostly due to high concentration of fluoride at these places.

The concentration of soluble salts in the water is the single most criterions are assessing the suitability of the water for irrigation purpose. The salinity problem related to water quality occurs if the total concentration of salts is high enough for salts to accumulate in the crop root zone to the extent that yields are affected (Taddese, 2003). If excessive quantities of the soluble salts accumulate in the root zone, the crop has difficulty in extracting enough water from the upper part of the root zone and respond more critically to the salinity in this part than to the salinity level in its lower depths. Ideally, it could be inferred that electrical conductivity of irrigation water should be as low as possible but the water which is completely free from the soluble salts is never the best for irrigation (Lal, 1996).The waters having electrical conductivity less than 200 micro mhos/ cm at 25^{o}C have not fertility value and are well known to create permeability problem in the soil. The irrigation water should, however, have electrical conductivity preferably less than 1500 micro mhos /cm so that the irrigation soil does not ever become saline and there is a complete choice to grow the crops (Materechera, 2010). The environmental hazard of salinity does not affect only the agricultural land and their crop productivity but also adversely affect growth

Table 4. *Groups of irrigation water based on Electrical Conductivity*

TDS mg/l	EC m/cm	Class	Characteristics
< 200	<250	C 1	Low salinity water (C 1) can be used for irrigation of most crops on most soils, with little likelihood that soil salinity will develop. Some leaching is required, but this occurs under normal irrigation practices extent in soils of extremely low permeability.
200-500	250-750	C 2	Medium salinity water (C 2) can be used if moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases, without special practices for salinity control.
500 - 1500	750 - 2250	C 3	High salinity water (C3) can not be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.
1500-3000	2250-5000	C 4	Very high salinity water (C 4) is not suitable for irrigation under ordinary conditions. The soils must be permeable, drainage adequate, irrigation water applied in excess to provide considerable leaching and very salt tolerant crops should be selected.

Source: Central Ground Water Board, 2009-10

of tress and other plant life (Table 4). Salinity resistant wild flora can be grown in flooded area .Some weeds and wild grasses like 'Era are grown in salt affected area.

The water-logging impedes normal circulation of air in the root zone , inhibiting of soil bacteria's oxygen is not drawn in soil and carbon dioxide liberated by plant roots, cannot be dissolved and carried away. Concentration of carbon dioxide reduces decomposition of organic matter where nitrogen remain locked up lacking nitrogen fixation and there nitrogen deficiency (Planning Commission, 1963)

Responses

The adverse impacts caused by the pressures on environment and natural resources of forest and biodiversity in the study area have drawn different state, the Government, and groups and communities affected directly by such impacts(Ministry of Food and Agriculture,1961). In has been felt by the society of environmental conservation in the world that natural vegetation should be protected and conserved at any cost to save the future of the next generation. It has been resolved and derided after several meeting at global level that each and every country or a geographical region should have at least 33% or more then that of total area under forest cover or "One-third land use of any country or region should be under the title of forest land use". In the study area however degradation has been decreased by approx 2% in the last 10 years which is quite low. But on the other hand gullied /ravenous land is increasing at an alarming rate. I

Many efforts have been carried out by country, state, region or district to enhance the land under green coverage. Afforestation and plantation programmers have been implemented. There are many programmes

implemented for the regeneration of forest in the region. The important are watershed scheme at Panchayat level, combating desertification programme, joint forest management etc. Social forestry programme was taken up by the government, in which Vilayati Babool was mainly planted. According to the forest Department, a forestation and plantation programmes are undergoing in the study area. There are many species planted under plantation programmes. The main species in hilly areas are Khumta, Ronj, Desi Babul, Ber etc., while acacia, Israeli babul, ber and desi babul are planted in plain areas. The ecological imbalance in the study area thereby can be arrested only by implementing a useful plan for the effective use of this extended barren land in according to its characteristics and size in definite period of time. In fact a through transformation of this gullied and salinity affected land through agricultural activities, tree plantation establishment of residential colonies and development of qualitative pastures etc will actually mark the ideal utilization of its wasteland for fulfillment of all the needs.

The gullied /ravenous land Committee as set up by the Agriculture and Food Ministries of Government of India has included unproductive barren land, productive barren land, pastoral land and old wasteland within the definition of barren land. Gully Land Development Programs has been launched in Rajasthan with an eye on ecological balance, improvement in the environments and the availability of forest products (Ministry of Environment and Forests, 1987). A National barren land development schemes for the speedy utilization of gullied land. Uncultivable lands under Governmental control, Panchayat Raj institution, unproductive wasteland which are likely to give more return by tree plantation have been selected under ravenous land development programme. In the study area, the area under gullied /ravenous land has increased 9.08 % in 10 years resulting; the increase of wastelands. The responsibility of implementing the gully land development programme is that of the department of Rural Development and Panchayati Raj which work in coordination with other related departments like forests revenue, planning, agriculture and irrigation development etc. The financial aid for the programme comes from many sources. In this context, it may be noted that the banks and other financial institution of the state play a major role in the mobilization of financial resources for the purpose of the development of the barren lands 25% of the available fund for the National Rural Employment Programme is spent on social forestry. Integrated Rural Development Programme, Social Forestry etc are some of the programmes which are covered under the scheme of development of barren land in the state.

Conclusions

Wasteland can result from inherent\imposed disabilities or both such as location environment, chemical and biological properties of the soil are financial or management constraints (NRSA, 1991). Soil is the basic resources for all agricultural activities. However, overtime as biotic presence is built up beyond the carrying capacity of this resource, there is misuse of cropland. The most important causes of wastelands are ravines/ gully erosion, salinity/alkanity, degradation of forest, besides over exploitation of land by the growing population. Human and animal

population, physical infrastructure, agricultural lands and socio economic system of the land/ areas are adversely exposed to multifaceted hazards. In many developing countries, many villages and communities have been displaced and virtually disappeared as a result of the encroachment of gully erosion. Sheet erosion, which consist of the washing away of the fertile top layer of the soil, is the most extensive form of erosion, occurring even on moderately sloping lands. It causes enormous losses to agriculture every year by reducing the productive capacity of lands. Gully erosion, which generally starts after sheet erosion has remained unchecked for some time, has already rendered large areas useless, and is steadily increasing. Ravines are a result of formation of gullies within unconsolidated, relatively loosely bound material such as soft sediments.

It has been found on the basis of analysis that more than 60% area is confined along the river Chambal mainly Baseri and Bari. Extent of wasteland in India has been analysed and wasteland category of India, Rajasthan and Dhaulpur has been compared. On comparing India, Rajasthan and Dhaulpur it is found that the study area occupies highest percentage of wastelands. The district occupies higher percentage of gullied / ravenous land and degraded forest in comparison to country and state. Wasteland pattern and trend in the study area shows that total wasteland in Dhaulpur district is 45.28%. Most of the area of the study area is occupied by wasteland of Chambal ravines. During the ten years interval wasteland in the study area has been increased especially, gullied /ravenous land .i.e 9.08% along the river Chambal, which gives shelter to the dacoits, resulting increase in the crimes. Further, tehsilwise wasteland pattern and trends shows that maximum concentration of gullied/ ravenous land is found in the north-eastern part of the district. Approximately one-half gullied / ravenous land to the total wastelands of the study area is concentrated in the tehsils viz. Baseri (41.12%) and Bari (32.65%). The area along river Chambal is highly affected by gully/ ravenous land followed by rivers parbati and uttangan.

Further, concentration of salts in the soil was found in almost every tehsils, being maximum along the river Chambal. Salinity areas are small in the western part, but as we proceed towards eastwards, the salinity problem becomes more acute. Salinity has decreased the soil fertility which has accelerated the rate of erosion, converting productive lands into degraded land. Suggestions have been put forward for the improvement and proper management of ravine lands. For locating wastelands and identifying the factors responsible for their growth, pilot projects should be taken up in areas where these lands are widely distributed. Depending upon the nature and capability of a particular patch of ravine land, specific reclamation strategies and plans should be worked out, keeping in view the use to which the reclaimed land is to be put, viz. agroforestry, forestry or agriculture. Due attention should be paid to such aspects as augmentation of irrigation facilities, timely and adequate supply of various needed inputs, particularly in the case of poor and landless farmers. Silvipasture may be defined as the combination of a top feed tree species and grasses or legumes as understory. The grass and tree species, which are native to the area, should be planted. Leguminous species many are planted along with grasses, which will contribute to soil nutrition though nitrogen

fixation. Control over further growth of gullies can be brought about by closure to grazing and other biotic interference as a first step and then by planting grass which should normally exist in the prevailing soil- climatic- environment. As natural vegetation improves it will help in progressive reduction of the loss of soil and water. The recommended species are Dichanthium annulatum, Cencurus ciliaris and Apulda Mutica. Contour and peripheral bunding for retaining as much precipitation possible. These bunds are stabilized by sodding with the grasses. Further, the transport network, education facilities should be well developed in the ravenous area and all villages should be connected through metalled roads to towns so that the isolation problem of the people particularly residing in ravine area could be minimized. And also, their socio-economic status should be improved so that the crime could be minimized. Social awareness programmes by the NGO and government, to improve the social structure of the society should be overtaken .wasteland can be minimized by contouring, afforestation, anicut building, leveling, construction of dams and proper management. To solve the irrigation and drinking problem, water of river Chambal should be lifted by construction of lift cannals.

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Book Review

Migration in India: Links to Urbanization, Regional Disparities and Development Policies, authored by **Shekhar Mukherji;** published by Rawat Publications, Jaipur: 2013; Hard Bound; pp. 512, Tables: 216, Figures 127; Price Rs. 1295/-; ISBN 978-316-0557-8.

Rural-urban migration in developing countries is a human response to geography of uneven distribution. Though migrants are economic gift to the cities but majority of them remain in poverty and deprivation, and lead a poor quality of life. The book entitled *Migration in India: Links to Urbanization, Regional Disparities and Development Policies* authored by Prof. Shekhar Mukherji attempts to establish relationship between migration, urbanisation and regional disparity in India based on voluminous data of two censuses at national, state, district, class I, million cities and mega city levels. It highlights the issues of more than 300 million migrants in India. Author has vividly explained the underlying socio-economic-political factors responsible behind the phenomenon of scale, pattern and process of migration in one hand and acute urban decay in India on the other hand. The book is divided into three parts. Part I deals with situations prevailing as per census 1991 whereas the part II is based on the census 2001. The part III highlights some relevant issues and challenges of migration and urbanization which is followed by suggestive development strategies by the author.

Chapter 1 based on 1991 census data, explains various aspects of migration. It highlights broader pattern of migration across all the streams exploring the possible reasons of migration with the occupational and educational characteristics of migrants in India in general and 51 selected Class I cities in particular. The chapter 2 interlinks the three phenomena i.e. distress migration, involutionary urbanisation and polarised capital accumulation citing the evolving features of four metropolitan cities. Author has systematically given the historical phenomenon of low quality migration going side by side with low quality or unplanned urbanization in chapter 3. The concept of continued spatial disorganization and role of liberalization, privatization and globalization (LPG) are organized and represented in framework.

In chapter 4, author uses canonical model to test the theory of spatial structure and spatial flow based on inter-state migration and regional disparities. It starts with mobility concept of Murray Chapman in which considerable emphasis has been given on migration phenomenon as behaviour of people in response to socio-economic stresses to explain why people move in the Third World countries. This chapter describes the conceptual model of the spatial field theory and application of canonical model to link spatial flow and spatial structure of the economy. The author has explained the algebraic model in detail using equation and diagrams and data for 443 districts of 18 major states. This theory talks about humane perspective of the movers. It permits a mathematical mapping of migration behaviour matrix and socio-economic attribute matrix of spatial regions and shows a causal linkage between the various elements of the two matrices.

In continuation, the chapter 5 presents the result of step-wise regression analysis performed at district level (between intra and inter district migration and socio-economic development index). Chapter 6 and chapter 8 deal with factor and canonical analysis between migration and socio-economic variables at district and state level respectively. Chapter 9 is the last chapter concludes that rural migrants make a quantum jump to four metros by-passing the smaller towns, therefore, structural transformation is required both at smaller towns and metropolitan cities to check urban

involution.

Similarly, the second part from chapter 10 to 18, thoroughly unfolds the pattern of migration as per 2001 census and analyses various aspects of migration at six levels of investigation across all India, 18 major states, 470 selected districts, 58 elected class I cities, 35 million cities and four metropolitans. It describes six basic phenomenon of migration-urbanization system which also includes economic polarization and economic disparity. The chapter 18 presents the summary of findings of 2011 census data at various levels and across gender. It highlights that despite negative condition of migrants, distress migration is desirable, and also advocates that mega cities must grow with respect to prosperity not only in terms of population explosion.

After presenting the linkages between migration-urbanization in first two sections, the issues, challenges and development policies are raised in the third section. The chapter 19 deals with issues of massive illegal migration from Bangladesh and its adverse consequences upon demographic character of population in India. Chapter 20 discusses the India's two burgeoning issues: population explosion and economic growth. Author mentions that there is demographic divide and new challenges emerging from demographic transition on one hand, while on the other hand, there is economic disparity between- a tiny India shining and a vast deprived India.

The book ends with the future development policies and strategies for migration planning, and urban and regional development. The author's view on migration and migrant is very clear and he accepts that for the most of the poor, migration is a choice between the quick death in villages and slow starvation stinking urban slums; it is an escape route from rural poverty. However, the author strongly says that urbanization and migration are not evil. Policy-wise, better urban governance and gainful migration must be encouraged. He has suggested strategies for balanced development of rural and urban areas, eradication of poverty and to check illegal Bangladeshi migration in detail in the last chapter.

This book, as per its title revolves around the issue of migration, urbanization, regional disparities and development policies in India based on 1991 and 2001 census data. It gives a deep insight into distress migration, regional disparity, and unplanned urbanization and rapid growth of slums in India. Author has deduced three migration theories in Indian context.Though various statistical techniques are used in the book but they are also explained thoroughly so that even a non-statistician can also understand easily. Study is analytical, systematic and policy oriented. The book is full of maps, graphs and figures to support the results. Undoubtedly, this is not only a valuable reference book for the students of social sciences and migration & urban studies, but also a valuable document for the city and county planners and policy makers. True to the author's claim-this book seems to be a collection of his lifelong research work in which he has presented an intensive and rigorous analysis of migration and urbanization. The author deserves appreciation for the completing daunting task of bringing together various issues and possible strategies to address India's migration scenario by handling plethora of data from census 1991 and census 2001 and relating with urbanization. This may be termed as landmark reference book in the field of migration and urban studies.

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