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Post-Disaster Investigation of the Malin Slope Failure Deccan Plateau, India

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Abstract

In the morning of 30th July 2014 at 07:30:00 (IST), a major part of the village Malin, located in the Western Ghats in Maharashtra was washed out and buried under a mass of mud, rock and plant debris. More than 150 peoples perished in the disaster. Primarily it was identified that extreme rainfall consecutively during 25 July to 30 July 2014 triggered the phenomenon. The present study makes an attempt to work out the events leading to devastating debris flow through mapping from high resolution remote sensing data of hillslope topography and land use of pre- and post-disaster dates. Digital elevation model generated from topographical map and high resolution remote sensing data from Google Earth image are used for the study. The steeply sloping plateau margin above the village as well as the gently sloping plateau top, were occupied by narrow strips of terraced agricultural fields with 1m to 2m high earthen retention walls/bunds. The question is what is the actual trigger that initiated the mass flow especially over the strip above Malin village? With incessant rain the fields over the plateau and the sloping strip turned into virtual ponds and water overflowed. The event appears to have been triggered because of bursting of retention walls/bunds of agricultural fields over the plateau surface leading to sudden surge of flow over the plateau margin. This flow uprooted a few trees at the plateau top edge which acted as surcharge in causing the mass to flow and the consequent disaster.

Key words: *Mass wasting, Slope failure, Malin, Rainfall, Land use, Landslide.*

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Introduction

A debris flow washed out and covered up three-fourths of Malin village situated at 73°41'18.32" E and 19°09'14.14" N at an altitude of about 775m amsl on the leeward side of the Western Ghats in Ambegaon taluk of Pune district in Maharashtra (Fig.1), in the wee hours of 30 July 2014 (07:30:00 IST) resulting in the death of as many as 150 people. It is a cataclysmic event of mass wasting process that happened over a short period of time; and, such events don't give one time to escape and don't happen with a warning. Normally most of the events connected with the natural disasters are mapped and studied after they happen. And, whatever one observes after 'events' had happened is 'history'. Earth scientists deal with events that are essentially historical and engage themselves in reconstructing the history of the surface of the earth and various other related events by analyzing what all (changes) they see after a certain event has occurred. Hence the often-quoted concept in earth science 'the present is key to the past'. So, it is literally a post-event study of morphology, the earth scientists undertake to unravel the causes that triggered an event or caused a change. The disaster followed a rainfall of about 17.5 cm in the area around Malin village consecutively from 25 July 2014 till 30 July 2014.

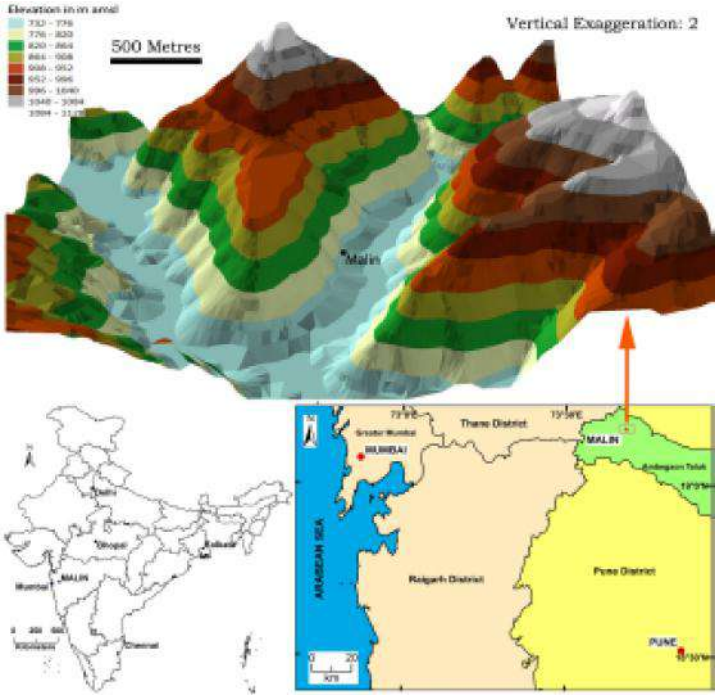

Figure 1 Location of Malin village and topography around it

During the last few decades, there were many catastrophic landslide events caused by particularly intense rainfall (Kanungo and Sharma, 2014; Martha and Vinod Kumar, 2013; Martha et al., 2014). Although most of these fatal landslides occurred in the Himalayan region, few were reported from the Western Ghats and Nilgiri Hills (Jaiswal and Van

Westen, 2009; Kuriakose et al., 2009; Neelakantan and Yuvaraj, 2013). The attention paid towards identifying potential landslide sites in the hills of Southern India is not as much as it is paid to Himalayas. Jaiswal et al., (2010) and Kannan et al., (2013) have expressed a similar opinion and had made an exhortation to identify potential landslide sites in the hills of Southern India. Post-landslide investigations help to understand the specific causes if any which triggered landslides in specific terrains under some specific conditions. The present investigation is one such exercise to point out on a specific set up which induced the initiation of the Malin disaster.

In geomorphic terms what happened there in Malin was a mass wasting process, assisted by water in oversaturated quantity. Of course, most of the mass movements are aided by water. It was variously categorised as mud avalanche (Bhandari, 2014), mudslide (Pune Mirror, August 2, 2014)and simply as landslide (Ramasamy et al., 2015). Exactly, what type of a mass wasting process is it, is not a question now. The question is, what is it that triggered the first event that started a series of cascading consequential events that preceded the disaster? The answer will help to take precautions in similar areas to prevent such disasters in future. In the Deccan Plateau region especially in Maharashtra, there are many such vulnerable places for catastrophic mass flows. Bhandari's (2014) 'time to ask right questions' and the question posed, 'why are scientific investigations in our landslide prone areas exceptions rather than a rule' have prompted this investigation using remote sensing data.

Data and Methodology

In the case of Malin mass flow, the past is erased. And, unless the past is known there can't be a possibility to analyse the situation to explain the events. It is in such cases, archival remote sensing data comes in handy to look into the past. Now, courtesy remote sensing data of Google Earth Image (of 9 February 2014 & of 3 April 2015) of very high resolution (1x1m), a look at the status of the area, in and around Malin before (Figure 2a) and after (Figure 2b)

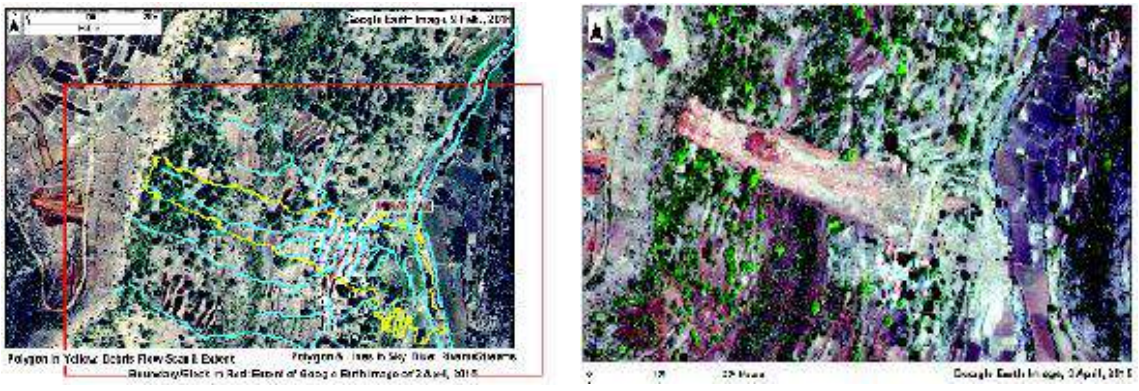

Figure 2 (a) Google Earth Image of 9 February 2014 of Malin area showing mudslide scar boundary, streams and the extent (box in red) of Google Earth Image of 3 April 2015 (b) Google Earth Image of 3 April 2015 of Malin area showing debris flow scar.

the village was buried under debris, revealed a great deal of information using which a sequence of events leading up to the disaster are inferred. Survey of India's toposheet on 1:50,000 scale with a contour interval of 10m is also used for the study to prepare a Dem and to eventually present it after draping with remote sensing data. Land use maps from the remote sensing data are prepared through on-screen digitization at a high magnification.

Status of Land use Before and After the Event

The plateau top and plateau margin above the village are beset with a number of agricultural fields with 1m to 2m high earthen bunds/ retention walls. The upper margin of this (plateau) plain drops down at a very high angle ranging between 45-75o and is fringed by a grove of bushy vegetation including some tall and big trees. Then for about 110-120 metres down slope in the direction of the Malin village, there is thick vegetation along the sloping plateau margin. The area covered under terraced fields (10%) is far less than the vegetative cover (75%). Then, further downslope for about 250 metres the sloping margin of the plateau is covered by low grass and bush dotted with an occasional tree (75%) with a few strips of terraced fields (25%). The end of this stretch is the beginning of Malin village. Figure 3a gives a detailed map of pre-disaster land use around the mass flow scar/Malin village, prepared from a background of Google Earth Image of 9 February 2014. It is clear from Figures 2a & 3a that the terraced fields are few and far between within the mass flow area compared with those in the adjoining areas in general north and south of the scar. As for streams draining down the slope there is one flowing right through the centre up to the village boundary and joins a stream flowing on the general north of the village and the third one flowing towards the southern side of the village (Figure 2a). From Figures 2, 3, and 4, one can have a visual estimate of the extent of mass flow and the part of the affected village. About 50 out of a total of about 90 houses in the village were washed away and/or dislocated and covered up under the debris.

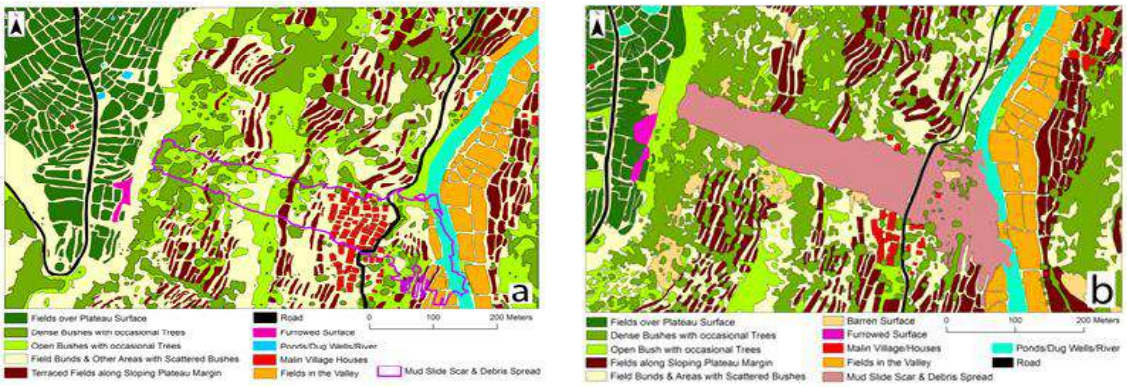

Figure 3 Land use maps of Malin area prepared from Google Earth Images (a) before mudslide-9 February 2014 and (b) after mudslide-3 April 2015

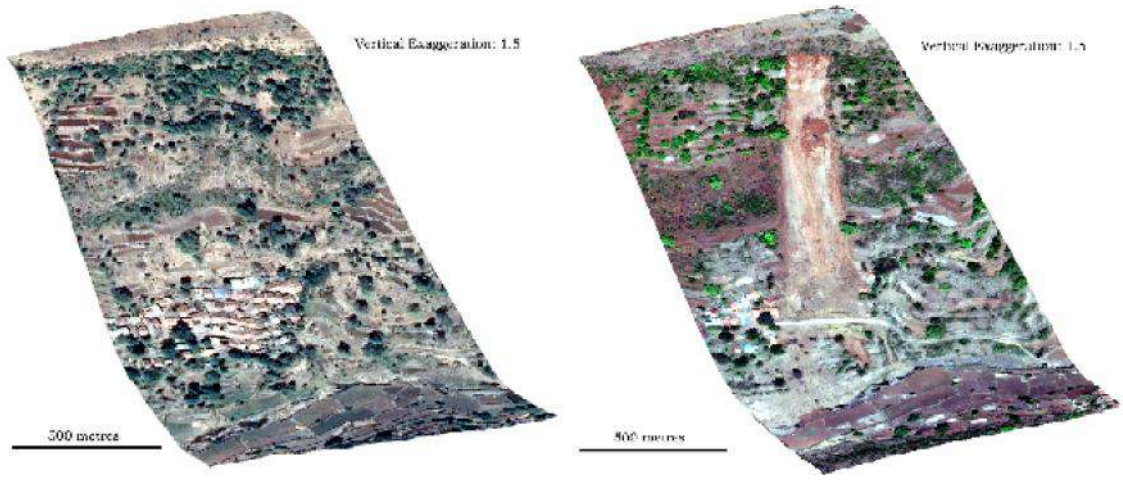

Figure 4 Google Earth Image draped over topographic model of Malin area (a)before mudslide-9 February 2014 and (b) after mudslide-3 April 2015

Discussion

In most of the cases where there is loss of life and property, disasters are by and large ascribed to anthropogenic influences. On examination of Figures 2a, 3a, and 4a it can be found out that the stretch with the least number of terraced fields and with maximum natural vegetation is affected whereas the stretches (in the general north and south of the affected portion), with maximum number of terraced fields and with minimum natural vegetation, remained unaffected. This is a point to reckon with before this particular disaster is ascribed to anthropogenic influences. Ramasamy et al. (2015) through geomorphic and land use units delineated from Google Earth imagery observed extensive 'anthropogenic invasion' around Malin village and through 'swarms of lineaments' traced from the same Google Earth imagery, found Malin area bound on all sides by lineaments and finally concluded that 'cumulative effect of tectonism and anthropogenic activities' caused Malin landslides. Though land use units presented here are also extracted/interpreted from the same Google Earth imagery, there is some variance between the maps presented in the present study and those of Ramasamy et al. (2015). Though remote sensing data doesn't lie, interpretations may vary from person to person. But with 1m cell size of Google Earth imagery, there is no possibility for gross commissions and omissions. Further, 'swarms of lineaments' marked by Ramasamy et al. (2015) are questionable. Most of them are denudational/erosional illusions on small scale imagery. The illusions would disappear when the same high-resolution small-scale data is viewed at moderately larger scales. Following are possible sequence of events worked out from the interpretation of remote sensing data:

(1) With the amount of rainfall (17.5 cms over 4-5 days) before the disaster struck the village, the soil over the plateau surface above the village and over the sloping plateau margin

above and below the village, got supersaturated.

(2) There was a possibility of bank full discharge in the central stream above the village (shown in Figure 3a) flowing downstream over the plateau margin and also a possibility of a few bushes and trees getting dislodged along the banks of this stream.

(3) The fields over the plateau surface got filled up and turned into virtual tanks basically because of copious rainfall and the significant height of field bunds/retention walls (with 1 to 2 m of relative relief). At a certain moment, one or two bunds of the fields breached releasing a huge quantity of water loaded with mud.

(4) This heavy and sudden discharge of water fully loaded with mud while flowing over the edge of the plateau dislodged a few trees.

(5) This sudden surge of mud and plant debris from above worked as surcharge to push the already supercharged soil/mud down slope to come crashing down on the village ultimately submerging it under a debris of rock, mud and uprooted trees. Yes, it was in a way a debris avalanche, happened so suddenly leaving no time to react by the sleeping villagers.

Conclusion

Consequent to continuous heavy rainfall, filling of fields and subsequent breaching of field bunds (over the plateau plain) and uprooting of some trees over the plateau margin acted in combination as a trigger for this disaster. This is not a random occurrence. There is a reason behind it. There is a relatively large catchment contributing headwaters (over the plateau surface) to the stream flowing down the slope perpendicular to the village. Another reason is, there is a wall of vegetation along the plateau margin vulnerable for uprooting. Had this vegetation been there to a considerable stretch right up to the field bunds, the force of flood surge of waters would have been reduced. Wherever there is this combination of large headwater catchment and a chance of fields turning into water tanks and a possibility of breaching of field bunds, there can be a repetition of such disasters in this Western Ghats region with similar situations of terraced fields over the slopes and occurrence of settlements along the footslopes. Yes, detailed mapping of catchments and streams with very high-resolution remote sensing data would help identify possible zones of such disasters.

References

Bhandari, R. K., (2014), The Malin mud avalanche tragedy of 30 July 2014 - time to ask the right questions. *Current Science*, v.107, pp.560-561.

Jaiswal, P., and Vanwesten, C.J., 2009, Estimating temporal probability for landslide initiation along transportation routes based on rainfall thresholds., *Geomorphology*, v.112(1-2), pp.96-105. https://doi.org/10.1016/j.geomorph. 2009.05.008

Jaiswal, P., Vanwesten, C.J., and Jetten, V., 2010, Quantitative landslide hazard assessment along a transportation corridor in southern India. *Engineering Geology*, v.116(3-4), pp.236-250. https://doi.org/10.1016/j.enggeo.2010.09.005

Kannan, M., Saranathan, E., and ANABALAGAN, R., 2013, Landslide vulnerability mapping using frequency ratio model: A geospatial approach in Bodi-Bodimettu Ghat section, Theni district, Tamil Nadu, India. *Arabian Journal of Geosciences*, v.6, pp.2901-2913. https://doi.org/10.1007/s12517-012-0587-5

Kanungo, D.P., and Sharma, S., 2014, Rainfall thresholds for prediction of shallow landslides around Chamoli-Joshimath region, Garhwal Himalayas,

India., **Landslides**, v.11(4), pp.629-638. https://doi.org/10.1007/s10346-013-0438-9

Kuriakose, S.L., Sankar, G., and Muraleedharan, C. (2009) History of landslide susceptibility and a chorology of landslide-prone areas in the Western Ghats of Kerala, India, *Environmental Geology*, v. 57(7), pp.1553-1568. https://doi.org/10.1007/s00254-008-1431-9

Martha, T.R., Roy, P., Govindharaj, K.B., Kumar, K.V., Diwakar, P.G., and Dadhwal, V.K. (2014) Landslides triggered by the June 2013 extreme rainfall event in parts of Uttarakhand state, India. *Landslides*, v.12 (1), pp.135-146. https://doi.org/10.1007/s10346-014-0540-7

Martha, T.R. and Vinod Kumar, K., 2013, September, 2012 landslide events in Okhimath, India-an assessment of landslide consequences using very high resolution satellite data, *Landslides*, v.10(4), pp.469-479. https://doi.org/10.1007/s10346-013-0420-6

Neelakanthan, R., and Yuvaraj, S., 2013, Relative effect-based landslide hazard zonation mapping in parts of Nilgiris, Tamil Nadu, South India, *Arabian Journal of Geosciences*, v.6 (11), pp.4207-4213. https://doi.org/10.1007/s12517-012-0693-4

Pune Mirror (2 August 2014) GSI not ruling out human interference in Malin disaster and Govt comes up with 8-year old disaster solution.

Ramasamy, S.M., Muthu Kumar, M. and Subagunasekar, M., 2015, Malin-Maharashtra landslides?: A disaster triggered by tectonics and anthropogenic phenomenon. *Current Science*, v.108, pp.1428-1430.

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Surface Water Quality in Gorakhpur City, Uttar Pradesh

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Abstract

Water is an essential component for the survival of life on the Earth. It contains minerals, which is important for human beings as well as plant and aquatic life. The availability of water both in terms of quality and quantity is essential for the very existence of mankind. There is heavy extraction of water for domestic, industrial and agricultural purposes. Lack of awareness and civic sense, use of inefficient methods and technology; lead to more than 50% of water wastage in the domestic, agricultural & industrial sectors. Water pollution is rendering much of the available water unsafe for consumption. In India, most of the population is dependent on surface water as the source of drinking water supply. Water quality index (WQI) provides a single number that expresses overall water quality at a certain location and time, based on several water quality parameters. Calculation of water quality index using standard method given by the Horton, Bureau of Indian Standards (BIS, 2003) and the Indian Council of Medical Research (ICMR, 1975). The present work is based on both primary and secondary data and aims to assess the water quality index (WQI) of the surface water of river Rapti and various ponds situated in Gorakhpur City. The analyzed data are compared with standard values recommended by BIS and ICMR. Ten parameters are considered for calculating the WQI such as: pH, Total Hardness, Total Alkalinity, Total Dissolved Solid (TDS), Calcium, Magnesium, Chloride, Sulphate, Nitrate, and Dissolved Oxygen (DO) and also calculate the seasonal variations of Physico-chemical parameters on the water quality of Gorakhpur city. The spatial distribution maps of the water quality index are prepared by using Arc GIS software. Data tabulation, Arithmetical calculation and diagrams are prepared in MS Excel.

Key Word: *water quality index, physico-chemical parameters, water quality standards, total dissolved solid,*

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Introduction

Water is necessary for all forms of life, either human beings or plants or animals. And the water may be either surface water or ground water. But, by increasing population of country and industrializations, the water qualities are affected now a day. The polluted water is affecting the public health and aquatic ecosystems. Both the natural process and human activities influence the quality of surface water and ground water. Water naturally contains dissolved substances, non - dissolved particulate matter and living organisms; indeed, such materials and organisms are necessary component of good quality of water, as they help to maintain vital biogeochemical cycles. There are few exceptions where naturally occurring substance trigger, water quality challenges detrimental to human health (Van Halem et al., 2009). Lakes and tanks are known to be ecological barometers of the health of a city as they regulate the micro-climate of any urban center (Benjamin et al., 1996). The quality of surface water in an inland water bodies have a profound effect on the ground water table and ground water quality of the nearby aquifers due to existence of direct interaction between surface and ground water. The environmental conditions of any lake ecosystem depend upon the nature of that lake and its exposure to various environmental factors. Hence, surface water quality depends not only on natural processes (precipitation inputs, erosion, and weathering of crustal material, etc.) but also on anthropogenic influences (urban, industrial, and agricultural activities) (Papatheodorou et al., 2006). The fragile ecosystem must maintain the state of environmental equilibrium with the existing surroundings particularly from a special prospective of human encroachment and pollution. However, in recent decades, population growth, agricultural practices and sewage runoff from urban areas have increased nutrient inputs; many folds to the level of their natural occurrence, resulting in accelerate eutrophication (Choudhary et al., 2010). Aquatic organisms need a healthy environment to live and adequate nutrients for their growth, the productivity depends on the physicochemical characteristics of the water body (Verma et al., 2012). The pollution of water is increased due to human population, industrialization, the use of fertilizers in agriculture and man-made activity. Water parameters such as temperature, turbidity, nutrients, hardness, alkalinity, dissolved oxygen, etc. are some of the important factors that determines the growth of living organisms in the water body (Smitha, 2013). Hence, water quality assessment involves to analyse the Physico-chemical, biological and microbiological parameters that reflect the biotic and abiotic status of the ecosystem (Verma et al., 2012).

Table 1: Water standards and recommending agencies.

Parameters	Standards	Recommended Agency
pH	6.5 - 8.5	ICMR/BIS
Total hardness (mg/l)	300	ICMR/BIS
TDS (mg/l)	500	ICMR/BIS
Magnesium (mg/l)	30	ICMR/BIS

Calcium (mg/l)	75	ICMR/BIS
Sulphate (mg/l)	150	ICMR/BIS
Chloride (mg/l)	250	ICMR
Nitrate (mg/l)	45	ICMR/BIS
Dissolved Oxygen (DO) (mg/l)	5.0	ICMR/BIS
Total Alkalinity (mg/l)	120	ICMR

Source: Thakor, et al., 2011. Water Quality Index (W.Q.I.) of Pariyej Lake Dist. Kheda-Gujarat, Current World Environment.

Poor water quality has a direct impact on water quantity which is available for drinking in a number of ways. Polluted water that cannot be used for drinking, bathing, and industry or agriculture purpose effectively reduces the amount of usable water within a given area. Notwithstanding, the use of low quality water (for example saline or brackish water) may have important and direct impacts on productive water such as irrigated agriculture, with important effects on land degradation, crop production and consequently on rural income and food security. Around 700 million people in 43 countries suffer today from water scarcity, a situation there is not sufficient water resources to satisfy long - term average requirement of mankind (Falkenmark et al., 2001). Unsafe domestic use, agriculture production, mining activities, industrial production, power generation, and other factor can alter the physical, chemical and biological characteristics of water in ways that can threaten ecosystem integrity and human health. The major sources of water pollution are human settlement, industrial and agriculture activity. Negative factors related to these activity includes unhygienic disposal and inadequate treatment of human and livestock wastes, deficient management and insufficient treatment of industrial residues, inappropriate agriculture practices and unsafe solid waste discharge. Over the 80 percent sewage in developing countries is discharged untreated directly into water bodies (WHO, 2008).

Study area

Gorakhpur is one of the fastest growing urban centers in tavai belt of Eastern Uttar Pradesh, located at 26^0 45' N to 26^0 57' N latitudes and 83^0 22' E to 83^0 32' E longitudes (Fig. 1). It is situated on the left bank of the river Rohin at the confluence of the river Rapti and Rohin. The National Highway No. 28 (Lucknow-Gorakhpur-Kasia) and National Highway No.29 (Varanasi-Gorakhpur) passes through the southern part of the City. The city with the geographical area of 152.80 sq. km is divided into 70 Administrative Wards (2011). After the 1970's with the establishment of the Northeastern Railway Headquarters and other Infrastructural development, major changes have taken place at every sector. The railway station is situated in the middle part of the city at the height of 79 meters. The topography of the city is largely plain with a marginal gradient from North to South. The slop decreases from the middle of the city to east and west ward. The height of the city ranges from 75 to 85 meter above the mean sea level (msl). There are numerous water bodies within the city. The biggest is Ramgarh tal (Lake) situated in the

South-Eastern part of the city. The neighboring area of Ghantaghar near Basantpur is situated in the west of the city at approximately 75 meter height. It is the second largest city of Eastern Uttar Pradesh after Varanasi in terms of population growth. The city has a total population of 673,446 (census 2011) with an average density of about 4407 person/km2 which is lower than other faster growing municipal corporation, like Varanasi, Allahabad and Kanpur.

Objectives

The main objectives of the present paper are-

1. to analyze the status of water quality and their quality index of various stations in the city.
2. to know the source of water deterioration in the study area.

Materials and methods

Present study is based on the both primary and secondary data which is gleaned from the unpublished dissertation, some articles, and UPPCB that compiled National Water Quality Monitoring Program publication series water quality for the year 2016. Water samples have been analysed for 10 physico-chemical parameters such as pH, Total Hardness, total Alkalinity, Total Dissolved Solid (TDS), Calcium, Magnesium, Chloride, Sulphate, Nitrate, and Dissolved Oxygen (DO) are analysed in the laboratory as per the standard procedures of Bureau of Indian Standards (BIS), APHA, 1998 and also calculate the seasonal variations of Physico-chemical parameters on the water quality of Gorakhpur city. The WQI has been calculated by using the standards of drinking water quality recommended by World Health Organization (WHO, 1992), Bureau of Indian Standards (BIS, 2003), and Indian Council for Medical Research (ICMR, 1975). The weighted Arithmetic index method has been used for the calculation of WQI of the water body. Further quality rating or sub index (Qn) has been calculated using the following expression.

Quality rating (Qn) = 100* [Vn - Vo] / [Sn - Vo] ---------- (i)

Where,

Qn = Quality rating for the nth water quality parameter.

Vn = Estimated value of the nth parameter at a given sampling station.

Sn = Standard permissible value of the nth parameter.

Vo = Ideal value of nth parameter in a pure water.

Ideal values in most cases Vo = 0 except in some parameters such as pH and dissolved oxygen. Calculation of quality rating for pH and dissolved oxygen is 7.0 and 14.6 mg/l respectively.

Calculation of quality rating for pH

For pH the ideal value is 7.0 (for natural water) and a permissible value is 8.5. Therefore, the quality rating for pH is calculated from the following equation:

Qn = 100 [Vn (pH) - 7.0] / [8.5 - 7.0] ..... (ii)

Where, Vn (pH) = observed value of pH.

Calculation of quality rating for dissolved oxygen

The ideal Value for dissolved oxygen is 14.6 mg/l and standard permissible value is 5 mg/l. Therefore, quality rating is calculated from fol-

lowing equation:

Qn = 100 [Vn (DO) - 14.6] / [5 - 14.6] ……..... (iii)

Calculation of Relative weight or Unit weight (Wn)

Unit weight has been calculated by a value inversely proportional to the recommended standard values Sn of the corresponding parameters.

Unit weight (Wn) = k/Sn ……(iv)

Where, Wn = Unit weight of the nth parameter.

Sn = Standard value for nth parameter.

K = Constant for proportionality.

The overall water quality index (WQI) has been calculated by aggregating the quality rating with the unit weight linearly.

Water Quality Index (WQI) = ģ Wn Qn / ģ Wn

Where, WQI = Water Quality Index

Wn = Unit Weight of the nth parameter.

Qn = Quality Rating of the nth parameter.

Based on the water quality index, status of water quality can be classified as following:

Table 2: Water Quality Status based on WQI.

Sl. No.	Water Quality Index	Status of Water Quality
1	0 - 25	Excellent Water Quality
2	26 - 50	Good Water Quality
3	51 -75	Poor Water Quality
4	76 - 100	Very Poor/Severe Water Quality

Discussion and results

WQI is established through the measurement of various important physicochemical parameters of the surface water. The physicochemical parameters of nine different stations (Ramgarh Tal (West), Nausar, Ramgarh Tal (East), Shivpur Sahbazganj, Chargawan, Shaktinagar, Rajendranagar, Purdilpur, Humayunpur North) are summarized.

Some remarkable variations of physicochemical data are observed at all the nine sites. The water temperature fluctuates with the change of season and other factors. The summary of all the results in the form of water quality index at different sampling locations is presented in table 6. The water quality index values is more than 100 or above it is unsuitable for drinking purpose and value below 50 incessantly change into good water as recommended by WHO. The water quality index is classified into excellent, good, poor, and very poor/severe based on values ranging from 42.86 to 81.80 in 2015 and 56.27 to 78.24 in 2017. It is also observed that there are spatial variations within the region. River is a dynamic system and pH is vital for river ecosystem. pH greater than 8.5 causes bitter test or soda like test. Eye irritation and exacerbation of skin disorder is also caused when pH is greater than 11. It is observed that pH value is ranging between 6.3 (Shivpur Sahbazganj) to 7.9 (Rapti river) in 2015 and 6.0 (Rapti river) to 8.0

(Purdilpur) in 2017. According to Bureau of Indian Standard this is within the desirable limit ranging from 6.0 to 8.5.

Table 3: Physico chemical parameters of surface water samples (mg/l) except pH, 2015.

Sampling Sites	Source of water	pH	TH	TDS	Mg	Ca	SO_4	Cl	NO_3	DO	TA
Ramgarh tal (East)	tal	7.2	154	266	26.0	36.0	14.0	29.6	16.0	5.9	110
Nausar	Rapti river	7.9	200	300	28.4	45.2	24.4	55.0	26.0	5.0	118
Ramgarh tal (West)	tal	6.8	174	242	18.0	52.1	31.2	32.0	19.0	6.2	148
Shivpur Sahbazganj	Gordhoia *Nala*	6.3	192	211	21.1	44.6	58.3	47.0	12.0	6.9	131
Chargawan	Pond	6.9	248	341	14.8	32.4	25.2	69.2	09.0	7.8	119
Shakti Nagar	Gordhoia *Nala*	7.1	310	386	23.4	37.8	40.7	78.1	15.0	6.7	167
Rajendra Nagar	Pond	6.9	211	297	12.6	28.7	13.9	39.5	08.0	8.2	102
Purdilpur	Pond	7.5	293	317	21.7	41.2	26.3	51.6	14.0	6.3	153
Humayunpur	Pond	7.7	335	344	26.9	44.5	31.2	56.7	21.0	4.9	112

Source: Rai, A. K., 2016. Assessment of Physico-chemical Water Quality Parameters of Surface Water in Gorakhpur City, Dissertation, Department of Civil Engineering, Madan Mohan Malviya Technical University, Gorakhpur.

(Note: TH-Total Hardness, TDS-Total Dissolved Solid, Mg- Magnesium, Ca- Calcium, SO_4-Sulphate, Cl- Chloride, NO_3-Nitrate, DO-Dissolved Oxygen, TA- Total Alkalinity.)

In the few sampling sites hardness in water is also above the desirable limit (300 mg/l $CaCO_3$) but within the permissible limit (600 mg/l $CaCO_3$). It ranges from 154 mg/l to 335 mg/l in 2015 and 240 mg/l to 420 mg/l in 2017, Maximum hardness is found in Purdilpur (420 mg/l), and Ramgarh *tal* (West) (380 mg/l). Most of the sampling sites are above the desirable limit in 2017. TDS is an important indicator of overall water quality; reflecting inorganic salt and organic matter in water bodies. There are four samples having values above the desirable limit (300 mg/l). They are Purdilpur (317 mg/l), Chargawan (341 mg/l), Humayunpur (344 mg/l) and Shakti Nagar (386 mg/l) in 2015 but eight samples having values more than desirable limit in 2017. It is showing the gradually increase of TDS in surface water in Gorakhpur city due to unplanned discharge of domestic waste water into water bodies and random disposal of municipal waste.

Table 4: Physico chemical parameters of surface water samples (mg/l) except pH, 2017.

Sampling Sites	Source of water	pH	TH	TDS	Mg	Ca	SO_4	Cl	NO_3	DO	TA
Ramgarh tal (East)	tal	7.7	320	410	22.0	44	85	110	38	7	128
Nausar	Rapti river	6.0	240	210	19.5	34	41	85	32	5	121
Ramgarh Tal (West)	Tal	7.5	380	365	36.0	47	76	91	40	3	140
Shivpur Sahbazganj	Gordhoia *Nala*	7.0	310	448	25.0	38	62	56	31	3	139
Chargawan	Pond	6.5	275	380	20.0	26	81	42	27	4	90.0
Shakti Nagar	Gordhoia *Nala*	7.0	284	400	28.0	35	61	62	28	3	130
Rajendra Nagar	Pond	7.0	310	345	24.0	21	67	38	34	4	105
Purdilpur	Pond	8.0	420	425	39.0	56	92	95	47	3	138
Humayunpur	Pond	7.7	360	355	31.0	42	65	90	36	3	132

Source: Sample tested by author in environmental lab, MMM technical university, 2017

Most of the sampling sites were magnesium is found high compared to the desirable limit of Bureau of Indian Standard (20 mg/l) but within the permissible limit (30 mg/l). The highest value is found in river Rapti (28.4 mg/l) and lowest is 12.6 mg/l at Rajendra Nagar in 2015. Average concentration of magnesium is 27.17 mg/l in 2017; it is above the desirable limit also. Concentration of calcium ranges between 28.7 mg/l to 52.1 mg/l at all the stations in 2015 and 26.0 mg/l to 56.0 mg/l in 2017. The average calcium concentration is 40.28 mg/l in 2015 and 38.11 mg/l in 2017. It is showing the calcium concentration in water is decrease. High concentration of chloride is observed at Shakti Nagar (78.1 mg/l), Chargawan (69.2 mg/l), and Humayunpur (56.7 mg/l) in 2015, while Ramgarh tal (East) (110.0 mg/l), Purdilpur (95.0 mg/l), Ramgarh tal West (91.0 mg/l) in 2017. All the locations were chloride is found within the desirable and permissible limit both in 2015 and 2017. Most of the locations were dissolved oxygen is found above desirable limit (5.0 mg/l); except Humayunpur. Highest concentration is 8.2 mg/l at Rajendra nagar followed by Chargawan (7.8 mg/l), Shivpur Sahbazganj (6.9mg/l), Shakti Nagar (6.7 mg/l), Purdilpur (6.3 mg/l), Ramgarh tal West (6.2 mg/l) and Ramgarh tal East (5.9 mg/l) etc.

Study also reveals that concentration of average alkalinity quite below the permissible limit. There are four samples which have crossed the desirable limit (120 mg/l).

Water quality index

Water quality index (WQI) provides a single number that expresses overall water quality at a certain location and time based on several water quality parameters. The objective of water quality index is to turn complex water

Table 5: Calculation of water quality index of Ramgarh *Tal* (East) 2015 and 2017.

Sr. No	Parameters	Observed Value		Standard Value (Sn)	Quality Rating (Qn)		Unit Weight (Wn)		Wn*Qn	
		2015	2017		2015	2017	2015	2017	2015	2017
1	pH	7.20	7.70	6.5-8.5	13.33	46.66	0.2943	0.2353	03.92	10.98
2	Total Hardness	154	320	300	51.33	106.6	0.0083	0.0067	00.43	0.714
3	TDS	266	410	500	53.20	82.00	0.0050	0.0040	00.27	0.328
4	Magnesium	26.0	22.0	30.0	86.67	73.33	0.0834	0.0667	07.23	4.891
5	Calcium	36.0	44.0	75.0	48.00	58.66	0.0334	0.0266	01.60	1.566
6	Sulphate	14.0	85.0	150	9.333	56.66	0.0167	0.0134	00.16	0.759
7	Chloride	29.6	110	250	11.84	44.00	0.0100	0.0080	00.12	0.352
8	Nitrate	16.0	45.0	45.0	35.56	84.44	0.0556	0.0444	01.98	3.749
9	(DO)	5.90	5.00	5.00	90.63	79.16	0.5004	0.4000	45.35	31.664
10	Total Alkalinity	110	120	120	91.67	58.33	0.0208	0.0167	01.91	1.781
					ģQn=		ģWn=		Wn*Q=	
					491.55	689.84	1.028	0.8219	62.963	56.784

Water Quality Index (WQI) = ģ Wn Qn / ģ Wn

WQI (2015) = 62.9636/1.028 = 61.254

WQI (2017) = 56.784/0.8219 =69.095

Source: Computed by the author

quality data into information that is understandable and used by the public. A water quality index based on some important parameters provides a single indicator of water quality.

In general, water quality indices incorporate data from multiple water quality parameters into a mathematical equation that rates the health of a water system with number. Physicochemical properties of water in any aquatic ecosystem are largely governed by the existing meteorological conditions and are essential for determining the structural and functional status of natural water. WQI is established through the measurement of various important physicochemical parameters of the surface water. The values of various physicochemical parameters for the calculation of WQI are presented in Table 5. The value of WQI shows the higher percentage of poor water quality category of surface water in 2015 but quit increase in 2017. Poor water quality observed at Civil Line 2, Mahadeo Jharkhandi, Shivpur Sahbazganj, Shakti Nagar, Purdilpur, in 2015 but quality of water at Mahadeo Jharkhandi and Purdilpur location have deteriorate as sever condition in current situation.

Table 6: Result of samples and their water quality index.

Sampling Stations	Water Quality Index (2015)	Status of Water Quality	Water Quality Index (2017)	Status of Water Quality
Civil Line 2	61.25	Poor Water Quality	69.09	Poor Water Quality
Nausar	81.80	Sever Water Quality	72.28	Poor Water Quality
Mahadeo Jharkhandi	59.48	Poor Water Quality	76.45	Sever Water Quality
Shivpur Sahbazganj	65.18	Poor Water Quality	68.72	Poor Water Quality
Chargawan	45.45	Good Water Quality	59.90	Poor Water Quality
Shakti Nagar	56.42	Poor Water Quality	62.33	Poor Water Quality
Rajendra Nagar	42.86	Good Water Quality	56.27	Poor Water Quality
Purdilpur	53.01	Poor Water Quality	77.51	Sever Water Quality
Humayunpur	76.80	Severe Water Quality	78.24	Sever Water Quality

Source: Computed by the author

There are only two stations have observed Good water quality such as Chargawan and Rajendra Nagar in 2015 because these areas was newly constructed and less settled but now in current situation, it has poor quality because encroachment of settlement around the water bodies . It is also observed that severe water quality is found at Nausar and Humayunpur in 2015 and two other one is added in 2017 such as Mahadeo Jharkhandi and Purdilpur. It may possible due to the effective ionic leaching, over exploitation and anthropogenic activities such as discharge of effluents from industrial, agricultural and domestic sector, more than 75 WQI showing the very poor or severe water quality in the city which is unsafe for domestic uses. No one location has found good water quality in 2017(Table: 6).

Causes of water deterioration

During the past few years it has been recognized that runoff from storms in urban area is not 'rainwater' in terms of quality. Storm runoff typically contains substantial quantities of impurities; so that it is a more serious source of pollutants in many areas. There are many causes of water deterioration in general but in this paper some important causes discussed in particular. The main important cause's are-

Industrial waste

Industries produce huge amount of waste

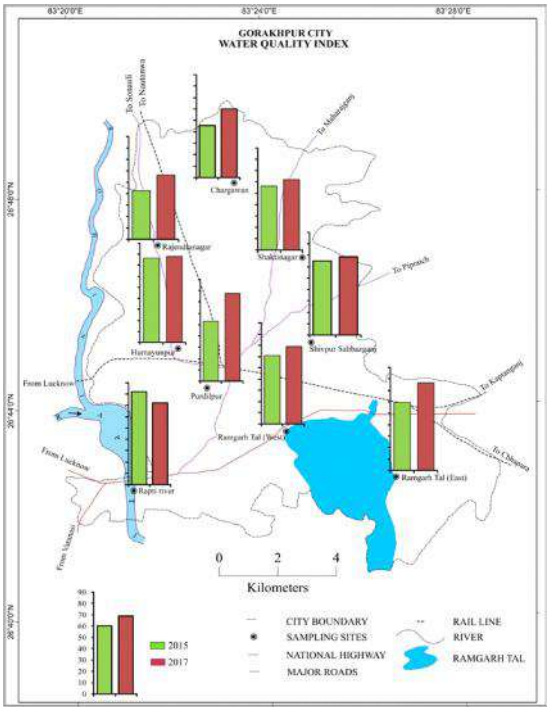

Fig: 1

which contains toxic chemicals and pollutants which can cause water pollution and damage our environment. They contain pollutants such as lead, mercury, sulphur, asbestos, nitrates and many other harmful chemicals. Many industries in the city do not have proper waste management system and drain the waste in fresh water which goes into river, canals etc. The toxic chemicals have the capability to change the color of water, increase the amount of minerals, also known as Eutrophication, change the temperature of water and pose serious hazard to water organisms, that problems facing river Rohin & Rapti and Ramgarh tal. Concentrations of Nitrate and Sulphate are high in this area due to established more industries and discharge their waste water into river and tall without treated.

Sewage and waste water

The sewage and waste water that is produced by each household is chemically treated and released into ponds and canals with fresh water, if it is not treated than sewage water carries harmful bacteria and chemicals that can cause serious health problems. Pathogens are known as a common water pollutant in the sewage. Sewers of Gorakhpur city house produce several pathogens and it contaminates nearby ponds such as Ramgarh *Tal*, Shivpur Sahbazganj and Shakti Nagar because sewer is joins the water bodies withou treated. Small leakages from sewer lines in the Gorakhnath, Rajendranagar, Rasulpur and Jungle Nakaha are contaminate nearly ponds as well as become a breeding ground for insects and mosquitoes.

Chemical fertilizer and pesticides

Chemical fertilizers and pesticides are used by farmers to protect crops from insects and bacteria; they are useful for the plants growth. However, when these chemicals are mixed up with water, produce harmful for plants, animals and human health also, chemicals mixes up with rainwater and flow down into rivers and canals which pose serious damages for aquatic life. Rapti and Rohin river are facing such a serious problem because these rivers transport nemours dissolved chemicals, and pesticides like nitrate, sulphate, lead, and phosphorus from nearby agricultural field. This is popularly known as Non-point source of pollution.

Medical waste

Medical waste is defined as potentially infectious waste materials generated from health care facilities, such as hospitals, clinics,

physician's offices, dental practices, blood banks, and veterinary hospitals/clinics, as well as medical research facilities and laboratories. Many more hospitals and private clinic (include Baba Raghaw Das Medical College and NSCB Sadar hospital) In Gorakhpur city; it produce huge amount of biomedical waste daily by daily.

Urban development

Recent time, population has grown rapidly so increase demand for housing, food and cloth in all over the world. More cities and towns are developed; they have resulted in increased use of fertilizers to produce more food. In Gorakhpur city, rapidly increase construction activities, inadequate sewer collection and treatment, encroachment by the people around natural water bodies result reduce their actual area have create more problems related to health because water quality in these area are not good for domestic purpose.

Municipal waste

The municipal solid wastes in India enormous quantities generated every day and it has creating severe problems continue. Even though only 31% of Indian population resides in urban areas, this population of 377 million (Census of India, 2011) generates a gigantic 143,449 metric tons per day of municipal solid waste, as per the Central Pollution Control Board (CPCB, 2014-15) and these figures increase every day with an increase in population. Same conditions are facing Gorakhpur city because rapid increase in population from countryside. It produce huge amount of municipal waste in the city. There is not proper treatment system prevailing for garbage. It dumped around lowland area such as Laldiggi, Rajendranagar, Nausar, Transportnagar, Gordhoia nala, as well as along the NH. 28.

Conclusion

The water quality index method is more methodical and it facilitates the comparative evaluation of water quality of several sampling sites. It is found that 25 percent of the surface water in the sampling site is of poor quality and 22 percent is of severe quality, only 18 percent of the surface water is of good quality. It is also observed that quality of water deteriorates in the eastern outer and southern outer periphery of the city. Thus, it is clear from the present study that water quality index value for some of the sampling sites in Gorakhpur city are within the permissible limit with most of the cases were proper treatment is essential before using it for various purposes. Water quality analysis revealed that water is getting polluted from different sources such as industrial effluents, domestic sewage, medical waste, and garbage disposal in water bodies. Distillation, Ion exchange, ultraviolet radiation is some of the techniques can be applied to improve the quality of water in the city.

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References

Bates, R., 1973, Determination of pH: Theory and Practices, Wiley and sons, New York, USA.

Benjamin, R., Chakrapani, B.K., Devashish, K., Nagarathna, A.V. and Ramachandra, T.V., 1996, Fish mortality in Bangalore Lakes, India. *Electronic Green Journal*, Vol.-1, No.-6.

Choudhary, P., Routh, J., Chakrapani, G.J., 2010, Organic geochemical record of increased produc-

tivity in Lake Naukuchiyatal, Kumaun Himalayas, India. *Environ Earth Science*, Vol.-60, No.-4.

De Zuane, J., 1997, Handbook of Drinking Water Quality (2 ed.), John Wiley and Sons.

Felkenmark, M. and Lindh, G., 2001, Water for a starving world, Westwiew Press, Boulder, Colorado.

Jhingran, V.G., 1975, Fish and Fisheries of India, Hindustan Publication Corporation, New Delhi, p. 354.

Khursid, S., Zaheeruddin and Basheer, A., 1998, Pollution assessment and water quality status in parts of Cochin, *Indian Journal of Environmental Protection*, Vol.-18, No.-4, pp. 246-249.

Kumar, V., and Goswami, K. P., 2014, Water Quality in Gorakhpur City, Uttar Pradesh, Magadh Geographical Review, Vol.-XIV, pp. 128-138.

Mahanta, H., Dhillon, S. S., Bath, K. S. and Mander, G., 2000, Abiotic and biotic components of a freshwater pond of Patiala (Punjab), *Pollution Research*. Vol.-15, No.-3, pp. 253-255.

Papatheodorou, G., Demopoulou, G., Lambrakis, N., 2006, A long-term study of temporal hydrochemical data in a shallow lake using multivariate statistical techniques. *Ecological Modelling*, Vol.-193, No.- 3.

Rai, A. K., 2016, Assessment of Physico-chemical Water Quality Parameters of Surface Water in Gorakhpur City, Dissertation, Department of Civil Engineering, Madan Mohan Malviya Technical University, Gorakhpur.

Smitha, 2013, Physico-chemical analysis of the freshwater at River Kapila, Nanjangudu Industrial Area, Mysore, India, *International Research Journal of Environment Sciences*, Vol.-2, pp. 59-65.

Solanki and Pandit, B.R., 2006, Trophic status of lentic waters of ponds water of Vadodara, Gujarat state, India, *International Journal of Bioscience Reporter*, Vol.-4, pp. 194-195.

Thakor, F.J., Bhoi, D.K., Dabhi, H.R., Pandya, S.N. and Chauhan, N.B., 2011, Water Quality Index (W.Q.I.) of Pariyej Lake Dist. Kheda-Gujarat, *Current World Environment*, Vol.-6, No.-2, p. 227.

Tresh, J.C., Suckling, E.V. and Beale, J.F., 1944, Chemical and zooplankton studies of lentic habitats in North Eastern, New South Wales, *Australian Journal Marine Freshwater Research*, Vol.-21, pp. 11-33.

Van Halem, D., Bakker, S.A., Amy, G.L., and Van Dijk, J.C., 2009, Arsenic in drinking water: Not just a problem for Bangladesh, *Drinking Water Engineering and Science Discussions*, Vol.-2, No.-51, p. 64.

Verma, P., Chandawat, D., Gupta, U. and Solanki, H.A., 2012, Water quality analysis of an organically polluted lake by investigating different physical and chemical parameters, *International Journal of Research in Chemistry and Environment*, Vol.-2, pp. 105-112.

Verma, P.U., Purohit, A.R., Patel, N.J., 2012, Pollution status of Chandlodia Lake located in Ahmedabad Gujarat, *International Journal of Engineering Research and Applications*, Vol.-2.

World Health Organization and United Nation Children's Fund Joint Monitoring Program (JMP) for Water Supply and Sanitation, 2008, Progress on Drinking Water and Sanitation: Special Focus on Sanitation, Geneva.

Zimba, P.V., Khoo, L., Gaunt, P.S., Brittain, S. and Carmichael, W.W., 2001, Confirmation of cat fish, Ictaluruspunciatus Rafinesque, mortality from microcystis toxins, *Journal of Fish Diseases*, Vol.-24, pp. 44-45.

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Socio-Economic Dimensions of Workers in the Vicinity of Bellary-Iron ore Mining Region, Karnataka : An Empirical Study

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Abstract

To achieve rapid economic development, many countries resort to various activities to exploit natural resources. One such activity is mining. It has the potential of contributing to the development of areas endowed with the resources. Bellary district is endowed with abundant mineral resources of international standard including iron ore, manganese ore and limestone. Keeping this background the investigator determined to examine the socio-economic conditions of the people who are residing close to the iron ore excavation area and environmental measures followed by mine leasers. Present study is purely based on primary data collected from field survey by selecting 80 non - mining people from sixteen villages by using questionnaire schedule. In addition to these, 19 private and 2 government iron ore company owners were interrogated to understand the mitigation measures adopted by the lease holders and facilities and safety measures provided to the workers. It is proved that local people are suffering from acute air borne (67.5 per cent) diseases like asthma, cold, cough and water borne (21.3 per cent), diseases namely diarrheal, skin and eye burning, fever and others (11.3 per cent). It is also proved that the local people are economically benefited from the mining but at the same time they face problems related to social aspects like health, potable water, and death due to accidents (52.5 per cent responded yes) at least 01-02 accident in a week

The small and medium land holders have lost their agricultural land which has been taken by mine owners on lease base for dumping yard, parking and other purpose. It is clear that mining affected the productivity of the land and yield of crop have decreased to a greater extent. Similarly, mining lease holders have not properly adopted the environmental protection measure.

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Key words: *excavation, socio-economic dimensions, vicinity of iron ore, mine lease, operation, contamination*

Introduction

Minerals constitute an important source of raw materials for most of the basic industries necessitating their exploration from the earth. It generates employment opportunities, income to the state exchequer and foreign exchange to the nation producing the minerals. But the extraction and processing of ores and minerals lead to widespread environmental pollution. Thus, mining is essentially a destructive developmental activity where ecology suffers at the cost of economy. As a result, people in that area have to suffer from many environmental and health hazards (Minati Sahoo, 2013). Mining remains one of the most perilous occupations in the world, both in term of short term injuries and fatalities, but also due to long term impacts such as cancer and respiratory conditions namely silicosis asbestosis and pneumoconiosis (Stephens and Ahern, 2001). The environmental deterioration caused by mining occurs mainly as a result of inappropriate, unscientific and unethical working practices and poor rehabilitation measures.

Mining has a number of common stages or activities, each of which has potentially-adverse impact on the natural environment, society and cultural heritage, health and safety of miners, and communities living in close proximity to mining operations (Kitula, 2005). This has attracted the attention of environmental engineers, medical practitioners, researchers and planners throughout the world and attempts are being made to make air, water and atmosphere clean. The social and environmental impacts are more pervasive in regions where operations are newly established or closing down.

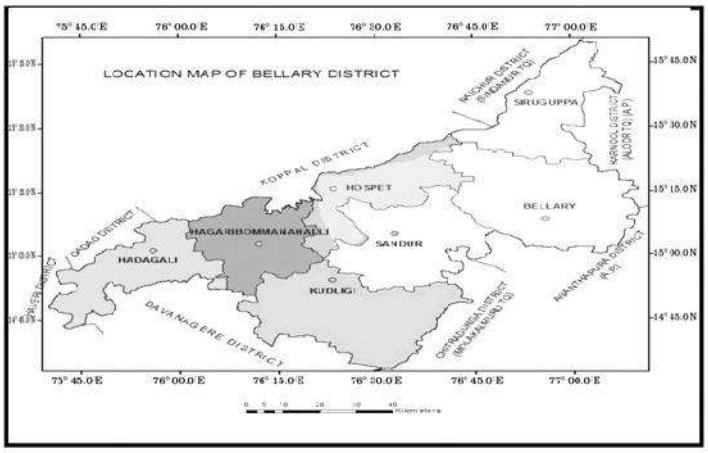
The participation of women workers in the production activities is a development indicator. The growing literature on environmental justice argues that the poor people and communities suffer economically and socially (Hatfield, 2000).The poverty is the foremost determinant of ill health being exposed to many environmental problems. The women are close to nature than men (Pratt, 2000).The participation of women in the productive sectors shall improve their both the social and economic environment (Siddique and Roy, 2009).

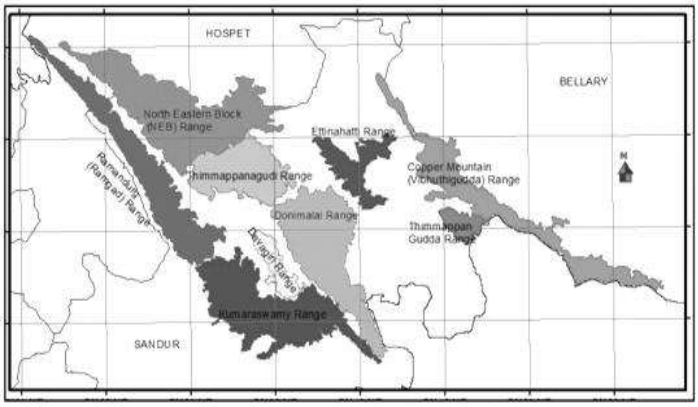
Assimilative capacity is the level of human activity (including population dynamics and economic activity), which a region can sustain at acceptable "quality-of-life" level. This has more specific relevance to a region where large-scale mining activities are being conducted and further expansion is being planned. This is so because the ability of the environment to sustain particular levels of activity might have been already exceeded in the area (ICFRE, 2004). In this regard evaluation of the assimilative capacity of a region is necessary to understand, which is essentially determined along with social, economic and environmental aspects, and their relative contribution in maintaining quality of life.

Study area

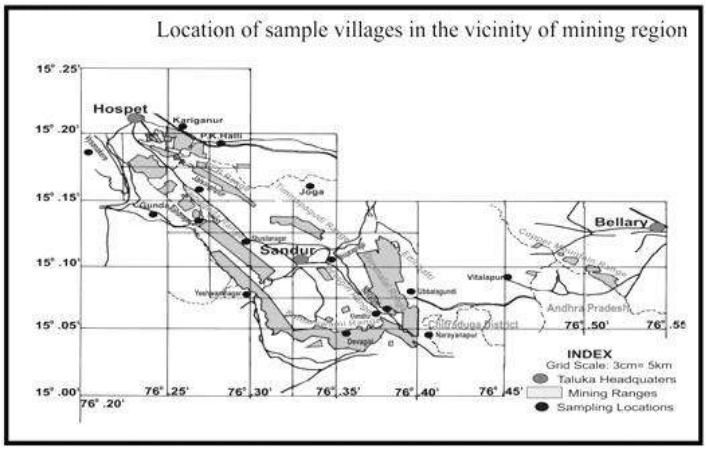
Bellary district is located in the Eastern part of Karnataka state. It spans over an area 8,447 sq.kms. The study area lies between 14^0 33'' North and 15^0 50" North latitudes and 75^0 42" East and 77^0 10" East longitudes (Fig.1). Topographically the region has a rugged terrain

covered with scanty vegetation. The District is bounded on the north -west by Gadag district, on the north by Koppal district, on the north - east by Raichur district and on west by Haveri district, on the south is Davanageri, on the south-east is Chitradurga district of Karnataka state, and on the east by Anantpur and Kurnool districts of Andhra Pradesh.





Different hill ranges with mining area in `Bellary district



Objectives

- To assess the socio-economic condition of people who are residing in the vicinity of mining area and perceptions of local community about the environmental impact.
- To identify the diseases prevalent around the mining area due to iron ore mining activities.
- To trace out the conditions of the small land holders and yield of the crops who gave their agricultural land on a lease basis to private mining companies.
- To examine the role of environment friendly mining practices by lease holders for sustainable mine.

Hypotheses

To achieve the above mentioned objectives, the following hypotheses have been formulated.

- The mining activities have significant impacts on livelihood of local communities.
- The rate of infection and respiratory tract infections diseases among residents is inversely related to distance from the mines.
- Small land holders are exploited by the private mining companies by taking their agricultural land on a lease base that becomes uncultivable.

Data base and methodology

The present study is purely based on primary data collected by using combination methods, including participatory rural appraisal (PRA), participant observations and formal surveys. The data collected includes background information of respondents, awareness, perception and effects of mining.

To collect the primary data on non- mining people sixteen villages were selected based on random sampling. Five people from each village of sixteen villages were selected randomly and in all 80 non - mining respondents were interviewed by using questionnaire schedule. In addition to these, owners of mining companies were interviewed to understand the facilities and safety provided to the workers. In this regard 19 private companies and 2 government iron ore companies were visited to gather the relevant information. There were formal interviews with the village *panchayat* members and other leaders in the surrounding areas.

Social dimensions of respondents.

To know the social status of the non - mining people educational qualification, distance of villages from the mining sites, health condition and information regarding accidents have been taken into consideration.

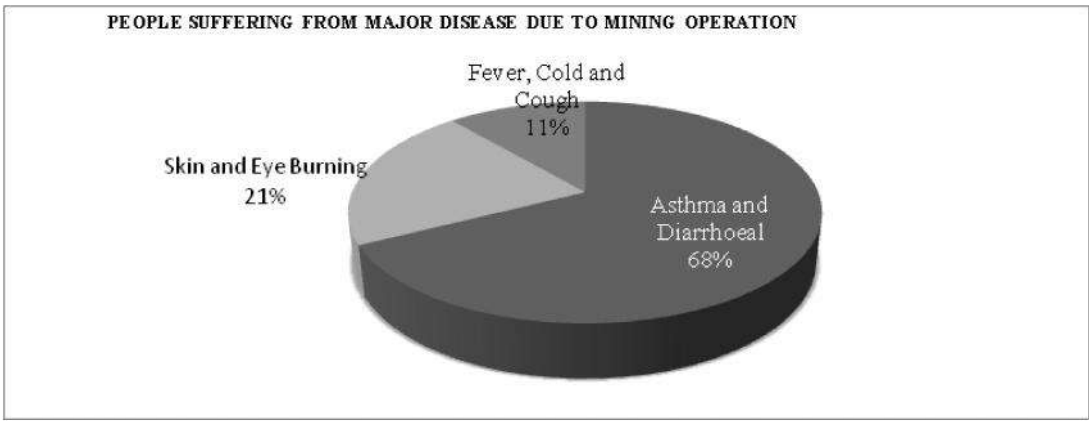
Education is the key for building 'human capital' and 'human capital' is a vital ingredient in building a nation (Haq and Haq,2011). Quality of population can be judged from life expectancy, level of literacy and level of technical training attained by the people of a country. The education status of the respondents show 42 (52.5 per cent) non- mining respondents are the illiterates, 20 respondents are educated who learned up Secondary education (1 to 10th standard), 17 respondents have studied up to PUC or Diploma qualification and one respondent has degree qualification to his credit.

Health can be defined as a state of complete physical, mental and social well being of

an individual, and not merely the absence of disease and infirmity (World Health Organization, 2005). People who live close to mining areas drink water from surface and groundwater sources contaminated by chemical wastes and other waste from mining activities and may also suffer from respiratory illnesses and hearing problems. Iron ore mining is the main occupation and this rampant mining activity has created unhealthy situations in the Bellary district.

The surveyed data displays the disturbance of daily activities of local people and their health condition in the study area. Iron ore mining is a dusty occupation in the world which creates many health problems. Out of 80 people interviewed, 71(88.8 per cent) people told that mining activities are disturbing their daily activity and remaining 9 (11.2) respondents stated that mining is not disturbing their daily activity. In addition to that, 70 (87 per cent) people told that due to rapid mining activities their health condition is not good and 10 (13 per cent) respondents stated that their health condition was not affected by the mining. Most of the earlier studies on mining and its associate activities proved that mining deteriorates health conditions and creates several problems like less precipitation, agricultural loss, health problems, and other problems. The present study is not an exception to it. Many people frequently fall sick and visit hospitals for treatment and spend lots of money for treatment.

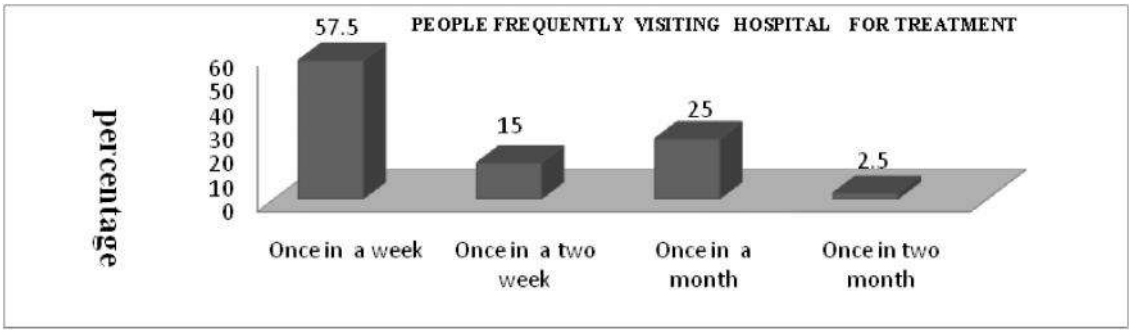
In general, in the mine region people face air borne and water borne diseases like asthma, diarrheal, skin and eye burning, fever, cold, cough and others. Out of 80 respondents 54 (67.5 per cent) were suffering from asthma and diarrheal followed by skin and eye burning problems, 17 (21.3 per cent) and 9 (11.3 per cent) respondents were suffering from fever regularly and cold and cough related diseases, respectively. This analysis clearly shows that the pollution created by mining activities in the study area have cause several diseases (Fig.2).



Welfare and financial assistance programs carried out by the mining companies for the better health of the people in the study area has been collected. Out of the 80 respondents interviewed 67 (83.8 per cent) opined that no mining company addressed the basic needs of the health of the community living around the mining region and did not undertake the health

campaign programmes and the remaining 13 (16.3 per cent) people answered positively that companies have taken care about the health of the people. On the other hand 72(80 per cent) respondents stated that they have not availed any financial assistance from the mining company or Government to consult the doctors for their ill health, and 8 (10 per cent) respondents stated that they had received meagre amount from the mining companies to get treatment.

Fig.3 shows the status of the health condition, and the number of people frequently visiting hospital for treatment. Out of 80 respondents, 46 (57.5 per cent) people suffered from sickness and visited the hospital once in a week for treatment, 12 (15 per cent) people fell sick once in two week, 20 (25 per cent) people fell sick once in a month and 2 (2.5 per cent) respondents opined that they fall sick once in two months . 19 (23.8 per cent) people spent Rs 3,000 to 10,000 per year towards the treatment and 44 (55 per cent) people spent Rs 10,000 to 20,000 per year and remaining 17(21.3 per cent) respondents spent more than Rs.20,000 per year for the treatment. It revealed that many people fall sick frequently and spent huge amount towards health treatment.



The distance of the non-mining residents from the mine site is very crucial in determining the prevalence of mining related pollution and diseases. It was established that the rates of mining related pollution and diseases decrease as one moves away from mine sites. To find the impact of mining activity on the surrounding area and people living there the data was collected on distance basis *i.e.* 2-8 kms distance from the mining sites to respondents' village. 38 respondents are located 2 km away from the mining area which accounted for 47 per cent of the total samples and 25 (31.3 per cent) respondents reside 2 to 4 km away from the mining area. It is pertinent to mention that 60 respondents were selected from the area near the mining site to know the effect on nearby villages. Generally the villages which are located close to mining site undoubtedly are most affected. 12 (15 per cent) respondents stayed at a distance of 4 to 6 km, 3 (3.8 per cent) respondents resided between 6 to 8 km and 2(2.5 per cent) respondents are located 8 km away and the impact is meagre.

As there is heavy traffic and with no restriction on the speed of trucks from the iron ore mines to the smelters many accidents have been reported causing environmental damage and human loss. Because of the heavy traffic and competition between the truck drivers on

the roads many accidents have been reported and these accidents have created horrible condition to the local people in the region. The rate of accidents that have occurred during transportation of ore from mining site to smelting industry was also collected. Of the 80 respondents 42 (52.5 per cent) opined that the transportation creates a horrible condition in the area, at least one accident case is reported in a week. 20 (25 per cent) respondents answered one case in two weeks, followed by 17 (21.3 per cent) respondents stated that one case in three weeks period and 1(1.3 per cent) respondent argued that the regularly minor accidents take place in the area. One of the respondents, a senior citizen of Galemmanagudi village stated that he lost his wife and sister in a drastic road accident in front of his house because of the fast movement of iron ore transporting trucks. It is clear that the iron ore transporting vehicles particularly, tippers and trucks have created worst conditions near the mining area and on the road.

Economic dimensions of respondents

Mining has an essential foundation for human development through creation of wealth (Acheampong, 2004). It has been argued that mining can be a fundamental economic roadway for most of the countries especially the developing ones. Mining has led to growing conflicts among most communities displaced by mining operations and has even increased the presence of social vices in the Bellary district. Bellary district is very rich in natural resources in India and has generated large income for local people. But most of the economic benefits are taken by the owner of the mines. Moreover, the source of income of a family depends on the family members involved in different types of economic activity. Agriculture is a major source of income for the people in the study region, which accounts for 82 per cent (66 respondents). 11 (13.8 per cent) respondents are working as agricultural labour, 3 are working as mining labor and one each in Govt. and private sector.

The study area has more employment opportunities in many sectors including mining and it has created job opportunity and economic benefit to the local people. Mining can have positive and negative impact on local people in respect of job opportunity. Out of 80 respondents 45(56.3 per cent) people responded positively that they had job opportunities occasionally in the mining companies and the other 35 (43.7 per cent) respondents, opined no job opportunity. Among the 45 respondents 38(84.4 per cent) people worked as mining labor, 6 (13.4 per cent) people worked as SDC and 1(2.2 per cent) person worked as an office bearer. It is proved from the fact that the mining sector is a major economic activity in the study area and larger numbers of people are willing to work in mining sector. In the study region many truck drivers are associated with mining activity and there are reports of death and injuries due to a series of accidents. But none of the company or government authorities have given compensation to the victim's families though the matter was reported in local news papers.

The facts reveal the condition of non- mining family member of those who worked as a truck driver, present physical condition of drivers and financial assistance that is given to them by the mining/govemment authorities in the area. Out of 80 respondents 42 (52.5 per cent) respondents stated that no one has worked as truck driver in the mining sector and while 38

(47.5 per cent) respondents said yes for the question. The truck drivers physical condition obtained from the 38 respondents indicated that 5 (13.15 per cent) truck drivers are alive and their condition is normal, 8 (21.05 per cent) drivers are also alive but there physical condition is serious and 25 (65.78 per cent) respondents' reported that truck driver are not alive. Of the total 38 respondents only 10 (26.31 mining truck drivers received little compensation from the concerned authorities and remaining 28 (73.68 per cent) respondents said no financial assistance was given by the authorities. This shows that in the mining sector, neither government nor mine owners take the responsibility of the family of the labourer or truck driver after his death.

Agriculture is the main economic activity of the district with 62 per cent of total geographical area, of which 19 per cent is irrigated by Tungabhadra reservoir. The condition of agriculture in the study region needs improvement in terms of soil quality and productivity. The major cause for losing interest in agriculture by Bellary district farmers is dust emission from the mining activities, less rainfall and the economic gain in leasing agricultural land for mining and its allied activities. Many farmers have abandoned agriculture and leased out the agricultural land for mining. The mining lobby is luring the farmers with assurances that the land will be restored by filling with topsoil after mining.

Non- mining people, agricultural land ownership, land leased for mining owners and basis of land attained by owners of mining information was also gathered during the field survey. Out of 80 respondents, 67(83.8 per cent) respondents have agricultural land and the remaining 13 (16.3 per cent) respondents do not have agricultural land. Among the 67 agriculture land holding respondents, 43 (64.2 per cent) have given their land on lease to owners of mining and 24 (35.8 per cent) farmers have not given their land for mining and its allied activities. Out of 43 farmers 10(23.3 per cent) sold their land to the mines owners, and 29 (67.5 per cent) farmers have given their land on lease basis. It is clear from this fact that many mining companies have taken the agricultural land from the farmer in many ways.

The collected data also provides the information on purpose of agricultural land obtained by owners of mines and per acre value of agricultural land taken by the owners of mines in the study area. As for this 43 farmers have given different answers, among them 26 (60.5 per cent) farmers told that their land was used for dumping yard because these lands are located near mining pits and traveling routes. 12 (27.9 per cent) farmers told that in their land iron ore was extracted by the mining, 4 (9.3 per cent) farmers told that the land was mainly used for vehicle parking and, finally 1(2.3 per cent) farmer told that his land was used for other mining related activity by the mining companies. Besides, farmers have also given information related to per acre value of agricultural land taken by the owners of mining. Of the 43 respondents, 12 (27.9 per cent) farmers had given their land for one lakh rupees per acre, 2(4.6 per cent) farmers sold their land for three lakh rupees per acre and 29 (67.5 per cent) farmers have given their land for two lakh rupees per acre. It is clear from respondents that mining has affected the productivity of the land and yield of crop has decreased to a greater extent.

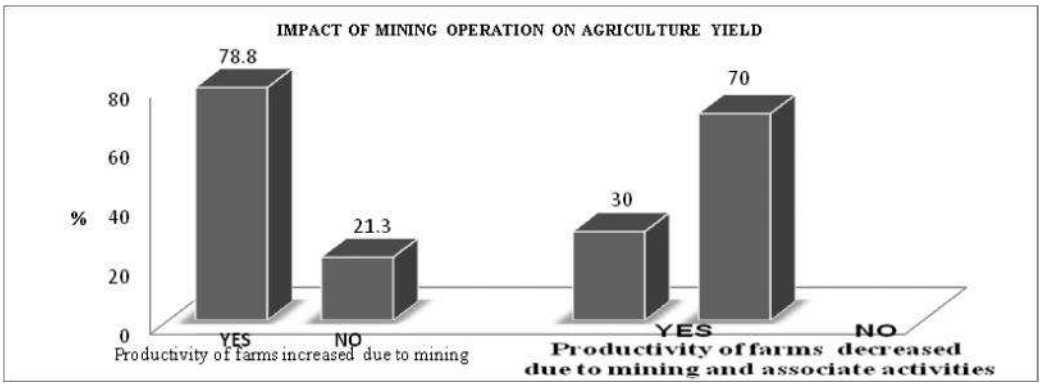


Fig. 4 shows the productivity of farms and quantity of decrease in yield due to mining and associate activities in the study area. Out of 80 farmers 63 (78.8 per cent) had the opinion that mining activity definitely decreased the productivity of farms and 17(21.3 per cent) respondents said that productivity of farms has not decreased due to mining activities but it is less due to natural causes *i.e.*, rainfall affected the agriculture. Of the total sample 34 (42.5 per cent) farmers responded that more than three quintal yield per acre is decreased, 22 (27.5 per cent) respondents said that two to three quintal per acre, 13 (16.3 per cent) respondents said two quintal per acre and 11(13.8 per cent) respondents opined that agricultural yield decreased one quintal per acre due to unscientific mining activity.

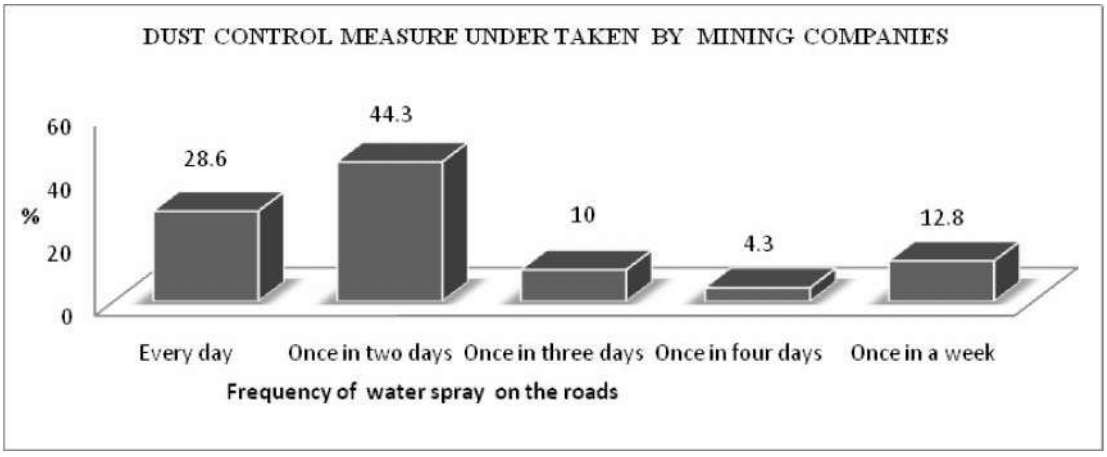
Diversion of agriculture land to mining has resulted in the loss of productive land to non-productive uses. For several years, the iron ore exploited area and waste dumping area cannot be used for cultivation. In this regard, after banning the illegal mining activities in the study area many farmers who had given their land on lease agreement base to the owners of mines have got back their land. 33 (76.7 per cent) farmers have taken back their land from mining companies after mining and 10 (23.3 per cent) farmers have not taken their land because the farmers have sold their land permanently. Among the 33 land regained farmers 12(36.4 per cent) stated that land can be used for agricultural purpose, 7(21.2 per cent) farmers stated that their regained land can't be used for agricultural purpose, 6 (18.2 per cent) farmers expressed that their land had became barren and 8 (24.2 per cent) farmers told that the regained land will take much time to get back to its earlier status.

Factors related to environment friendly mining

The environmental setting of Bellary district itself is semi-arid in nature and prone to drought, as major part of the district lies in a rainfall deficit region. Mining and its allied activities have affected the local environment negatively. Mining cannot be done without degrading land and without affecting the existing environment adversely. Mining operation can damage the environment and ecology to an unacceptable degree, unless planned and effectively controlled. Environmental effects of iron ore mining are prominent in the communities where from respondents' views were obtained. Some of them, as noted by respondents,

are discussed here. The important measures to maintain the sustainability of environment are construction of silting tanks, Coir matting on Dumps, Garland Drain retaining walls along Dumps, Green belts or safety, watering on the roads by water sprinkler to wash away the dust accumulated on the tree and the like.

Opinions elicited from sample respondents in the mining areas were relevant to gauge their awareness levels regarding the steps taken by mining companies to control dust pollution. Accordingly 70 (87.5 per cent) respondents stated that mining companies spray water on the roads to prevent the dust and 10 (12.5 per cent) opined that no company watered the roads. In addition to this 20 (28.6 per cent) respondents said that mining companies were spraying water every day where as 31 (44.3 per cent) respondents said that it was only once in two days, 7 (10 per cent) respondents said that it was once in three days, 3 (4.3 per cent) respondents said once in four days and 9 (12.8 per cent) respondents said that it was only once in week. Regarding covering of tarple over the loaded trucks 48 (60 per cent) respondents said yes and 32 (40 per cent) respondents said no. It has been proved that people in the region were aware of the need for precaution measures by mining companies to mitigate dust pollution (Fig.5).



Mines and Geology department is supposed to monitor the mining leases, methods of extraction and maintenance of ore quality etc. It has been noticed that unhygienic condition prevailed over all most all mining camp, and the Karnataka state pollution control board officials need to visit the area frequently to monitor the existing situation. In this regard opinions were sought from respondents regarding the frequency of the visits of the pollution control board officials to the field's areas. Out of the total respondents 59 (73.7) and 63 (78.8 per cent) respondents stated that no DMG and KSPCB government officials visited to the field respectively, and 21 (26.3 per cent) and 17(21.3 per cent) answered in the affirmative. In addition to this, people of the region were not satisfied with the officers who made the attempts to minimize the effects of mining on the environment; 53 (66.2 per cent) respondents were not satisfied about DMG and KSPCB attempts towards the reduction of adverse effect of mining on environment. However, 27 (33.8 per cent) people expressed

positive opinion about the good work done by DMG and KSPCB in the study area. 29 (54.7 per cent) respondents stated that government had done afforestation work in the vicinity of mining regions, but maintenance was poor, 12 (22.6 per cent) respondents were satisfied with the rehabilitation programmes with the efforts of mining companies and the government to produce the alternatives for the supply of drinking water to the communities and 4(7.6 per cent) respondents spoke about reviving of operation methods in the area. 63 (78.8 per cent) respondents were not satisfied by the efforts made by the government to reduce the environmental impacts in the study area while 17(21.3 per cent) were satisfied.

Information related to mining lease holders

There were 122 iron ore mining leases operating in the study area but at the time of survey only few companies were involved in mine operation. Therefore, 21 owners/managers of working mines were interviewed. Out of 21 companies visited for data, 9 (40.85 per cent) leases have small size of mining areas, *i.e.* below 50 hectares, 7 (33.33 per cent) leases have medium extent *i.e.* 50 to 100 hectares and remaining 5(21.80 per cent) leases are larger in extent (Table 4.1). Out of 21 companies, 6 (28.57 per cent) companies have acquired agricultural land, among them 2(33.3 per cent) companies use the acquired land for dumping; while the remaining 4 (66.66 per cent) companies use such acquired land for vehicle parking, and the other 15 (71.42 per cent) companies did not acquire agricultural land.

Green belt is one of the basic strategies to maintain a sustainable environment in the region, and this strategy is being maintained by most of the companies. Safety zones around the mine periphery are required to stop the out flow of the mine waste deposited at the dumping yard as most of mines are on hill tops and are prone to erosion in the absence of proper green belts around them. Since iron ore mining in the district is mostly on hill tops with steep slopes, a progressive mining plan should be the only option to mining owners rather than opening the entire hill top area. 16 (76.19 per cent) companies have maintained 7.5 meters width with 1.5 hectares areas around a lease mining area as a green belt and 5 (23.80 per cent) companies are maintaining 7.5 meters width with 2.5 hectares area around their mine lease area as a green belt. Maintenance of green belt around the mines is good for the environmental concern; the green belt must be at least 15 meters wide for above 25 hectares lease mining area and 7.5 meters wide for below 25 hectares, for better protection of the surrounding environment.

Concluding remarks

Mining activity not merely awaking and disturbing the daily activities of the people residing in the vicinity of mining area but also made them suffer from water and air borne disease. Asthma, diarrheal, skin and eye burning, fever, cold and cough problems are common in this area. Due to overloaded trucks and uncontrolled speed the accident in the area is quite common and financial assistance is not given to the victim family members. It is pertinent to mention that the small and medium land holders have given their farm land to the mining owners on lease base for dumping yards and excavation purpose. After completion of lease period and exhaust of iron ore the same land is returned to the farmers that have be-

come barren and unproductive. It has been observed that lot of dust is generated from mining and its allied activities which accumulate on the standing crops and runoff water from mining area is let into agriculture field that is responsible for the decrease of productivity. Eye witness proved that maintenance of the Sustainable and environmental friendly mining in the study area is urgently needed and it can be done only by adopting sustainability measures namely Greenbelt, mechanized mine, Garland drain retaining wall along dump, Plantation over terracing, silting tank, Check dam with recharge pits, Plantation over stabilized dump, teak trees planted over dump, Watering on the road by water tanker, Coir Matting on dumps and the like. It is unfortunate to note that none of the companies has adopted proper measures to maintain sustainability of environment.

References

Acheampong. , 2004, Impact Assessment of Mining Activities by Ashanti Gold field-Bibiani Limited on the Environment and socio-economic Development of Bibiani Undergraduate Dissertation Faculty of Social Science, Kwame Nkrumah University of Science and Technology.

Buckingham Hatfield, S., 2000, Gender and Environment Rout ledge, London, pp 169-181

ICFRE. 2011. Micro Level Environmental Impact Assessment Study Report of Bellary District, Karnataka,Volume-II, New Forest, Dehradun, Uttarakhand. Pp. 1-187

Haq and Haq, 2011, Socio- economic Dimension of Environmental impact due to Mining. Human Development Index in South Asia., 1988, Bellary District, India

Kitula, A.G.N., 2006, The environmental and Socio-economic impacts of mining of local livelihood in Tanzania: a case study of Geita district. *Journal of cleaner production*, Vol.14, Issue 3-4,2006 . ELSEVIER. pp. 405-414.

Minati Sahoo, 2013, Socio-Economic Impact of Mining on People Living in Mining area, A Case Study in Joda block of Keonjhar district of Odisha, *International Journal of Arts, Commerce and Literature* Vol. 1 Issue 2.pp. 38-47.

Pratt,V., 2000, Environment and Philosophy, Routledge London. *Indian Journal of Regional Science*. Vol. XXXXI, No. 2, 2009. pp.101-110

Siddique and Roy, 2009, The Socio-Economic Impact of Coal Mining on the Eastern Coalfield, West Bengal. *Indian Journal of Regional Science*. Volume XXXXI , Number, 2.pp.103-109

Stephens, C. and Ahern, M., 2001, Worker and Community Health Impacts Related to Mining Operation': A rapid review of the literature, http:/ www.natura resources. org/doc/mmcs/l World Health Organization 2005):http://www.rbm. who.int/cmc_upload/0/000/015/37/70/ RBMInfosheet_3nt.

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The Study of Land Use/Land Cover in Chunar Tehsil, Mirzapur District using Landsat Data

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Abstract

In this paper an attempt has been made to analyse Land use/Landcover change in Chunar Tehsil of Mirzapur District in Uttar Pradesh using Geospatial technology.Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use/land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. In the present study two scenes of freely available Landsat 5 and Landsat 8 (TM and OLI-TIRS) data of path and row 142/43 for the years 1991 and 2013 have been used.Supervised classification with maximum likelihood classifier has been performed to delineate the different landuse/landcover classes in the study area. In all six classes viz. agricultural land, built up land, dense forest, scrub, water body and barren land have been identified. The study shows sporadic changes in the land use land cover of the study area between 1991 and 2013. There has been a substantial decline in area under forest, scrub and barrenland. Most of it has been converted either into built up land or agriculture. This can be attributed to the sporadic growth of population and resulting expansion of agricultural activities.

Key words: *landuse, land cover, landsat, supervised classification.*

Introduction

Land, the fundamental factor of production and economic development, is dynamic in nature. 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. Land cover refers to the physical and biophysical cover on the earth's surface. It includes vegetation, water, desert, ice and other physical features on the surface of the earth. Land use refers to the arrangement, management and modification of land cover

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type by anthropogenic activities. Particularly, land use implies manner and intent of manipulation of the biophysical characteristics of earth's surface (IGBP-IHDP, 1999).

The land use/land cover change detection of a region is an outcome of natural and socio-economic factors cultural or man-made features and their utilization by man in time and space. Land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use/land cover and possibilities for their optimal use is essential for the selection, planning and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population.

Land use is constrained by environmental factors such as soil characteristics, climate, topography, and vegetation. But it also reflects the importance of land as a key and finite resource for most human activities including agriculture, industry, forestry, energy production, settlement, recreation, and water catchment and storage. Land is a fundamental factor of production, and through much of the course of human history, it has been tightly coupled with economic growth. Often improper land use is causing various forms of environmental degradation. For sustainable utilization of the land ecosystems, it is essential to know the characteristics, extent and location, its quality, productivity, suitability and limitations of various land uses. Land use is a product of interactions between a society's cultural background, state, and its physical needs on the one hand, and the natural potential of land on the other hand. In order to improve the economic condition of the area without further deteriorating the bio-environment, every bit of the available land has to be used in the most rational way. This requires the present and the past land use/land cover data of the area to be evaluated carefully.

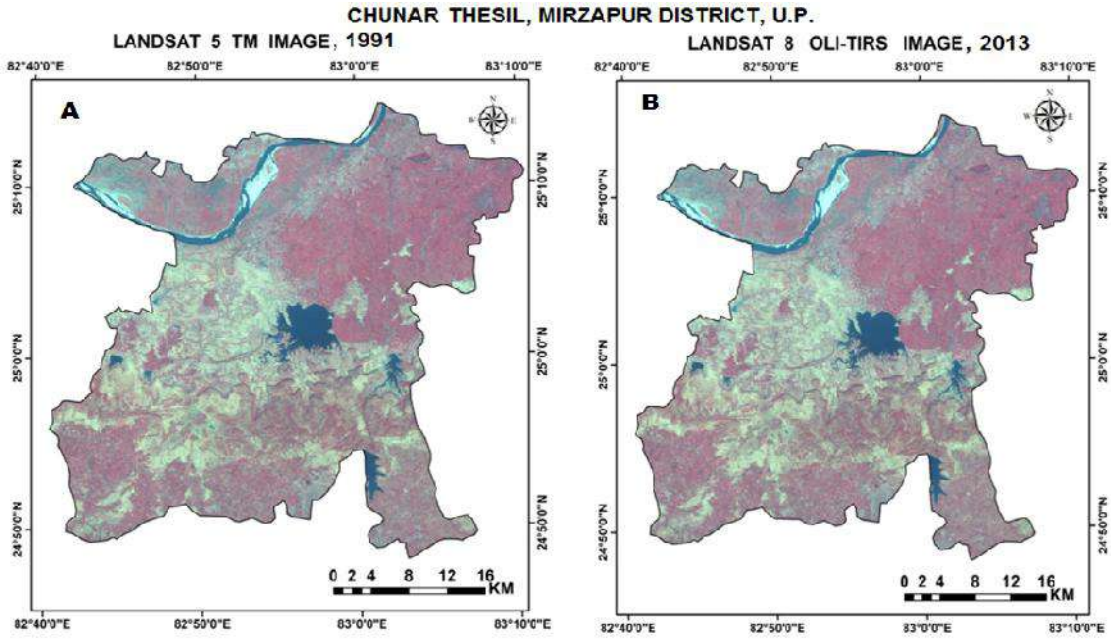
In this paper an attempt has been made to analyse the pattern of land use land cover change in Chunar Thesil of Mirzapur district of Uttar Pradesh (U.P), between 1991 and 2013.

Objective of study

The main objective of the study is to analyse the land use pattern in ChunarThesil in 1991 and 2013 and trace the changes in the land use pattern

Materials and methods

In order to fulfil the above objective freely available Landsat 5 and Landsat 8 (TM and OLI-TIRS) data of path and row 142/43 for the years 1991 and 2013 (Fig-1 A&B) have been downloaded from the Global Land Cover Facility (GLCF) website (http://glcf.umd.edu/).Two scenes captured in the months of November 1991 and October 2013 have been used for the present study. Since the time difference in both the scenes for the 2 years under study is less than 20 days there is not much seasonal variation in the scenes to cause any significant impact on the end result of the land use change detection analysis. As, datasets are geometrically and radiometrically corrected, all bands of TM and OLI-TIRS data are stacked as a single image for each scene, following acquisition.The dataset are projected in UTM projection system (datum WGS 1984, 44N zone)and masked for the study area before classification.



source : earthexplorer.usgs.gov

Figure 1 Landsat Images of Study Area

Supervised classification with maximum likelihood classifier has been performed to delineate the different landuse/landcover classes in the study area. In all six classes viz. agricultural land, built up land, dense forest, scrub, water body and barren land have been identified. Supervised classification provides unsatisfactory classification results resulting from spectral confusion. Spectral similarity of various objects causes such confusion. For example, barren land and agricultural fallow land are often erroneously classified into other class. To overcome this problem, in post classification process erroneously classified land use classes have been reclassified to appropriate classes through recode function based on digitized polygons of LULC classes obtained from Google earth image. The digitized polygons are converted into AOI and within AOI, corresponding classes of 2013 LULC image are changed by recoding.Finally, to remove 'salt & paper' noise that quite often appears in digital image processing, a majority filter (3 X 3 filter) is employed for the two classified images.

The reliability of any overlay derived from satellite image depends upon the accuracy with which the image has been classified. Using the accuracy assessment tool present in ERDAS Imagine software an accuracy assessment of the classified images has been performed. The error matrices are plotted as cross?tabulations of information obtained from classified maps versus the GPS data. Overall accuracy, user's and producer's accuracies and the kappa statistic are estimated from the error matrices.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):

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

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

$$Kappa coefficient (k) = \frac{N\sum_{i=1}^{m} C_{ii} - \sum_{i=1}^{m} Nr_i . Nc_j}{N^2 - \sum_{i=1}^{m} Nr_i . Nc_j} \quad \text{(Eq. 3)}$$

where, Nr is sum of any row i and Ncj is sum of any column j in the confusion matrix.

To understand the nature of land use/land cover changes over a period of 22 years between 1991 and 2013 in the study area change detection analysis using the change detection matrix tool in ERDAS IMAGINE has been done. For the estimation of LULC conversion, a confusion matrix is prepared in MS Excel and net conversion (gain or loss) of each land cover from/to other classes is estimated.

Study area

Chunar block lies in Mirzapur district, Uttar Pradesh. It lies between 24^0 48'N and 25^o 14'N latitudes and 82^0 40'E and 83^o 10' longitude. The block lies in eastern part of Mirzapur district and is bounded by Varanasi district in the north, Chandauli district in the east and Robertsganj block of Sonbhadra district in the south. The river Ganga makes a physical boundary in the north between Chunar block and Varanasi district.

Geologically the study area is composed of rock exposures ranging from pre-Cambrian to the Tertiary period.The rock outcrops belong mainly to the Dhandraul quartzite, of the Kaimur group of Upper Vindhyan super group. The rocks of this group are more or less horizontally bedded and are characterized by deep gorges. The Vindhyan system covers major part of the district. Vindhyan formation is composed of Kaimur series comprising variegated sandstone, quartzite & interceded shale without marginal alluvial cover. Physiographically the area comes under the Vindhyan upland area. The Ganga river flows in the northern part of the area. The north and north western part of the region is flat flood plain mostly covered by agriculture and settlement, whereas the south and south western part is mostly covered by forest and barren land.

The soil of the area is light brown in colour, which is rich in organic matter and non-calcareous in nature. It also consists of clay and silt. Theupland area is rich in clay and the river side has alluvium soil and clayey loam. Vindhyan clayey loam is calcareous in nature. The bar deposition area has coarse sandy soil.

Result and discussion

Table-1 and figure-2 shows the overall land use pattern of the study area for the years 1991 and 2013 and the corresponding change in 2013 over 1991.From the table it can be observed that in the year 1991 barren land constituted the largest proportion of land use accounting for 35 percent of the total land cover. This was followed by agriculture 31 percent and scrubland 24 percent. Forests constituted only 7.36 percent, water bodies 6.11 percent and built up area 3.06 percent of the total land cover.

Table-1: Chunar Tehsil Pattern of Land Use/Land Cover 1991, 2013

Landuse/Land	Area (km2)		Change in Area(Km2)	Relative Change (%)
cover Class	1991	2013	1991-2013	
Water body	84.12	96.61	10.4904	12.47
Forest	101.12	58.9	-42.6918	-42.01
Scrub	331.48	115.69	-215.7820	-65.07
Agricultural land	429.17	824.12	394.8426	92.00
Built-up	42.14	71.8	29.6124	70.18
Barren land	488.34	311.89	-175.0720	-35.84

Source: Calculated by the author from classified Landsat TM 5 and Landsat 8 Images

In the year 2013 agricultural land accounted for the maximum of 55 percent area followed by barren land 21 percent, scrubland 7.8 percent, built up area 4.8 percent and forests 3.9 percent of the total land cover. If we analyse the pattern of change than it can be seen that there has been a substantial decline in area under scrub, forests and barren land in 2013 over 1991. These have reduced by 65 percent, 42 percent and 36 percent respectively. On the other hand area under agriculture and built up area has gained the maximum accounting for 92 percent and 70 percent increase in 2013.

Table 2 : Change Matrix of Landuse/Land Cover in Chunar Tehsil 1991-2013 (in Km2)

		2013						
1991	LULC Classes	Water Body	Dense Forest	Scrubland	Agricultural Land	Built-up	Barren Land	Total
	Water Body	0.00	0.08	0.67	0.63	26.44	-38.31	-10.49
	Dense Forest	-0.08	0.00	5.98	36.01	0.37	0.41	42.69
	Scrub	-0.67	-5.98	0.00	225.20	1.50	-4.27	215.78
	Agricultural Land	-0.63	-36.01	-225.20	0.00	0.60	-133.60	-394.84
	Built-up	-26.44	-0.37	-1.50	-0.60	0.00	0.70	-28.21
	Barren Land	38.31	-0.41	4.27	133.60	-0.70	0.00	175.07
	Total	10.49	-42.69	-215.78	394.84	28.21	-175.07	

Source: Calculated by the author from classified Landsat TM 5 and Landsat 8 Images

Table- 2 shows the class wise change matrix of land use land cover change in 2013. From the table it can be observed that in 2013 while water body has lost 0.08km^2 area to dense forest, 0.67 km^2 to scrubland, 0.63 km^2 to agricultural land and 26. 44km^2 to built-up area, it has gained 38.31 km^2 land from barren land thereby having a net positive gain of 10.49km^2 in 2013 over 1991. Similarly agricultural land has gained a whopping 394.

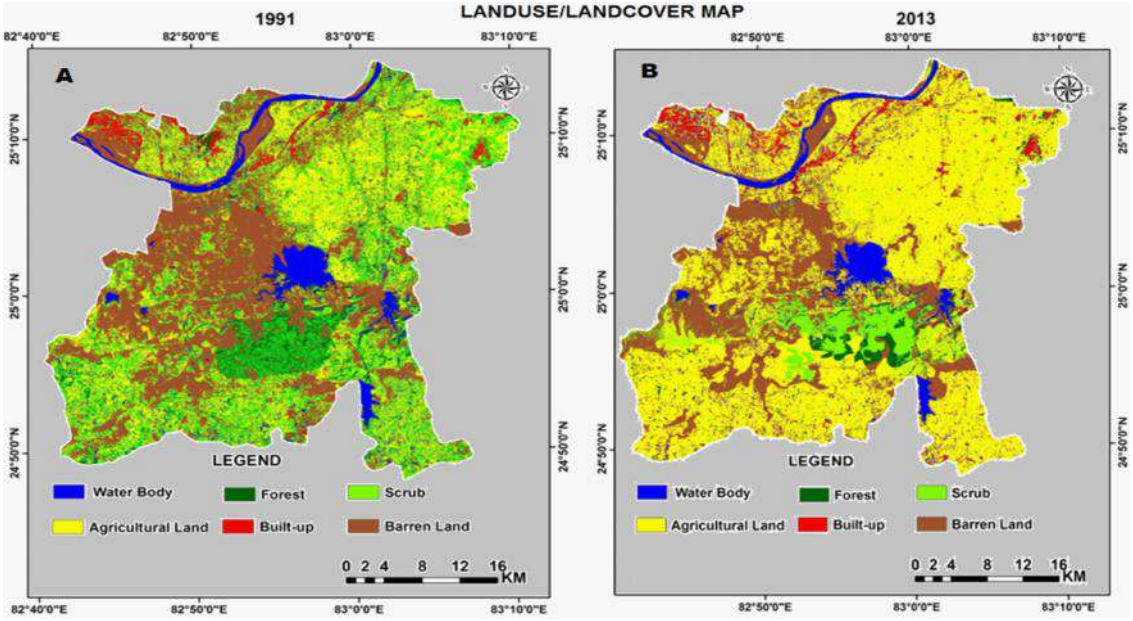


Figure 2 Land Use/ Land Cover

84 km^2 area during this period. Of this 0.63 km^2 has been gained from water bodies, 36.01 km^2 from dense forest, 225 km^2 from scrubland and 133 km^2 from barren land. However built-up land has gained a marginal,0.6 km^2 land from it. On the contrary scrubland, and barren land have had substantial reduction in their area. Scrubland has gained a slender 10.82 km^2 area from water body, dense forest and barren land, a significant proportion, 225.2 km^2 of its area has been converted into agricultural land. Likewise area under barren land has also reduced by 175 km^2 in 2013 much of which (133km2) has been converted into agricultural land.

Accuracy assessment

The reliability of any information derived from any satellite data depends upon the level of accuracy achieved in the classification of the image. According to Anderson the level of accuracy of any classified image has to be more than 85 percent for attaining a reliable map based on that information. Kappa coefficient and confusion matrix are the two most widely used tools for assessing the accuracy of the classified images. Table-3 provides the confusion matrix of the 2013 classified map. In all 130 samples for different land use/land cover classes were collected from the field using the hand held GPS in May 2015. The overall accuracy of the classified map is equal to 84.61 percent. The producer's accuracy ranges from a minimum of 70 percent for cropland to 100 percent for dense forest and water. Similarly the users accuracy is 100 percent for dense forest and water body whereas it is only 60 percent in case of barrenland. And the Kappa coefficient is estimated at 80.97 percent.

Conclusion

In the present study land use/ land cover change in Chunar Tehsil of Mirzapur District in Uttar Pradesh has been undertaken using Landsat Data between 1991 and 2013. The

Table 3: Confusion matrix and accuracy measures for 2013 classified map.

Reference	DF	SCR	AGRI	BRN	BU	WTR	Nri	User's Accuracy
DF	15	0	0	0	0	0	15	100.00
SCR	0	21	4	3	0	0	28	75.00
AGRI	0	2	28	0	1	0	31	90.32
BRN	0	2	6	16	0	0	24	60.21
BU	0	0	2	0	22	0	24	91.66
WTR	0	0	0	0	0	8	8	100.00
Ncj	15	25	40	19	23	8	130	
Producer's accuracy	100	84.00	70.00	84.21	95.45	100	Overall accuracy = 84.61 kappa coefficient (k) = 80.97	

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

Source: Calculated by the author from classified Landsat TM 5 and Landsat 8 Images

results show a substantial change in Land Use/ land cover in the study area in the period under study. While area under forests, scrub and barren land has registered a considerable decline there has been a sporadic increase in area under built up and agricultural land. This can be attributed to the growth in population that has necessitated the need for expansion of area under agriculture. A decline in forest cover is a cause of concern however reduction in barrenland indicates a positive development in land use in the area. Further the study also brings to light the viability of remote sensing in undertaking land use land cover change detection study. This is substantiated from the accuracy assessment result which is more than 80 percent in this case.

References

Anderson, J. R. et.al., 1976, A Land Use and Land Cover Classification System for use with Remote Sensor Data, Geological Survey Professional Paper 964, Washington, USA.

Boakye, E.et.al., 2008, Landsat Images for Assessment of the Impact of Land Use and Land Cover changes on the Barekese Catchment in Ghana, European Journal of Scientific Research, 22(2), pp. 269-278.

Cingolani, A. M., Renison, D., Zak, M. R., and Cabido, M. R., 2004, Mapping vegetation in a heterogeneous mountain rangeland using Landsat data: an alternative method to define and classify land-cover units, Remote Sensing of the Environment, 92, 84-97.

Costa, M. H., Botta, A., and Cardille, J. A., 2003, Effects of large-scale changes in land cover on the discharge of the Tocantins River, Southeastern Amazonia, J. Hydrol., 283, pp 206-217.

Manandhar, R., Odeh, I. O. A., and Ancev, T., 2009, Improving the accuracy of land use and land cover classification of Landsat data using post-classification Enhancement, J. Remote Sensing, 1, pp. 330-344.

Opeyemi, Z. A., 2006, Change Detection in Land Use and Land Cover Using Remote Sensing Data and GIS: A Case Study of Ilorin and its Environs in Kwara State, MSc. Thesis, Ibadan University, Nigeria.

Singh, A., 1989, Digital change detection techniques using remotely-sensed data, Int. J. Remote Sensing, 10 (6), pp. 989-1003.

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Land Use Pattern in Azamgarh District (UP): A Geographical Analysis

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Abstract

The agricultural land use refers to primary use of geographical area for different purposes and activities. Land use is the surface utilization of all developed and vacant land on a specific point at given time and space (Mandal, 1982). It is a very important indicator of agricultural development. The land use analysis is an important aspect of geographical studies which provides proper guidelines for regional planning and development and also for future orientation of agriculture. Therefore, the study of land use and its change has been carried out by many researchers and geographers at national and international level. The study reveals that marginal changes have occurred in all land use categories except for the proportion of area under forests which has very low increase from 0.02% in 1995 to 0.03% in 2014. Net sown area to total area has slightly declined from 72.81% in 1995 to 71.81% in 2014, while area under non-agricultural uses has negative change which decreased from 16 % in 1995 to 9.19 % in 2014. The main objective of the study is to find out spatio-temporal change of land use pattern in Azamgarh district. The present study is based on secondary data. This data has been collected from District Agriculture Office and District Statistical Magazine for the year 1995 to 2014. After analyzing the data different relevant diagrams and maps are prepared.

Key words: *land use, resource, agriculture, barren land, fallow land, net sown area.*

Introduction

Today the research focus is on the dynamics of land use. Land represents an important resource for the economic life of a majority of people in the world. The way people handle and use land resource is decisive for their social and economic well-being as well as for the sustained quality of land resources. Land use is perhaps the most basic concept of agricultural economy. It is the key to an understanding of geographic adjustment of agricultural

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resources. Moreover, regional land use patterns are the geographical expression of a large number of societal decisions made at different times for very different reasons which are responsible for an expansion of one category of land use at the cost of the other. Although Land use patterns, are directly related to physical controls yet, there are several human and economic elements, which are responsible for land use and its distribution. It is the set of varying social values and certain institutional controls, which create different patterns of land use within the limitations imposed by different agro-physical controls. The impact of physical factors is subtle and interwoven with spatio-economic forces. Population increase leads to a major shift in the pattern of land use. Land use means utilization of land in a particular area. Land use pattern includes types of land and how much land is being utilized under different uses. Land is basic resource of human society and land use is the surface utilization of all developed and vacant land on specific point at a given time and space. It is a systematic arrangement of various classes of land on the basis of certain similar characteristics mainly to identify and understand their fundamental utility, intelligently and effectively satisfying the needs of human society (Chowdaiah, 2001).

Its importance also increased due to population pressure which increased the demand for food and raw materials. Thus, the need for optimum utilization of land in an integrated manner has assumed greater relevance. Therefore, scientific regional intensive and proper use of every parcel of land has become essential. Lands planning on micro level, based on land use surveys is the first step in putting our lands to the maximum use. The nature and intensity of land use is closely related to the technology adopted by man. Extension of agriculture land with the help of technology may cause considerable changes in land use. Geography deals with the spatial relationship between these aspects and planning. This is because land use changes to meet available demands of the land by the society in its new ways and conditions of life. The demands for new uses of land may be inspired by a technological change or by a change in the size composition and requirements of a community. Some changes are short linked whereas other are more constant (Jackson, 1963).

The study of land utilization is of immense value in tracing out the past use of land and its future trend. Only through the study of past land utilization can one be able to predict its future use and evolve land use planning of a particular region. Land use in any region of the world varies due to the variations in the distribution of sunshine, rainfall, topography of the land, drainage conditions, and soil characteristics of the region. The spatial differentiation in these elements affects the purpose of land use for agriculture. Before the using of land, we have to make proper planning. The practical purpose in the use of land is for growing /cultivating crops in harmony with the environment. This is to record, the distribution of land, put to various uses in different environmental and socio economic conditions and to record the changing needs and pressure of an ever increasing population. The main function of planning is to frame a guide for land use in such a way that all the available land resources are put to the most beneficial use together with their conservation for future generation. The meaning of land use sometimes restricts to various uses of land, but

in its use, we find over use, under use and misuse, which assist us to plan in order to attain maximum utilization of land.

Objectives

The present study is aimed at the following objectives:

1. to classify and analyze the various land use categories.
2. to find out the development block wise variations in land use pattern.
3. to focus on the changes which have taken place in land use pattern in Azamgarh District.

Data source and methodology

The study is based on secondary data taken from District Statistical Magazine of Azamgarh District published by Economic and Statistics Division, State Planning Institute, Lucknow, Uttar Pradesh. Land use change has been analyzed by block level considering the data of 1995 to 2013-14 year and the land use categories are based on the census classification. The data has been classified, tabulated, processed, analyzed and interpreted by applying suitable statistical methods and cartographic techniques. Development block-wise proportion of area under different land use categories has been calculated and shown on map with the help of pie diagrams for both the time periods.

Study area

Azamgarh district (25°38'- 26°27' North latitudes and 82°40' - 83°27' East longitudes) is located in the mid-eastern part of Uttar Pradesh. It came into existence in 1665. The district's name Azamgarh is coined on the name of its founder Azam Khan. The district shares its boundary with Maunath Bhanjan district in the east, Ghazipur (Fig. 1) district in the south east, Jaunpur district in the south west, Ambedkar Nagar in the north west, Gorakhpur in the north and Sultanpur district in the west. The River Ghaghara separates Azamgarh from Gorakhpur and Deoria district (Fig. 1). It covers an area of about 4,053 square km. which is 1.80 percent of the size of Uttar Pradesh state. The population of the district was 3939916 comprising of 1950415 males and 1989501 females in 2001. In the 2011 census, Azamgarh district had a population of 4616509 of which males constituted 2289336 and females 2327172.

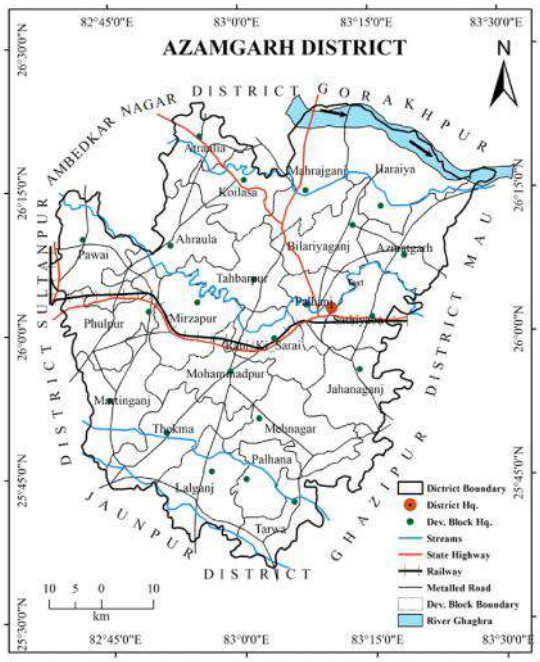

Fig.1

Classification of land use

Land use classifications is the systematic arrangement of land on the basis of certain similar characteristics mainly to identity and understand their fundamental utilities intelligently and

effectively. Census of India has classified land utilization into nine different categories, but in the present study these have been grouped into five major land use categories as the percentage of area under individual categories is relatively insignificant [Source: Indian Agriculture in brief (1997-98 edition) Directorate of Economics and Statistic]. On the basis of the statistical data abstracted from the sources referred, Azamgarh district may be divided into five major land use categories.1. Area under forest 2. Area not available for cultivation 3. Other uncultivated waste land excluding fallow land, 4. Fallow land, 5. Net sown area, (area under other categories are negligible).

In overall Land use pattern of Azamgarh district in 2013-14, forest land had occupied 0.03 percent, Land not available for cultivation 16.09 percent, other uncultivable waste land constituted 3.23 percent, fallow land 9.83 percent and net sown area covered 70.82 percent area of total reporting area (Table:1).

Table : 1 Land use Pattern in Azamgarh District- 1993-94 to 2013-14.

Sr. No.	Land use category	Total Area (in hect.)	1993-94 (in %)	Total Area (in hect.)	2014-15 (in %)	Changes (in %)
1.	Forest Land	101	0.02	110	0.03	0.01
2.	Area not Available for Cultivation	58037	13.75	68236	16.09	2.34
3.	Other Uncultivable Waste Land excluding fallow land	9172	3.86	13707	3.23	-0.63
4.	Fallow Land	40323	9.56	41670	9.83	0.27
5.	Net Sown Area	307252	72.81	300335	70.82	-1.99
	Total Reported Area	421985	100.00	424058	100.00	

Source: Computed from District Statistical Handbook, Azamgarh District. Uttar Pradesh, 1995 to 2014-15. (www.updesh.up.nic.in/spatrika)

Development block wise land use pattern

The land use pattern of the region under study differs from block to block due to the locality and physical condition. The existing pattern of land use is shown in Fig. no. 4. There is change in physiography, soil types, rainfall and geology. All these factors played important role in determining the agricultural practices.

1. Area under forest

This category include any land classed or administered as a forest under legal terms. Proportion of area under this land use category has increased sharply from 101 hectares (0.02%) of the total geographical area of Azamgarh District during 1993-94 to 110 hectares (0.03%) during the period of 2013-14. Some development blocks have positive changes like Atraulia, Azmatgarh, Pawai, Lalganj and Tarwa and some blocks have no changes. It has increased due to some measures taken by the government to prevent deforestation and maintain ecological balance. Government has taken the said measures due to international pressure to control global warm-

ing. Awareness among the people is also considered an important factor for the increase in afforestation.

2. Area not available for cultivation

This category includes (i) the land put to non-agricultural use and (ii) Barren and uncultivable land (i) The land put to non-agricultural uses- A large part of land is not available for cultivation but these lands are considered to be arable land. Non-agricultural uses land covers a wide range of other uses. These lands are used for inhabitation, factories, roads to be used for transportation, canals and reservoirs etc. (ii) Barren and uncultivable land- This category of land includes all such land which are practically useless or unproductive and virtually unfit for cultivation. This area is covered by sandy soils where not a single blade/row of vegetation grows.

Table : 2 Development Block Wise Land use pattern in 1993-94.

Sl.	Development Block	Total area in hect.	Fallow Land		Area not available for Cultivation		Other Uncultivated waste Land		Net Sown Area	
			hect.	percent	hect.	percent	hect.	percent	hect.	percent
1.	Atraulia	16016	1207	7.54	1805	11.27	517	6.04	12030	75.11
2.	Koilsa	16539	1226	7.41	1875	11.34	560	4.32	12720	76.91
3.	Ahiraula	19602	2115	10.79	2628	13.41	445	4.10	14046	71.66
4.	Mahrajganj	24006	1795	7.48	4576	19.06	724	4.19	16625	69.25
5.	Haraiya	26391	3928	14.88	4061	15.39	866	5.04	17073	64.69
6.	Bilariyaganj	19927	1082	5.43	2307	11.58	261	2.11	16105	80.82
7.	Azmatgarh	20535	1413	6.88	2742	13.35	633	4.19	15519	75.57
8.	Tahbarpur	17626	1098	6.23	2001	11.35	527	5.20	13607	77.20
9.	Mirzapur	16556	946	5.71	2335	14.10	801	7.53	12024	72.63
10.	Mohammadpur	19192	2574	13.41	3012	15.69	370	3.54	12924	67.34
11.	Rani Ki Sarai	13901	1014	7.29	1920	13.81	423	5.08	10259	73.80
12.	Palhani	12728	739	5.81	1811	14.23	435	4.86	9557	75.09
13.	Sathiyaon	16416	1336	8.14	1754	10.68	215	2.49	12915	78.67
14.	Jahanaganj	18089	1311	7.25	1812	10.02	193	2.32	14544	80.40
15.	Pawai	20699	2606	12.59	3004	14.51	623	5.02	14043	67.84
16.	Phulpur	19120	2774	14.51	2666	13.94	336	3.82	12942	67.69
17.	Marti nganj	23235	2360	10.16	3593	15.46	128	1.91	16834	72.45
18.	Thekma	22768	2759	12.12	3532	15.51	345	2.73	15854	69.63
19.	Lalganj	24707	2726	11.03	3493	14.14	164	2.87	17768	71.91
20.	Mehnagar	25494	1647	6.46	3543	13.90	342	3.17	19492	76.46
21.	Tarwa	26204	3305	12.61	2603	9.93	226	2.93	19522	74.50
	Total District	421985	40323	9.56	58037	13.75	9172	3.86	307252	2.81

Source: Computed from District Statistical Handbook, Azamgarh District Uttar Pradesh, 1995.

In Azamgarh district 1993-94 the area not available for cultivation was 58037 hectares (13.75%) but in 2014-15 it is 68236 hectares (16.09%). This land use category has increased for which the main reason is population pressure like urban centers, expansion of residential areas both urban and rural, increase in transport facilities etc. Under this category, almost all development blocks are showing increasing trend. In a study of this region in 1993-94 the highest area not available for cultivation is found in Maharajganj block 4576 hectares (19.06%) and lowest is Tarwa block 2603 hectare (9.92%), while in 2013-14 the highest area not available for cultivation is found in Maharajganj 5122 hectare (21.68%), Haraiya 5255 hectare (21.40%). Here the main reason is the flow of Ghagra and chhoti Saraju rivers. The lowest area not available for cultivation is in Jahanaganj, 2065 hectare (10.64%) and Sathiyaon, 2303 hectare (12.47) as show in (Table: 2, 3 & Fig2, 3.). Here the main reason are urban centers, increase in transportation facilities, canals, reservoirs, etc.

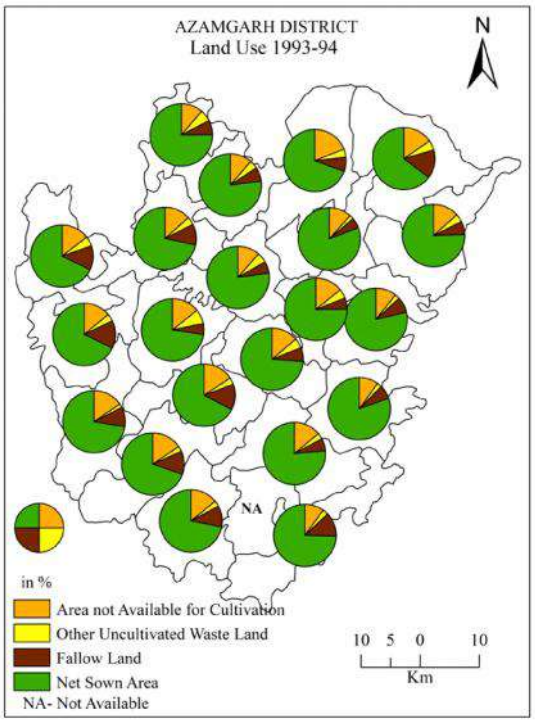

Fig: 2

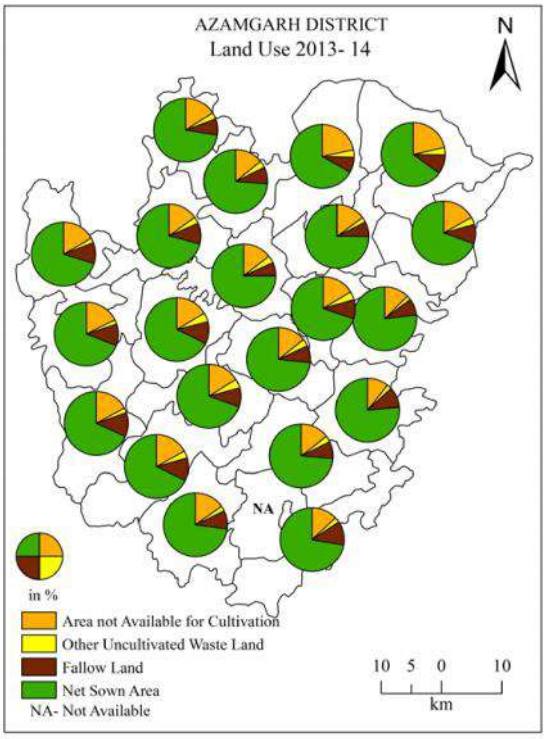

Fig: 3

3. Other uncultivable waste land (excluding fallow land)

This category consists of three types of land (a) barren cultivated wasteland (b) Pastures (c) Area under bush, forest and garden. a) Barren Cultivated wasteland- As the term indicates, the land under this category may be put for cultivation but they are lying waste on account of a number of reasons. The reasons may be enumerated as: encroachment by weeds, Floods and erosion, Poor drainage system, Scarcity of water etc. (b) Pastures - Pasture land include all grazing lands whether they are permanent pastures and meadows or not. Com-

mon village and grazing land within forested area shall be under this head. (c) Area under bush, forest and garden- This denotes all cultivable land, which is not included in net sown area but is put to some agricultural use. Most of these lands-are used to grow trees like mango, sheesham, babul and eucalyptus. In Azamgarh district 1993-94 the other uncultivated waste land was 9172 hectares (3.86%) but in 2013-14 it is 13707 hectares (3.23%) for which the main reason is undulating and dissected topography, soil erosion due to seasonal streams, etc. In 1993-94 the highest of the category of other uncultivated waste land is found in Mirzapur block, 801 hectares (7.53%), Atraulia, 517 hectares (6.04%), Tahbarpur, 527 hectares (5.20%) and lowest in Martinganj, 128 hectares (1.91%) and Bilariyaganj, 261 hectares (2.11%). While in 2013-14 the highest of other uncultivated waste land is found in Mohammadpur 937 hectare (4.72%), Mirzapur 758 hectare (4.64%), Palhani 631 hectare (4.27%) as shown in (Table: 2, 3 & Fig2, 3.). In this development block barren cultivable wasteland, pasture, bush, forest and garden are found in a large part of this area. The lowest uncultivated waste land is found in Sathiyaon (2.14%). In the study region the area of "other uncultivated waste land" is increasing for which the main reason is that the pasture land, forest trees, grooves and agriculture waste land has increased.

Table : 3 Development Block Wise Land use pattern in 2013-14.

Sl. no.	Development	Total area (in hect.)	Total Fallow Land		Area not available for Cultivation		Other Uncultivated waste Land		Net Sown Area	
			hect.	percent	hect.	percent	hect.	percent	hect.	percent
1.	Atraulia	14306	1191	8.33	2264	15.83	477	3.33	10367	72.47
2.	Koilsa	16658	1421	8.53	2359	14.16	591	3.55	12283	73.74
3.	Ahiraula	20174	2145	10.63	3018	14.96	690	3.42	14311	70.94
4.	Mahrajganj	23627	1873	7.93	5122	21.68	880	3.72	15747	66.65
5.	Haraiya	24554	2414	9.83	5255	21.40	921	3.75	15963	65.01
6.	Bilariyaganj	19091	1452	7.61	2830	14.82	495	2.59	14302	74.91
7.	Azmatgarh	18162	1783	9.82	3041	16.74	695	3.83	12642	69.61
8.	Tahbarpur	19650	1323	6.73	2853	14.52	734	3.74	14736	74.99
9.	Mirzapur	16350	1819	11.13	2691	16.46	758	4.64	11078	67.76
10.	Mohammadpur	19848	1939	9.77	3173	15.99	937	4.72	13796	69.51
11.	Rani Ki Sarai	16026	1398	8.72	2285	14.26	571	3.56	11770	73.44
12.	Palhani	14794	1445	9.77	2405	16.26	631	4.27	10311	69.70
13.	Sathiyaon	18464	1566	8.48	2303	12.47	395	2.14	14198	76.90

14.	Jahanaganj	19406	2047	10.55	2065	10.64	474	2.44	14817	76.35
15.	Pawai	20052	2179	10.87	3337	16.64	467	2.33	14062	70.13
16.	Phulpur	19256	2107	10.94	3381	17.56	441	2.29	13319	69.17
17.	Marti nganj	22791	2845	12.48	3855	16.91	569	2.50	15517	68.08
18.	Thekma	21751	2527	11.62	3645	16.76	822	3.78	14755	67.84
19.	Lalganj	20951	1965	9.38	3159	15.08	556	2.65	15259	72.83
20.	Mehnagar	18872	1658	8.79	2732	14.48	575	3.05	13903	73.67
21.	Tarwa	22374	2678	11.97	2935	13.12	585	2.61	16170	72.27
22.	Palhna**	14433	1530	10.60	2298	15.92	392	2.72	10213	70.76
Total District		424058	41670	9.83	68236	16.09	13707	3.23	300335	70.82

** Palhna is newly created Development block.

Source: Computed from District Statistical Handbook, Azamgarh District 2014-15, Uttar Pradesh.

4. Fallow land

Term fallow land is applied to lands not under cultivation at the time of reporting, but which have been sown in the past. The duration of period for which land remains fallow is different in different parts of the study region. This land use category consists of "Current fallow land" and "other fallow land". Current fallow means the lands, left unsown during the current agricultural year to allow them to regain fertility and also that which remained uncultivated in the short term for want of moisture and economic reasons. Other fallow lands comprise all land which was taken up for a period of not less than one year and not more than five years. However, in the present study both the sub-categories are grouped together. This includes all land, which was taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five years. The reason for keeping such land fallow may be one of the following viz., poverty of the cultivators and inadequate supply of water material, climate, silting of canals and rivers, and remunerative nature of farming. Fallow land is a part of cultivated land but it differs from net sown area in the sense that, at the time of reporting the area covered by this class was without crops, although it was brought under cultivation during the previous agricultural season. The area under this category has declined from 9.56% in 1993-94 to 7.84 % in 2013-14. Azamgarh district has a proportion of fallow land of an average of 7.84% to the total geographical area. In 1993-94 the highest fallow land is found in Haraiya (14.88%) and lowest in Palhani block (5.81%), while in 2013-14 the highest fallow land is found in Martinganj block (12.48%) and lowest in Tahbarpur block (6.75%) with negative change in phulpur block (-3.57%) show in (Table: 2, 3 and Fig 2, 3.). In Azamgarh district the fallow land is decreasing for which the main reason is the high use of fertilizers, an increase of irrigation facilities and also the trend to leave fallow land for farmers.

5. Net sown area

Net sown area is the land which is being actively filled for raising of crops. This land use category and the follow land together constitute the extent of cropped land in the region and therefore are of vital significance in studies relating to agricultural geography. The net area sown is the actual area under crops, counting areas sown more than once in the same years, only once. Net sown area represents the extent of the cultivated area actually sown during the agricultural year. It may be reoffered to as net cropped area also. The extent of net sown area has decreased from 72.81 percent to 70.82 percent during 1993-94 to 2013-14. There is a marked variation among the development block of Azamgarh District with respect to the net sown area. Net sown area has declined for which the main reason are development works like construction of road, canal and agro-industries. In 1993-94 highest net sown area found in Bilariyaganj block (80.82%) and lowest in Haraiya block (64.69%) while in 2013-14 the highest net sown area is found in Shatiyaon (76.90%), and lowest in Hariya block (65.01%) shows in (Table: 2, 3 and Fig 2, 3.). In our study the reason net sown area has decreased is because irrigation has not improved, so the barren land, fallows land and tree or groves is increasing. Soil characteristics are the main factors for variation in the distribution of net cultivated area in this region and the other factors which may be accounted for the continuing population pressure, a substantial rise in prices of individual commodities, an increasing demand for food grains, government efforts in extension of services to the farmers etc.

Changes in land use pattern

Changes in land use pattern is the outcome of physical and non-physical environment. Any change in physical and non-physical environment leads to changes in the land use pattern (Riar 2000). Changes in land use pattern provides an index for measuring the stages of agricultural development in an area. Population growth and urbanization are the main instruments of change in land use patterns. Other important factors include improvements in road accessibility, increasing demand for food grains, increasing demand of land for settlement purposes etc. All these factors are responsible for changes in land use pattern in the study region during the 1993-94 to 2013-14.

Table : 4 Changing Land use pattern in Development Block wise, 1993-94 to 2013-14.

Sl.no	Name of Development Block	Area not available for cultivation	Other Uncultivated waste Land	Fallow Land	Net Sown Area
1.	Atraulia	4.56	-2.70	0.79	-2.65
2.	Koilsa	2.82	-0.77	1.12	-3.17
3.	Ahiraula	1.55	-0.68	-0.16	-0.72
4.	Mahrajganj	2.62	-0.47	0.45	-2.61
5.	Haraiya	6.01	-1.28	-5.05	0.32
6.	Bilariyaganj	3.25	0.48	2.18	-5.91

7.	Azmatgarh	3.39	-0.37	2.94	-5.97
8.	Tahbarpur	3.17	-1.47	0.50	-2.21
9.	Mirzapur	2.36	-2.90	5.41	-4.87
10.	Mohammadpur	0.29	1.18	-3.64	2.17
11.	Rani ki Sarai	0.45	-1.52	1.43	-0.36
12.	Palhani	2.03	-0.60	3.96	-5.39
13.	Sathiyaon	1.79	-0.35	0.34	-1.78
14.	Jahanaganj	0.62	0.13	3.30	-4.05
15.	Pawai	2.13	-2.70	-1.72	2.28
16.	Phulpur	3.61	-1.53	-3.57	1.48
17.	Martinganj	1.45	0.59	2.33	-4.37
18.	Thekma	1.24	1.05	-0.50	-1.80
19.	Lalganj	0.94	-0.21	-1.65	0.92
20.	Mehnagar	0.58	-0.13	2.33	-2.79
21.	Tarwa	3.18	-0.32	-0.64	-2.23
22.	Palhna**	0.00	0.00	0.00	0.00
Total District		2.34	-0.63	0.27	-1.99

** Palhna is newly created Development block.

Source: Computed from District Statistical Handbook, Azamgarh District Uttar Pradesh, 1993-94 to 2014-15.

The study region has undergone considerable changes in land use patterns during these period. Forest land has increased from 101 hectares (0.02 percent) in 1993-94 to 110 hectare (0.03 percent) in 2013-14 with positive change of 0.01 percent and it is also noticed that forest land has increased during 1993-94 to 2013-14. Area not available for cultivation has increased from 13.75 percent in 1993-94 to 16.09 percent in 2013-14 with positive change of 2.34 percent. Other uncultivable wasteland has declined from 3.86 percent to 3.23 percent during 1993-94 to 2013-14 with negative change of -0.63 percent. Fallow land has experienced a positive change of 0.27 percent increasing from 9.56 percent in 1993-94 to 9.83 percent in 2013-14. The Net sown area in the study has decreased from 307252 hectares (72.81 percent) to 300335 hectares (70.82 percent) during 1993-94 to 2013-14 with negative change -1.99 percent show in (Table: 4).

Conclusion

A change in the land use implies a change in the proportion of area under different categories at two different times. The changes in land use of district Azamgarh have been analysed for a period of twenty years from (1993-94) to (2013-14) and the possible

causes of changing land use are interpreted. These phenomena of changes occur within particular physical, social and technological environments. Forest area increased from 101 hectares to 110 hectares (0.03%) during the period of analysis. The area under forest has very low increase which shows that the effect of Social Forestry Programme on these district. The average of the area under this category is considerably low compared to the state. Area not available for cultivation was 16.09% of the total geographical area in Azamgarh district. The lowest area, not available for cultivation to the total geographical area of the study region, was observed in Sathiyaon block (12.46%) whereas, the highest area under this group was noticed in Phulpur block (17.46%) during 1993-94 to 2013-14. Total area under the other uncultivable wasteland was 3.23% in 2013-14. Regional distribution under this land use category varies from 3.86% to over 3.23%. In the study region, the other uncultivated waste land is decreasing for which the main reason is that pasture land, trees, grooves and Agriculture waste land has increased. During 1993-94 fallow land is decreasing for which the main reason is the high use of fertilizer, an increase of irrigation facilities and also trend to leave land fallow by farmers. About (-1.99%) net sown area has seen change in the district during the period of 1993-94 to 2013-14. The main reason is that irrigation facilities are not better, so the barren land, fallow land and tree or groves is increasing. In this context it can be assumed that physical environments like climate, soil, terrain and slope, which influence agriculture, are not likely to change so drastically as to influence the change to a greater extent. However, in a short span of a decade, changes in social, technological environments can effect substantial changes in the patterns of land use. As an example, expanding irrigation, introducing improved varieties of seed and by using plant protection measures, new farm implements, improvement in road network, incentives by Government Agencies and initiatives by the cultivators are capable of bringing a lot of change in the agriculture patterns and this cycle of changes, provide individually, to the changed land use.

References

Chowdaian, C., 2001, Productive land and its Misuse: A comparative analysis of Big, Small and Marginal farmers in Mysore District'. *The Deccan Geographer*, vol. 39. No.1-p-76

District Statistical Handbook, Azamgarh, 1995 and 2015, http://updes.up.nic.in/spatrika/

Kaur, D., 1991, Changing Patterns of Agricultural Land use, Rawat Publications, Jaipur, Pp-50.

Jackson, I.N., 1963, Survey for Town and country planning, Hutchinson University Library, London.p-109.

Khan, M.S.A., 2006, Changing land use pattern and Rural Transformation in Eastern Uttar Pradesh, Ph.D. Thesis, AMU, Aligarh.

Kumar, J., 1986, Land use Analysis: A case study of Nalanda District, Bihar Inter-India Publications New Delhi-p.1

Mandal, R.B., 1982, Land Utilization: Theory and Practice, Concept Publication, New Delhi, Pp1-21.

Mishra, B. N., 1990, Land utilization and management in India, Chugh.

Nageshwara, R.K. and Vaidyanathan, R., 1981, Landuse capability studies from Aeial Photo-Interpretation -A case study from Krishna Delta, *Geographical Review of India*. Vol.43, No.3 pp-226-236.

Rao, V. L. S. P., 1959, The role of geographers in Land Use Planning, *Bombay Geographical Magazine*, Vol. VI-VII, No.2, pp. 39-44.

Rayamane, A.S., 2001, Changing landuse profile in Belgaum district (Karnataka): A SpatioTemporal Analysis, *The Deccan Geographer*, Vol.39, No.2.June-Dec.2001, Pp88-96.

Siddiqui, A.M., 2011, Spatio-Temporal Analysis of Landuse change in Budaun District, UP, *National Geographical Journal of India*, Vol. 57, Pt. (1), Pp.79-88.

Singh, A.K. and Dwivedi Amrita, 2012, Population pressure and Land use changes in Chakia block of Chanduli District, UP., *National Geographical Journal of India*, Vol. 58, Pt. (2), pp.107-116.

Tupe, B.K., 2014, Land use and cropping pattern changes- A case study of Akole Tehsil in Ahmadnagar District (M.S). Ph.D. Thesis, Ahmadnagar college.

Vaidya B.C., 1997, Agricultural landuse in India: A study in Yashoda Basin. Manak Publication, New Delhi, Pp 81-100.

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Histogenesis and Urban Growth in Supaul Town, Bihar

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Abstract

Histogenesis and urban growth of any town passes through several phases of development, phase adds something for its different dimensions. It depends upon the human-environment relationship in plain of resource base and its interaction, that how much any phase of growth is either boon or bane for that area. In the present study an attempt is made to analyse the history of Supaul town in Kosi plain wherein Mithila culture survived in upheaval situation of turbulent river. Supaul town luckily came under Supaul sub-division as early as in 1870s than the other towns of this region. But the natural factors especially swinging course of Kosi River abruptly broke all the linkages and communication for a significant period up to independence and the administrative edge could not be plugged in for its betterment. The objective of this paper is to find out the significant milestones and changes through its histogenesis and evolution. Supaul town has a long historicity, though geographically it often faces constraints either in connectivity or development. A new hope is likely to usher in town after integration of modern infrastructures and peoples participation. Both primary and secondary data have been analysed here with the help of Arc GIS 9.3 to analyse the pattern of histogenesis. Existing status of urban growth is measured through extensive field investigation survey, as well as field observation and cartographic techniques which are used for the interpretation of the study.

Key words: *histogenesis, urban growth, resource base, development.*

Introduction

Histogenesis of town if really unveils at the global level it would provide a plenty of information on interesting factors that created the ancient towns in different parts of the world. Right from Bronze Age to Iron Age each have

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some common aspects while some specific characteristics in its genesis are viewed distinctively as per varying special units also. In Greek civilisation a specific defensive citadels as well as artefact design were some of the important features in cities which were common to other places but Greeks had unparallel architecture and security aspects of town. Egypt, Mesopotamia, Indus and other contemporary towns and cities were well planned and situated at node of accessible point of mobility of goods and services. Cultural heritage as defined in the Helsinki conference (1995) covers all the manifestation and messages of intellectual activity in our environment.The evolution of landscape focuses mainly on key processes that are influential in the formation of the landscape.

All processes were not equally acting through the landscape that became significant in their effects, especially with respect to change. Other processes may cause localized, usually short-lived changes but do not contribute to the overall pattern of change (Bessey, 2002). Duncan (1961) emphasizes that how external (environmental) and internal (social) interrelationships operated together to promote the growth of towns in the pre-industrial era.

Study area

The study area, Supaul town is located (26^0 5' 20" N to 26^0 8' 24" N Latitude and 86^0 34' 16" E to 86^0 37' 57" E Longitude) in the fertile new alluvial land of Kosi flood plain, that is situated towards south of the river Kosi (a tributary of river Ganga). It sprawls around the vital junction of roads connecting Madhepura, Saharasa, Madhubani and Nepal in north-eastern Bihar. It lies on the main urban axis of Supaul district headquarter and is connected with four major roads Supaul-Saharasa road, Arariya via Supaul to Madhepura (SH 76), Supaul-Madhepura road and Supaul to Nebua road. Mansi to Saharasa railway extends up to Supaul district under north eastern railways. The population of Supaul town is 65,445 persons (Census 2011). Supaul as a district was created in 1991 from the neighbouring district of Saharasa. Supaul district touches the international boundary of Nepal in north, Madhubani district in west, Araria district in east and Madhepura district in south.

Data base and methodology

In the present study, historic appraisal and development of the town is interpreted through topographical sheets of two different time period. This study is based on both primary and secondary sources of data. Primary data is collected by a comprehensive field investigation survey carried out during the year 2016-17 to reveal the current status of town and availability of civic amenities. Extensive field checks and personal observations have been done in the study area to track out the pattern and trend in the course of settlement development, population growth, emergence of urban nods with different institutions like education, health, transportation, trade and commerce, recreation and sports facilities. Secondary data were collected through published/ unpublished records at Municipal council, PWD and Census of India etc. Google Earth Satellite imagery of 1 metre resolution was geo-referenced with the toposheet no. G45/12 on the scale of 1:50000 that was also mosaiced. The map was digitised on Arc GIS 9.3 software.

Objectives

The major objective of the study is to understand the histogenesis and trend of urban

growth of the study area are as follows:

1. To study the temporal analysis of growth of the town regarding its histogenesis.
2. To understand availability of urban facilities and constraints on its development.
3. To analyse the causes and consequences of proposed and prevailing developmental works in town.

Histogenesis and urban growth

Supaul town has a rich history of its own. The district of Supaul had been a part of Mithilanchal since the Vedic period. The area has been referred to as the fishery area (Matsya Kshetra) in the Hindu mythology. The two oldest democracies namely Angutaran and Apadnigam are known for their existence during the Buddhist era, which comprised today's area of district Supaul. It is also called Videha ruled by Mithi and later it came under Tirabhukti in Gupta period. (District Gazetteer, Saharasa). Aryans migrated from Sadanira to this region in their early expedition (Satpath Brahman).

Ancient period

There was a small Janpad named Apana, in Anguttarup situated north of the famous republic of Vaishali. It included a portion of Saharasa from which the district Supaul was carved out. Older sites are completely eroded by Kosi namely Bitarpur, Budhiagarhi, Bhudhadi, Pithahi, Mathahi etc. that were associated with Buddhism. Local legends confirmed that Lord Buddha and Lord Mahavira passed through the district in course of their missionary travels and delivered their sermon. Both Anga and north Bihar (including Supaul) continued to be independent till early part of 6th centaury B.C. Though Anga seems to have passed into the hands of the Magadha sovereignty, Anguttarup remained independent until it was finally conquered by Azatshatru.

In the last decade of this century a bourd of 58 punch mark coins of the Maurya period was discovered. The Maurya rule in this area stands confirmed by a Mauryan pillar at Sikalig on the Banmankhi-Forbesganj road, under the Kisangani police station. Since Saharasa was a boarder district, even in those days the Mauryan rules apparently took special care to guard its frontiers. During Sunga and Kanva no major political change happened in the area. Within Gupta period (320AD) entire north consolidated as Tirabhukti (province) with its capital at Vaishali. Hence forward province came to be known as Bhukti and district as Vishayas. In the north Bihar there were Pundrabhukti including portion of Saharasa of which Supaul district is a part.

Medieval period (1097-1765)

Decline of Palas authority in Bihar and Bengal was followed by the establishment of Karnat in Mithila and the Sena dynasty in Bengal. Both the Karnats and Senas claimed authority over portions of Supaul and often entered into armed conflict. Nanyadev the first of karnate extended his influence from Champaran to Purnia, probably the two chief (Nanydev of karnate and Vijay sen of Sen dynasty) were allies who fell into disagreement over division of territory. The Deopana inscription of Vijaysen indicates that Nanyadev was defeated and imprisoned somewhere in Supaul district. It was Gangadev who liberated him. The Sonkar inscription of Vallalsen proves that his rule extended upto the district of Bhagalpur. The Gandhavarya Rajputs are said to have acquired power and ruled here who traced their descent from the ruling chief of Tirhut. The en-

tire Saharsa district was dotted with small chieftainships created by both Hindus and Muslims. Even in the early part of the Mughal rule they ventured in north Bihar and the central authority of Bihar. Afghans were opposed to the establishment of the authority. The Karranis and the Afghans in collusion with the local Rajput rules and petty chief had made this district the centre of revolt. Todermal made the revenue settlement of Suba Bihar in 1582.

British period (1765-1947)

During this period before (1875) it was not under grip of flood. It was endowed with a nice vegetative cover with fertile land and full grown mango orchards and agriculture fields. Since 1875 Kosi river started westward shifting and gradually came in this town in 1938, as it is clearly evident in fig.1 which was regular from 1938 to 1944. British influence was felt in the town on its flooded landscape. Britisher S.C.William might have established a church there. It was embanked for flooded water. Later it became a ring dam presently known as (ring road) along an off suit branch of mighty river Koshi known as Gajana river. William High school on the bank of Gajana river is the eye witness of British establishment here. Similarly Public library, Jail, Court, Lal Kothi structures still exist. A public library was established in 1884 wherein officers used to discuss the then prevalent scenario of town. It was the library from where local officers and planner dreamt about William school and Rastriya Sarvjanik Mela Samiti. Supaul was declared as subdivision as early as in 1861. Since then a number of institutions have emerged on Supaul horizon. Britisher established district that had acquired significant importance (Census of India 1981). Broad gauge railway track passes from the town that goes from Saharasa to Raghopur railway station. Lal kothi presently situated in ward no.-8 beside, *Nau- anna marg* worked earlier as *Kachahari.* But the innumerable branches of Kosi set the huge task on the fate of people in later years. It often used to break the connectivity of town. Due to water interspersed no consolidation of landscape got accelerated that too very slowly rather. A huge track of vegetation got converted into grasses and scrubs that were seen monotonously and somewhere barren sandy track dominates with the fertile soil also. Kas, pater, etc were boon to the owners of sandy tract.

Communications and transportation

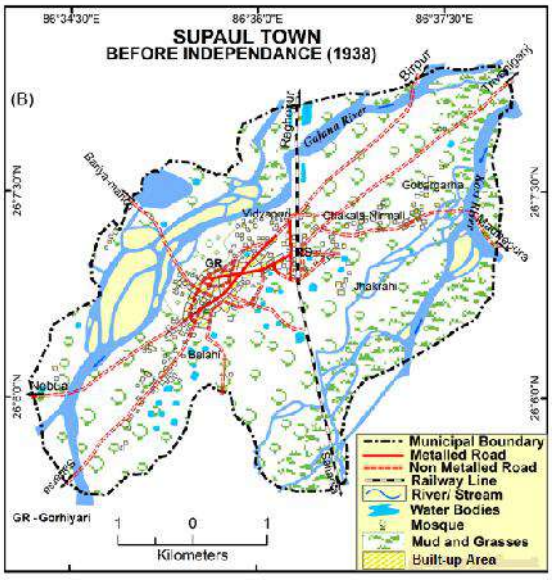
After 1875 Kosi river severely affected the means of communication, railways, roadways and waterway. Fig.1 clearly shows the grim situation of transportation and communication after ingression of devastating Kosi River in this town. Now the earlier landscape which was integrated and connected with surroundings with whatever means or route were available started facing onerous challenge of flood furry.

Important roads of this period include Madhepura to Supaul (21 miles) and Supaul via Pratapganj to Birpur on the Nepal frontier (37 miles). Few of these roads were metalled but covered with mango and banyan tree shed. Roads were grappling with many gaps and comprised marshy track often in rainy season. Many of the roads in the district were constructed during the famine of 1872-73 at the expenses of the Darbhanga estate which was then under the management of the court of wards. The conveyances were bullock carts, dolis, pony and elephant.

According to the report on the survey and settlement operation in the Bhagalpur District 1902-1910, Samastipur- Pratapganj branch entered the district at Niramali which is presently part of Supaul district. Prior to1904 this line entered upto Kanwa Ghat on the Kosi River, from where passengers were ferried in country boats belonging to Railway Company, to Anchara Ghat on the opposite side of the river in Purnia. Archara Ghat in turn was connected by rail with the Deviganj- Katihar branch of the East Bengal State Railway. But due to recurring breaches in Kosi Pratapganj to Kanwa Ghat line was abandoned. In 1905, a railway line was constructed from Mansi, a station on the Barauni- Katihar branch of the Bengal and north-western railway to Bhaptiahi crossing through Supaul town and adjoins the previous line of Pratapganj (Map.1). This line accelerated the rice trade. Another branch from Saharasa was constructed upto Bodhama Ghat via Madhepura. Since one line entering Niramali from Samastipur via Pratapganj to Kanwa ghat got already abandoned due to shifting course of Kosi and later flood furry further compounded when it struck down town and grappled it from all sides as it is shown in Map.1 that also breaks the connectivity of Mansi to Bhaptiahi. This very Period was worst and critical situation for its growth because its linkages to the town got disastrously wracked and its rice trade and other goods and services as well as transportation and communication got widely and adversely affected.

Map-1

Supaul Town: Before Independence (1938)



Source: Based on Toposheet No. 72 J/12 and processed on Arc GIS 9.3 Software.

After Independence (1947-1991)

The changing patterns of Supaul town during post independence period is analysed in four sub-phases (1950- 1990), (1991- 2001), (2001-2011) and (2011-2017). The study shows the devastating river Kosi tamed through embankment construction in 1954 under Kosi project in westward of town (Map-2) now the earlier branch this river which was known as Gajana river at that time now becomes rain-fed Gajana Dhar. Now it has become inactive and remains no threat of any flood so the people started settling down nearby Gajana by the governments as punarwas and those people who were resident of prior of Gajana stream formation soon they started reclaiming their land of agriculture and settlements.

Stage-I (1950-1991)

In 1954 after completion of embankment work of Koshi project, people living in between two embankments earlier were rehabilitated around Gajana dhar. The land for rehabilitation was government land that was allocated to the people. Due complation of koshi project people started growing crops and clearing lands grasses and scrubs so eerie look rapidly changed into consolidated agricultural land. Regarding administrative development of Supaul, notified area committee started w.e.f. 28 January, 1959 (vide Govt notification no 796, dated 28 January, 1959) for the development of Supaul town. It covered an area of 8.5 square miles that was divided into three wards in 1951. There were 2531 holdings and the population of the notified area was 17,460 (9297 M and 8163 F) as per 1961 census. The office of the notified area committee was housed in a room of the building belonging to District Board of Saharasa (District Gazetteer, Saharasa, 1965).

Communications and transportation

Road: Roads were the major means of transport. Bullock carts and rickshaws were the principal means of conveyance with a few private cars in 1965. Before 1963 there was no rickshaw but after that eight rickshaws came in the town. Generally roads were not metalled before 1960 except only two main road was metalled during the decade of 1960. In (May 1963) the committee maintained about 17miles of non-metalled roads and was constructing one and half miles of metalled road. Later on all the main roads were made metalled one. (Map 2). Two State highways SH 76 and SH 66 came into existence in this period.

Water supply: Wells and tube wells were the principal source of water supply in the town. The notified area Committee has installed 71 tubes well in the notified area committee. There are 377 private wells within notified area but a large number of them dried up in summer months. The expansion of the town made water problem more acute. In April, 1963 the committee moved to the government for a grant to work out of a scheme of supply of piped water.

Education: The town had one Degree College and one Bharat Sewak Samaj College that has its historical linkages which come under Bhupendra Narayan Mandal University. One Industrial Training Institute was opened in 1960. There are three important higher secondary schools which are working in present scenario namely (i) Tezendra High School at Chakala niramali (ii) William High School near Gandhi maidan and (iii) at Gaurawgarh Hajari Uchch Vidyalay. Besides, one private school was also opened in 1987 that is known as R.S.M Public School.

Sanitation: There was a health inspector since May 1960 to look after the sanitation work. Vaccination within the area was done by the govt or the district board vaccinators. The notified area committee expected to be take- up the work of improving roads and construction of pucca drains. There was no pucca drain in the town. Every year kutcha drains were dug during the monsoon period but they did not serve purpose as water continued to accumulate on the road during rains. The NAC did not have adequate funds to meet the expenditure over the improvement and construction of pucca drains which would cost more than a new town had to be done through the

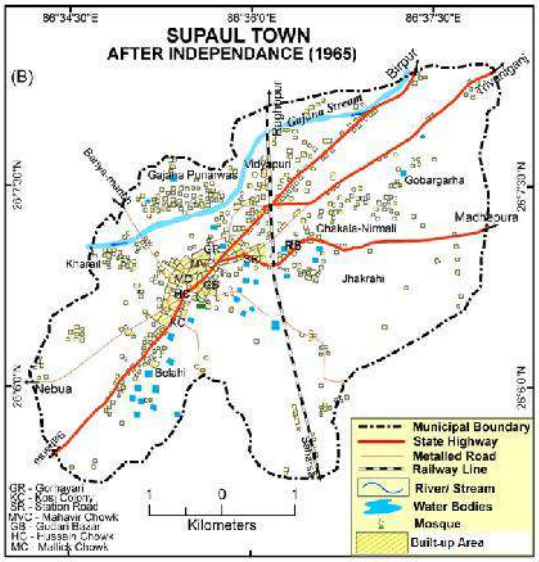
construction of pucca drains. The town had the largest urban population in the district but civic amenities like public garden, town hall, etc, were absent.

Conservancy: Night soil was collected by the sweepers as head load. The NAC had received a grant of Rs 5,175 for purchasing wheel- barrow. The use of wheel barrow did not start at that time. One trenching ground measuring five acres of land had been acquired but disposal of night soil had not started (District Gazetteer, Saharasa, 1965).

Market: The market was settled for three years w. e. f. 1st march, 1962 at Rs 3000 and since then it has been functioning. These used to be a big weekly cattle market at Supaul years that before. The committee was contemplating to have a public garden at the cost of Rs 10,000 from the government in 1962. The NAC in its resolution no.1, dated 2 March, 1959 levied holding and latrine taxes at the rate of 9 and 7.5%, respectively on the annual value of the holding which were given effect from 2nd quarter of 1959-60. At that time no license fee was imposed and the matter was in the correspondence with the government. It appeared that the NAC was slowly but gradually progressing. The income was increased from Rs 58,348/- (1959-60) to Rs. 70, 597/- in 1965. During the period of the Koshi ravages, the business this place had received a set -back. But now, due to the erection of Koshi embankment, area was reviving its trade related activities. Jute and rice were important business commodities for export. License fee of for jute trade is levied on the merchant on the capacity of their godowns and not on the quantity exported in the Murliganj N.A.C. There was one gudari market noted for trade and commerce in central part of town. Here rice, vegetables and fishes were sold out and exchanged.

Map-2

Supaul Town: After Independence (1965)



Source: Based on Toposheet No. G45/12 and processed on Arc GIS 9.3 Software.

Population: The population growth was considered as the change in the size of population of a region over a given period of time (Barclay, 1958; Bogue, 1969). Supaul town was situated along the south - east margin of the Koshi river which often used to cut of town it from its surroundings that hampered its natural growth of economy and ultimately the growth of town was restrained. In Fig. 4 shows the decadal population growth of Supaul Town that shows the accelerating growth of population since 1961. That shows the accelerating growth of population since 1961. In 1961 population was 17460 persons and in 2011 it was 65437 persons.

Stage-II (1991-2001)

In 1991 Supaul became a separate district

headquarter from the Saharasa district. As a consequence, new offices and establishments gained momentum. Number of offices got upgraded and many new offices were built by the government on the Supaul to Saraigarh road. Chakala niramali started its expansion along Supaul- Singheswar road. Expansion of settlement along Supaul Kisanpur road rapidly took place rapidly due to widening of roads. Low lying places of Jhakhrahi and Babhani Chakala also got momentum of development. This accelerated up-gradation is also witnessed in other modes of communication and transportation like telephone exchange centre, TV tower and layers of mobile company towers.

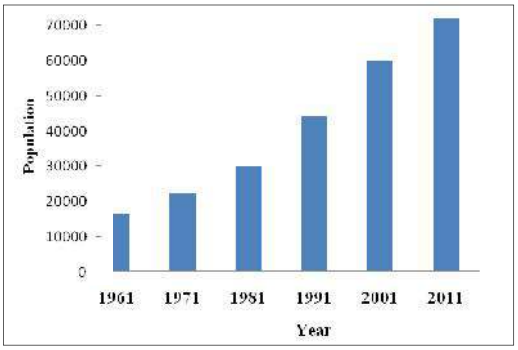
Since the new district was carved out, a number of new schools, offices of administration established to cater to the essentialities of town. In private educational institutes like as Golden Public school, Kerala boarding schools are notable among them. A sea change in railway construction of broad gauge (Aman Pariwartan) got inauguration and its first phase work started in this period so still this period in Supaul town metre gauge was not sufficient for proper transportation of goods and services. East-west corridor started in neighbourhood also augments to the process of development of town. Broadening of roads / state highways and spacing along street makes it viable for pedestrian. Establishment of collectorate, circuit house, stadium, financial institutions as well as repair and renovation of government hospital, schools, roads, bus stops, restaurants, telecommunication and training centre, Gandhi maidan, inn and transportation added to the betterment of townscape.

Stage-III (2001-2011)

Now days, town is connected through road that leads it to revived Koshi Bridge which is pivotal for the regional socio- economic development and trade and commerce. Transformation of urban infrastructures like schools, roads, railway, drainage, bridge, plantation and civic amenities had undergone through sea change. All government school primary and middle schools are transformed into new one from its dilapidated condition of building and also provided required number of teachers on contract basis. Adjoining Saharasa junction joining the Patna via Mansi gets upgraded in this period. Plantation along Gandhi maidan and Supaul Saharasa railway line as well as on many roads were completed. In area of civic amenities door- to- door waste collection is available and besides there are tractors, trolley, dumper, and loader with increased number of staffs responsible for waste disposal. Drainage work is structured and transformed into RCC construction at main market. Ward wise drainage work is likely to complete in upcoming days.

Fig. 1

Supaul Town: Population Growth (1961 to 2011)



Source: District Census Abstract Saharsa and Supaul (1961 to 2011)

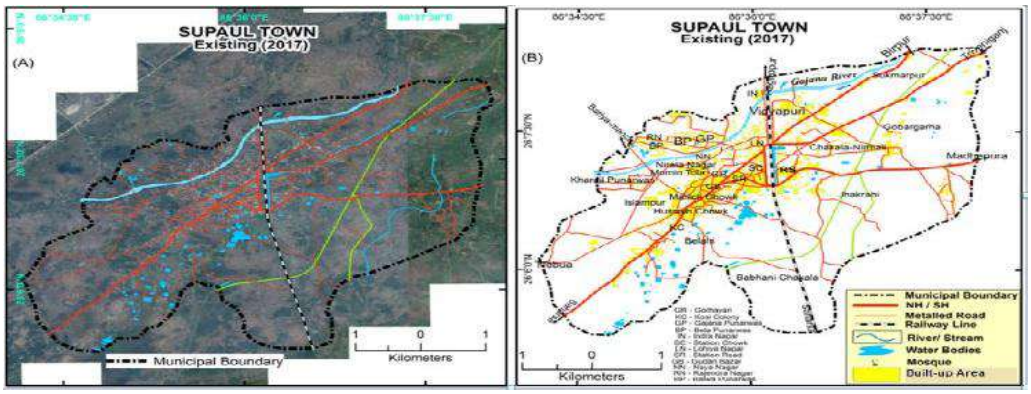
Urban Expansion (2017)

The analysis of various elements of urban expansion of the town has been divided into different zones on the basis of following consideration: (A) Transportation and communication facilities like smooth and wide RCC road reconstruction, plying of several AC or Non - AC buses of Bihar transport agency and private buses, plying of e-rickshaw a pollution free as well as noise less vehicle in town. North Bihar Power Corporation Limited office is established that maintains proper electric supply in town to a time of 22 to 23 hour. (B) Health care infrastructure facilities include construction of new large apartment of Sadar Hopital having several wards including emergency, mother and natal care and different diagnostic facilities. (C) Educational infrastructures are slowly increasing like opening of new computer training and vocational training and new ITI girl's institute. (D) Administrative offices Block, collectorate, are enlarged into new one adding several facilities, similarly District Planning office, Industrial building also opened in current period.

The urban expansion of Supaul town is mainly consisting along the major roads and western part of Supaul town Like (i) western part of the town in Punarwas area. (ii) Supaul-Saharasa road (iii) Supaul-Triveniganj road (iv) Supaul- Madhepura road and (v) administrative offices along Kisanpur road (Map- 3).

Map-3

Supaul Town: Existing (2017)



Source: Map based on Google Earth Satellite Imageries (2017) and Image processed on ArcGIS 9.3 Software, including validation through Personal field observation.

Proposed infrastructures

Several milestone and vital infrastructures are likely to come up in next one or two year. Broad gauge railway and plan of new railway line in transportation to other district are in way. There is also Proposal of engineering college or women's college in education, agro based industry like dairy or milk industry which is in under construction, new Police-line and Separate building of Women Police station in administration is also in under construction. Proposed or under construction for drinking water facility and other civic amenities that will leave indelible mark on its course of meteoric rise of the Supaul urban development.

Conclusion

The Histogenesis of Supaul town is very interesting and long but the lack of artefact and archaeological evidences, it is not fully revealed about its antiquity in its sculpture, morals and art. In British period there were some buildings like Williams school, Lal Kothi, Supaul station, Public library etc. that are sign of old town history. Otherwise devastating Koshi river wiped out maximum evidence. Supaul town growth and histogenesis comprises several stages like different period of dynasty and in modern period it is divided into before and after independence (1947). In after independence it is divided into four -phases 1947 to 1991, 19991 to 2001, and 2001 to 2011 and existing. 1991 year is watershed year from where several institutions, offices, agencies, number of goods and services increased to fulfil the requirements of people. It accelerated intensity of land use pattern and traverses a new course of orientation like spreading new settlement along new and cheap land. It breaks the homogeneity of the town and conspicuously shows the different pattern. Presently rush and haphazard constructions are started in core area as well as periphery area that will obstruct its basic functions and resource productivity. Besides this the increasing waste and its sound management is required for safe and clean town and in this regard the awareness of people and government capacity of management would be increased. Segregation of work and proper zoning of land is inevitable for the smooth services, it requires both top to bottom and vice-versa approach to make healthy and sustainable town. Environmentally urban forestry is required for urban area and its role in soil conservation. Connectivity either physically or culturally direly needed for its people for their competence to global era.

Reference

Barclay, G.W., 1958, Techniques of Population Analysis, John Wiley and Sons: New York.

Bessey, K. M., 2002, Structure and Dynamics in an Urban Landscape: Towards a multi-scale View, Ecosystems, Vol. 5(4), June, pp. 360-375.

Bogue, D.J., 1969, Principles of Demography, John Wiley and Sons: New York.

Carter, Harold, 2002, The Study of Urban Geography, (4th ed.), Crane Russak and Co.: New York.

Government of Bihar, District Gazetteer, 1965, Saharasa, Revenue Department, Govt. of Bihar, Patna.

Chip, S.S., 1995, Demographic Dynamics in the Trans-Himalayan Tribal Region of Kinnaur, H.P: Perspective on Socio-Economic Implications, *Geographical Review of India*, Vol. 57(1), pp. 20-28.

Clark, J.I., 1972, The Less Developed Realm: A Geography of its Population, John Wiley and Sons: New York.

Duncon, O., 1961, From Social System to Ecosystem, *Sociological Inquiry*, Vol.31, pp. 140-149.

Geddes, P., 1949, Cities in Evolution, Williams and Norgate, UK: London.

Kaplan, David; Wheeler, James and Hollow, Steven, 2009, Urban Geography, (2nd ed), INC Rosewood Drive, U.S.A.: Danvers.

Lewis, D., 1968, Urban Structure (ed.) John Wiley and Sons: New York, pp.74-83.

Pacione, M., 2009, Urban Geography- A Global Perspective, (4th ed,) Routledge, U.K.: London.

Sharma, P.R. and A.N. Tiwary, 2008, Histogenesis and Development of Mirzapur City, National Geographical Journal of India, Vol. 54 (3-4), Sept.-Dec., pp.65-77.

Tayler, G., 1949, Urban Geography: A Study of Site, Evolution, Pattern and Classification in Villages, Towns and Cities, Rutledge, U.K.: London.

Tiwary, A.N., 2010, An Appraisal of Urban Development and Histogenesis: A Case Study of Mirzapur City, (Ph.D. Thesis Published, VDM Verlag Dr. Muller GmbH and Co.KG, USA).

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Socio-Economic Status of Scheduled Tribes in Sonbhadra District, Uttar Pradesh

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Abstract

This paper aim to investigate the socio-economic status of scheduled tribes dwelling in Sonbhadra district of Uttar Pradesh. Primary data is collected [stratified random sampling method] from 70 respondents of the tribal community of the district. They have their own distinctive cultural and social aspect but they are very backward in the view of socio-economic condition for centuries. They share 20.67 percent of the total population of the district yet they have remained outside the realm of the general development process due to their habitation in forests and hilly tracts. They are living very low paid life in spite of dwelling in the energy capital of India. Mostly respondents are uneducated with the literacy rate of 44.2 percent of the district. They are leading a miserable life of unskilled laborers. The survey reveals that the tribes of the study area have not got the full benefits of the development processes undertaken by the governments over more than past six decades. Mostly respondent are living under the heavy burden of private and government loans. There should be made more and more effective attempts to develop the social, economical and educational status of the tribal people living in Sonbhadra district so that they might be connected to the main stream of modern technical development process.

Key words: scheduled tribe; *literacy; work participation rate; land alienation*

Introduction

India is a land of diversity. There should be socio-economic justice, equality of status, cultural and educational opportunities to all Indians. The term 'tribe' basically refers to the people, dwelling in forest or hilly tracts. They are thought of being poor, uneducated and savage people (Sharma, 2010). Without abolishing these narrow attitudes of the outsiders, there

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can be no dream of *'Abhinav Bharat', 'Ek Bharat, Shreshth Bharat'* or such imaginations. Historically a tribal community as an isolated group is confined mostly to forest or to other remote regions away from the main-stream of society. Forest resources and daily wages are the main source of the livelihood of the tribes of the study area. Some respondents of Gond and Kharwars are in agricultural occupation yet their living standard is too low. They have unique culture, life style, tradition and practices which is quite different from outsiders. This is why they are quite referred to as backward and uncivilized people dwelling in forests. Indian government has declared 'Dudhi' and 'Obra' as reserved seat for S.T. in legislative assembly *(vidhan shabha)* so that the status of tribal people can be improved.

The schedule tribes participate 8.6 percent to the total population at national level (census 2011) and tribes of Sonbhadra district account 20.67 percent to the total population of the District. The term 'Development' concerns here with the development of a country along with the development of the whole people.

The present research paper aims to analyze the socio-economic status of scheduled tribes so that the views of governing bodies can be attracted towards these societies through some special laws, regulations and provisions that can be implemented for their welfare. The World Bank studied on poverty in India and quoted that "An illiterate rural women, a member of scheduled tribe, a person who lives in a landless household or is dependent on wage earnings, all face a significantly higher than average risk of poverty." This statement explains the real status of tribal people living in our country (World Bank,1991).

Objectives

This paper aims to study the socio-economic aspect of the schedule tribes in respect to their living condition and also taking into considerations under the sub-headings of education, sex-ratio, occupational structure, indebtedness and practice of land alienation etc.

Data base and methodology

The study is conducted mainly in tribal dominated areas of Sonbhadra district. Both primary and secondary sources of data are where analyzed to fulfill the objectives. A pilot survey is designed to probe the socio-economic condition of tribal inhabitants of the study area and to interview the tribal population belonging to different cross sections of the tribal society. Both qualitative and quantitative measures are used to analyze the fact and compute the quality of life of the tribal area. Finally the respondents of tribal society are interviewed to analyze the socio-economic condition of the tribes. District census Handbook (DCHB 2011) is also considered to present comparative status of the tribes of the study area.

Study area

Sonbhadra district lies in South- Eastern tip of Uttar Pradesh known as 'energy capital of India', is the second largest district of Uttar Pradesh. The total area of the district is 6905 sq. km. It came into existence in 1989 separated out from Mirzapur district of Uttar Pradesh. It is bordered by Mirzapur and Chandauli district of Uttar Pradesh, Kaimur and Rohtas district of Bihar state , Garhwa district of Jharkhand state, Koria and Surguja district of Chhattisgarh state and Singrauli district of Madhya Pradesh state. The Robertsganj city is the district headquarters. It is only district of

India which borders four states namely M.P., Chhattisgarh, Jharkhand and Bihar. The rural area covers 6779.6 sq. km. and urban area records 125.4 sq. km. (census 2011). Geographically the study area is located between 23^{0}51'20"N to 24^{0}53'16" N and 82^{0}31'55"E to 83^{0}33'45"E (Fig.1).

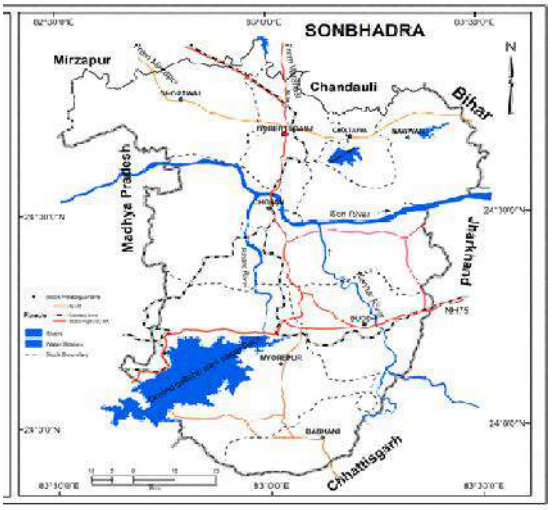

Fig. 1

Sonbhadra is one of the most backward district of Uttar Pradesh, in view of economical, social and political aspect. This district ranked 2nd in area, while it ranks 51st in population and 52nd in literacy (64 percent) in the State (census 2011). It is the land of tribal inhabitants since the turn of civilization and Gond, Kharwar, Paharia, Agaria, Panika, Patari, Bhuiya, Chero etc. are the prominent tribal groups in this district (census 2011). They are leading a very miserable life due to their social and economical background and the lack of political supports.

Socio-economic condition of tribals

The tribal of Sonbhadra district are among the unsettled tribal groups who are too backward to join the main stream of planned and sustainable development and they are unable to retain their distinctive and colorful cultural varieties. Although they are 20.67 percent of total population of the area yet they are forced to live a miserable life (Table 1).

Table 1: Block-wise Tribal Population in Sonbhadra District.

S.N.	Block population	(Rural/Urban) population	Total tribal	Male	Female
1.	Babhani	Total	525229	26642	25887
		Rural	52529	26642	25887
		Urban			
2.	Ghorawal	Total	13052	6678	6374
		Rural	13052	6678	6374
		Urban	-	-	-
3.	Chopan	Total	107336	55673	51663
		Rural	103411	53613	49798
		Urban	3925	2060	1865
4.	Robertsganj	Total	15042	7767	7275
	Rural	15042	7767	7275	
	Urban	-	-	-	

5.	Chatra	Total	6916	3550	3366
		Rural	6916	3550	3366
		Urban	-	-	-
6.	Nagwa	Total	32432	16605	15827
		Rural	32432	16605	15827
		Urban	-	-	-
7.	Myopur	Total	88088	45347	42741
		Rural	85622	44081	41541
		Urban	2466	1266	1200
8.	Dudhi	Total	65912	33588	32324
		Rural	65912	33588	32324
		Urban	-	-	-
9.	Sonbhadra	Total	385018	197825	187193
		Rural	374916	192524	182392
		Urban	10102	5301	4801

Source: Computed from Census Abstract, 2011.

Table 1 reveals that there is uneven distribution of tribal population at block level. Chopan block is the largest block in tribal population (total tribal population 107336, Census 2011) and Chatra is the lowest in tribal population. Majority of the tribal households are leading their miserable life and they are placed Below Poverty Line (BPL), possess meager assets, exclusively dependent on forest resources and some on agricultural farming.

The respondents are selected from different villages like Chorpania and Nakatwar from Chopan block, Salaiyadeh and Budhaperawa from Dudhi block, Panikap from Nagawa block, Alai and Ramgarh from Chatra block for interview. These villages have different kinds of physical and economic setup as criteria for their selection as sample study.

Tribal society of the study area is mostly male dominated while female participation in the work is in equal term. Male headed households are found to be more than 94% when it is compared to female headed. It shows that there is lack of the awareness and require change in mentality regarding gender equality among the tribal community of the area (Tripti, 2012).

Educational status

Education as a process is said to liberate the mind of an individual and enhances the capability to understand and negotiate the physical and social environment. Different philosophies attach due value to education at times to the extent that it guides the human towards liberation from all forms of darkness and ignorance (Lewin,1993).

Sonbhadra district is still very backward in education. This is the main factor for the poverty of tribal community. Most of them are illiterate and unmannered. The literacy rate of the district (44.2%) is too behind the literacy

rate of state average (55.7%). There is wide gap in the proportional literacy rate of the District and State. The Chopan is placed accunted the lowest (35.2%) in literacy rate while it is the largest block in the view of tribal population in the district. In this block, there is the serious problem of health and education as the area is uneven terrain. Mostly tribal people are forced to be a labourer. There is lack of formal and informal education. The condition of female(23.1) in this block is serious (Table 2).

Table 2: Tribal Literacy Rate in Sonbhadra District (2011).

S.N.	State/District/Block	Literacy Rate (%)		
		Persons	Male	Female
	Uttar Pradesh	55.7	67.1	43.7
	Sonbhadra	44.2	56.2	31.4
1.	Ghorawal	47.6	57.8	37.0
2.	Chopan	35.2	46.5	23.1
3.	Robertsganj	48.1	59.8	35.7
4.	Chatra	51.4	64.1	38.1
5.	Nagwa	47.4	60.3	33.7
6.	Myorpur	45.2	57.3	32.2
7.	Duddhi	49.1	62.3	35.2
8.	Babhani	47.2	59.3	34.7

Source: Computed from Census Abstract, 2011.

The respondents of the all age group are interviewed for educational qualification. The respondents are classified into four categories accordance to their qualification as primary level, high school level, intermediate level, graduation level and others are uneducated. The table 3 shows that 51.43 percent of the respondents are uneducated which is much higher than 43.3 percent of the state average (Census, 2011). Only 27.14 percent of the respondents have completed primary school level while 12.86 percent of the respondent has completed high school, 7.14 percent of the respondents have completed intermediate level education and only 1.43 percent of the respondents have completed their graduation (Table 3).

Table 3: Educational Status of the respondents

Educational Qualification	Respondent	Percentage
Uneducated	36	51.43
Primary	19	27.14

High School	09	12.86
Intermediate	05	7.14
Graduation	01	1.43
Total	70	100.00

Source: Based on Personal Survey, 2017.

Sex ratio

The ratio of females to the male ('sex ratio') in any given population of the region is a sensitive indicator of the status of women in that society. In modern Indian social context it has been observed that the increase in sex ratio indicates for the better life expectancy in the favour of women while India has a history of low sex ratios. A reversal in this trend has been seen since 1991. The sex ratio in India was 927 (per 1000 males) according to the 1991 Census and reached up to 933 in 2001 and 943 in 2011 (Table 4).

Table 4: Block wise sex ratio of Tribal Society in Sonbhadra District (2011).

Sl.No.	State/District/Block	Sex Ratio
-	Uttar Pradesh	952
-	Sonbhadra	946
1.	Ghorawal	954
2.	Chopan	927
3.	Robertsganj	937
4.	Chatra	948
5.	Nagwa	953
6,	Myorpur	942
7.	Duddhi	962
8.	Babhani	971

Source: Computed from Census Abstract, 2011.

The overall tribal sex ratio of the tribal community in Sonbhadra district is 946 (2011) which is lower than the average tribal sex ratio of Uttar Pradesh (952). It is observed that in some blocks tribal sex ratio is higher than the state average tribal sex ratio such as Ghorawal (954) Nagwa (953), Dudhi (962) and Babhani (971)blocks. While the tribal sex ratio of Chopan (927) and Robertsganj (937) is too behind the state average . During the survey it is observed that women are mainly earning members. This data shows the unbalance ratio of social and economical condition of tribes of the districts (Table 4).

Occupational structure

Occupational change has been largely understood as a change in the activities of the

member of a society for their livelihood. The change is observed by the increase or decrease in the distribution of their activities and socio-economic structure of a society. This is done by counting the number of persons engaged in different activities.

In Sonbhadra district, unemployment is also a major problem among the tribal people. They are forced to lead their idle lives due to insufficient livelihood opportunities. There are recognized under the two type of economical activity status e.g. labour force and out of labour force.

In labour force activity- the tribes people who are working or seeking for job and in out of labour force activity- the tribel come who are neither working nor seeking for job. The tribal people of Sonbhadra categorized under "out of labour force" are more and more responsible for their social and economic backwardness.

Table 5: Block Wise Occupational Structure of Tribal Peoples in Sonbhadra district (2011).

District/

District/	Total Workers (%)			Main Workers (%)			Marginal Workers (%)			Non Workers (%)		
Block	Persons	M	F	Persons	M	F	Persons	M	F	Persons	M	F
Sonbhadra	43.2	49.2	36.8	42.7	49.7	33	57.3	50.3	67	56.8	50.8	63.2
Ghorawal	44.3	50.4	37.9	52.6	60.2	42.0	47.4	39.8	58.0	55.7	49.6	62.1
Chopan	42.5	48.8	35.8	46.2	51.6	38.2	53.8	48.4	61.8	57.5	51.2	64.2
Robertsganj	42.6	48.5	36.4	46.6	59.0	29	53.4	41.0	71.0	57.4	51.5	63.6
Chatra	45.4	48.7	41.8	20.9	25.7	15	79.1	74.3	85.0	54.6	51.3	58.2
Nagwa	47.4	50.3	44.4	53.8	58.2	48.5	46.2	41.8	51.5	52.6	49.7	55.6
Myorpur	41.4	48.9	33.5	45	53.1	32.6	55.0	46.9	67.4	58.6	51.1	66.5
Duddhi	45.3	50.6	39.7	38.2	47.9	25.4	61.8	52.1	74.6	54.7	49.4	60.3
Babhani	42.8	48.1	37.4	28.5	32.2	23.6	71.5	67.8	76.4	57.2	51.9	62.6

Source: Census Abstract, Sonbhdra District, 2011.

The 43.2 percent of total workers for tribal population of Sonbhadra district are registered which is much lower to the aggregate of national level (49.19 percent) (Table 5). The percentage of non- worker is 56.8 percent which is higher to create the serious problems of unemployment. The percentage of marginal worker in the study area has been recorded 57.3 percent which is much above to the national level (53.9%) which is the main causes of economical imbalance among the tribal people of the district. The female Work Participation Rate (WPR) is 38.8 percent which is lower than the male participation rate (49.2%) among the tribal people. The WPR of female tribal worker in Myorpur block is 33.5 percent and in Chopan block, it is 35.8 percent which is quite lower than the district level. The table 5 depicts the condition of tribal women and is worse than both, male and female are respectively on national level.

Status of indebtedness

The Sonbhadra district in spite of lots of alteration in access to education and positive welfare programs, tribal groups who were traditionally at the out of main stream of social hierarchy are still economically worse off. Here poverty level is very high among the several tribes. They are tangled in ever suffering problems of indebtedness. The tribal people of the study area are exploited by the money lenders in such a way that they bend under the burden of indebtedness from a generation after generation and there is left no hope of survival.

For the tribal people, the money lenders and traders are still the major source of small and big loans here. They provide loans to the tribal people on simple procedure so they do not want to go through the intricate procedure of Banks. They are forced to take loans at heavy compound interest rate from these creditors with the bargaining right to purchase the standing crops in case of not paying taken loans on due date. They approach the local money lenders for their loans at the time of festivals, marriages, ailments or funerals of their favorites etc. Mostly tribal people are illiterate and out of labour force. So they knowledge of care about the calculation of heavy rate of compound interest. Due to it they always leave an arrear in the favors of the creditors. Due to insufficient income much money goes to the creditors by the way of heavy interest and these things make them still much poorer.

Table 6 shows that the tribal of the area are dwelling in the clutches of money lenders and land lords. This is only the reason of dire condition of indebtedness and land alienation in this area. Only 2.86 percent out of 70 respondents are out of their clutches. More than 97 percent of the respondents are living under the burden of outstanding loans.

The result shows that it is very disheartening to state that institutional sources are serving only 17 percent of the sample households while money lenders are serving maximum though charges high rate of compound interest.

Table 6: Observation of Indebtedness on outstanding loans.

Loan ranges	Institutional Source	Private source money lenders and landlords	SHG
No Loans	58(82.86%)	02(2.86%)	37(52.86%)
Below-4000	-	08 (11.43%)	29(41.8%)
4000-10000	-	33(47.14%)	4(5.71%)
10001-20000	03(4.29%)	20(28.57%)	-
20001-Above	09(12.85%)	07(10.00%)	-
Total	70(100.00%)	70(100.00%)	70(100.00%)

Source: Based on personal survey, 2017.

The sample reveal that the majorly respondents take loan for agriculture (38.57%) or marriage and ailment purposes (44.28%) (Table7)). The huge amount of their loan is spent in unproductive purposes as marriage and ailment. Agriculture does not compensate the

amount of compound interest of their loans. There are no rays of hope among the tribal's of Sonbhadra district for their progress because a tribal father leaves heavy sum of loan to his son.

Table 7: Purpose of Loans.

Purpose of loan	Respondent	Percentage
Self-employment	5	7.14
Agriculture	27	38.57
Marriage & ailment	31	44.28
Business	02	2.86
Education	03	4.29
Others	02	2.86
Total	70	100.00

Source: Based on personal survey, 2017.

Practice of land alienation

Land is the primary source of livelihood for the tribal's. Land based livelihoods have assumed added importance with the depletion of non-timber forest produce (NTFP). Land alienation

in its broad sense is among the major causes of impoverishment of tribal's Occupation by non-tribals; reduced access to forest-based livelihoods; reservation of forests and restrictions on shifting cultivation; land administration policies; and displacement by development projects (Rao, et al., 2006). Tribal population of Sonbhadra district are out of the main stream of development. They are unable to avail the benefits provided by government due to being out of labour force. This is the main reason for the transfers of tribal land to hands of non tribal. It has been taking place at rapid rate in the study area. On the basis of primary survey, it is found that there are many reason of land alienation in the hands of non tribal people.

The main causes have been observed or accounted for the transfer of land as follows:

1. Due to being in dire indebtedness, they are forced to transfer their land to the money lender who is often non-tribal people.

2. There is serious condition of unemployment among the tribal people. They sell their land for the various reasons such as marriage , ailments, cropping etc., non-tribal people gave them a little more rate of their land than any tribal purchaser.

3. Transfer of land from tribal to non-tribal in this form of lease and mortgage.

4. Non-tribal people take advantage of their power of status and political approach in getting tribal land.

5. In tribal area the word *'Rehan'* is in practice. In this process tribal people give the ownership of cultivating for a certain time for a large sum of money but being too poor, they are unable to regain their land.

There are several laws and legislations for restricting alienation of tribal lands but there is lack of implementation of these laws and regulations. The officials are not able to implement fully the provisions of protective legislation as several non tribal landlords are breaking these protections by endearing into the social fabric of tribal communities (Roa, 1999).

Table 8: Land Holding Size of Tribal People.

Land holding size	Respondent	Percentage
Below 1 acre	21	30.00
2 to 3 Acre	37	52.86
3 to 4 Acre	09	12.85
Above 4 acre	03	4.29
Total	70	100

Source: Based on personal survey, 2017.

Table 8 shows that 30 percent of the respondents have land below 1 acre and 53.86 percent of the respondents have 2 to 3 acre of land. Only 12.85 percent of the respondents have 3 to 4 acre land and very small proportion of (4.29%) of the respondent have above 4 acre land showing their miserable conditions regarding land holdings.

Conclusion

The tribal society of the study area is forced to live under the conditions of dire deprivation because of the inadequate co-operation of aristocrat, social group as well as the governments. Both economical conditions and their standard of living are too low. There is paucity of land due to reserve forest area, tribal people have unskilled education and less co-operative linkages with non tribal people. These are the main problems which restrict them to join and participate in the stream of development. They are known as real 'backward' or 'savage' by the society as well as by the authorities.

In spite of being providing lots of constitutional provisions and policies for the tribal, it is a hard reality that the tribal people of the study area are still lagging behind in many respect and they have to face many challenges. The study emphasized the need for tribal development in Sonbhadra district. There is low economic activities, social backwardness, low rate of literacy, poor health status, dire indebtedness conditions, practice of land alienation led then far away from the main stream of social and economical development process. Some of them work very hard and contribute properly to help their family but they are still facing poverty because they are prey to indebtedness or ailments. Education is a vital instrument to bring about a change in their cultural norms and pattern of living and to change their outlook and made them economically self independent. Education will also enable them to take up Jobs so that they can improve their situation but their literacy rate is too behind in comparison of state and national average. There is need for awareness regarding health and education. They also suffer from various diseases because of the lack of proper hygiene awareness. Thus, by increasing the literacy rate and providing more op-

portunities for skill development process at village level for tribal (both male and female) people on behalf of government will be instrumental in bringing about a change in their status in the study area and to handle the future challenges successfully.

References

Census, 2011, Provisional Population Totals. available at http://censusindia.gov.in

Lewin, M.K.,1993, Education and Development: The Issues and the Evidence, Education Research, 6: p.61.

Rao, Mohan K.,1999, Tribal Development in Andhra Pradesh: Problems, Performance and Prospects, Booklinks Corporation, Hyderabad.

Rao, S.L., Deshingkar, P., Farrington, P.,2006, Tribal Land Alienation in Andhra Pradesh: Processes, Impacts and Policy Concerns, *Economic and Political Weekly*, Dec.30, pp.5401-5407.

Sen, A.K.,1990, More than a Hundred Million Women Are Missing, The New York Review of Books, Christmas Number. < http://www.nybooks.com/articles/1990/12/20/>

Sharma, A. K.,2010, Tribes Through the Ages, Vista International Publishing House, New Delhi.

The World Bank., 2012, Measuring Poverty; Movies or Snapshots? Development Research, < http://www.worldbank.org>

Tripti, Kumari and Choudhary, B.K., 2012, Education and Women's Empowerment: A Case Study of Mehsi Block, East Champaran, Bihar, National Geographical Journal of India, 58 (3): 81-88.

World Bank, 1991, Gender and poverty in India, A world Bank Country Study, 18 H Street, N.W. Washington, D.C. 20433, U.S.A.

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Contextualizing the Concept of Women's Empowerment and its Approaches in Indian Context

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Abstract

The present discourse on women's empowerment is now trying to mainstream the gender concerns and engaging them in the development process of the country. Besides, it seeks to see women as more recipients of welfare benefits. In this article investigators try to envisage into the understanding of women's empowerment perspectives. The study also tries to focus those development approaches which can accelerate to the pace of women's empowerment. To study the gradual changes which have taken place in improving the status of women since Independence (1947) along with understanding improvements of their status. Data from Census of India, NSSO and National Crime Records Bureau (NCRB) show the contemporary scenario regarding demographic, health-care, educational, economic participation, decision-making conditions with the major social obstacles in path of women's empowerment in Indian context.

Key words: *autonomy, gender-concerns, power-redistribution, social-justice.*

"To call woman the weaker sex is a libel; it is a man's injustice to woman. If by strength it is meant moral power then woman is immeasurably man's superior. Has she not more self-sacrificing, has she not great powers of endurance, has she not greater courage? Without her man could not be. If non- violence is the law of our being, the future is with women." (Gandhi, Harijan, October 3, 1936).

Introduction

The discourse on women's empowerment has been gradually evolving over the last few decades, where in paradigm shifts have taken place from seeing women as more recipients of welfare benefits to mainstreaming gender concerns and engaging them in the develop-

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ment process of the country. Empowerment is a process aimed at changing the nature and reaction of systemic forces which marginalize women and other disadvantaged sections in a given context.

Women's empowerment is a global concern and discourse on women's rights has been the focal point in each and every formal and informal activity across the globe. The concept of women's empowerment seems to be the result of a number of important critiques and debates which emerged during the women's movements throughout the globe in general and third world feminists' movements in particular. The rapid use of the term 'women's empowerment' by different development actors have gradually, started interpreting it in multiple ways. However, this concept was first invoked by the third world feminists and women's organizations in seventies. It was explicitly used to frame and facilitate the struggle for social justice and women's equality through a transformation of economic, social and political structures at national and international level.

In this context, recently Ministry of women and child development, GOI, published a draft namely articulating a vision for empowerment of women elaborates women's empowerment as "Empowerment of women is a socio-political envisioned in relation to the wider framework of women's rights. It is a process that leads women to realize their full potential, their rights to have access to opportunities, resources and choices with the freedom of decision making both within and outside home. Empowerment would be achieved only when advancement in the conditions of women is accompanied by their ability to influence the direction of social change gained through equal opportunities in economic, social and political spheres of life." (National Policy for Women, 2016). On the same line, millennium development goals report (2015), also reiterates gender equality and women's empowerment as its 3rd goal (UNMDGs).

As the term 'women empowerment' has cut across various trajectories. It has become the most persuasive term in the ongoing gender discourse at national or international level. Therefore, the conceptualization of women's empowerment has remained a challenge and different authors have defined the concept in different ways (Malhotra et al; 2002). The most comprehensive and widely accepted definition of empowerment has been proposed by Batliwala (1995), who defines empowerment as "the process, and the outcome of process, by which women gain greater control over material and intellectual resources, and challenge the ideology of patriarchy and the gender based discrimination against women in all institutions and structures of society." Again, Srilatha Batliwala (1995) has stated that the most conspicuous features of the term empowerment are that it contains the word "POWER." To sidestep philosophical debate, it may be broadly defined as control over material assets, intellectual resources and ideology. "The process of challenging existing power relations and of gaining greater control over the sources of power may be termed as empowerment. This broad definition is defined by feminists' scholars and activities within the context of their earnings." But merely, challenging existing power relations and of gaining greater control over the sources of power may assure empowerment of women? It also needs to operate the process of empowerment to access self-confidence and

cognisance about their potentialities. Therefore, they have to get rid of traditionally structured patriarchal framework to access empowerment resources.

Further, Antrobus (2004) critically defines the concept by saying empowerment is a process that enables a powerless woman to develop autonomy, self control and confidence and, with a group of women and men, a sense of collective influence over oppressive social conditions. She argues that when women begin to understand gender oppression and organize to change ways in which different institutions sanction and facilitate their treatment as second-class citizens, the collective empowerment of women will occur. To the construction of more equal and just society, the process of women's empowerment results in a 'redistribution of power within, as well as between societies and groups'. This is accomplished in part, through activities ranging from acts of individual resistance to mass political mobilization that challenge basic power relations."

In addition to this discourse, Pillai (1996) argues "empowerment is an active multidimensional process which enables women to realize their full identity and powers in all spheres of life. Power had to be acquired and once acquired, it needs to be exercised, sustained and preserved." In brief, it can be narrated that empowerment is a process of awareness and capacity building leading to greater participation in decision-making activities and to transform decisions into actions. Empowerment implies the creation of enabling environment where individuals can fully use one's capabilities to take charges of one's life. The process of empowerment is to free people from rigorous control and to give them freedom to take responsibilities for their own ideas and actions and to release hidden resources which would otherwise remain inaccessible. Therefore, women's empowerment can be viewed as a continuum of several interrelated and mutually reinforcing components.

Approaches to study

Batliwala (1994) identifies three approaches to women's empowerment in her study of selected empowerment strategies implemented by specific South Asian non-governmental organizations (NGOs). (a) Economic development approach, (b) Integrated development approach and (c) Consciousness raising and organising among women approach

(a) Economic development approach situates "women's economic vulnerability at the centre of their powerlessness", and assumes that economic empowerment positively impact various aspects of women's existence. Its strategies are built around strengthening women's position as workers through organising and providing them with access to support services.

In this approach, Groups are formed using the methods organizing women around savings and credit, income generation or skill training activities for example; *Grameen* bank in Bangladesh, programmes of credit for rural women in Nepal. These groups may work in a range of areas, including savings and credit, training and skill development, new technologies or marketing as well as providing such ancillary support as child care, health services, literacy programmes, legal aid etc. As economic development plays vital role in women's empowerment directly strengthens women in day to day life along with providing access to empowerment constituents particularly health, education, earning opportunities, rights and

political participation, decision making etc. Economic development also helps women to overcome from the trap of poverty. The active participation of women in income generating activities facilitates both, their families at household level and nation on global level, at the same time.

(b) Integrated development approach interprets women's powerlessness to be a result of their "greater poverty and lower access to health care, education, and survival resources". Batliwala states that strategies deployed under this approach aim to enhance women's economic status through the provision of services. This approach improves women's everyday realities by assisting them in meeting their survival and livelihood needs, *i.e.*, their practical needs.

This approach is focused on strategies such as increasing women's access to employment, markets, education, and other material and development resources. Here, the assumption is that if women's economic inequalities were eliminated, then their status and power would also increase in other spheres of life. In this way, development interventions focused largely on getting more women to participate and be represented in social, economic, political, and legal structures through various levels of policy interventions. Therefore, it provides a package of interventions to alleviate poverty, meet basic survivals, basic needs, reduce gender discrimination and helping women in gaining self-respect. It precedes either by forming women's (group) collectives that engage in development activities and tackle social problems. For example, Proshika in Bangladesh, RDRS in Rajasthan, India address issues related to dowry, child marriage, male alcoholism etc.

(c) Consciousness-raising and organising among women approach is based on a complex understanding of gender relations and women's status. This method ascribes women's powerlessness to the ideology and practice of patriarchy and socio-economic inequality. Strategies focus on organising women to recognise and challenge gender and class based discrimination in all aspects of their lives.

Unawareness among women about their social, economic, political, and human rights make them subordinate in comparison to their male counterparts. The main focus of consciousness raising approach is to establish a gender just society. Now, it has developed an environment where women at individual or collective level have started knowing their basic rights along with practicing it. At the same time, they have also challenged gender and social power relations in patriarchal framework. Because of, the consciousness raising among women enabling them to be more empowered, by the virtue of this they develop their interest in political participation, decision making, economic activity, social welfare etc. This approach has positively transferred the life of women by consciousness development among them.

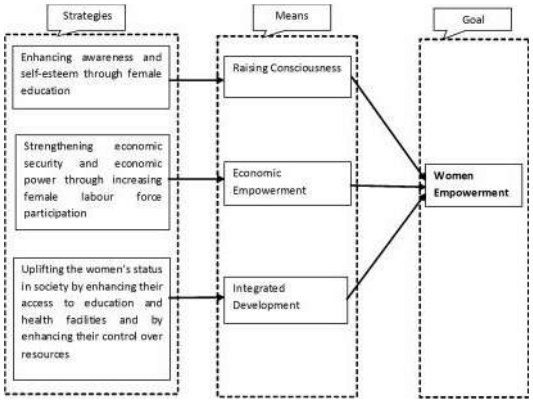

Figure No.1. After: Chaudhary,Chani, and Pervaiz (2012).

Status of women's empowerment: A contemporary perspective

The post-independence period in India has seen a number of positive and concerted efforts by the government to improve the socio-economic status of women. The process had set in much earlier with efforts of social reformers. After independence, attainment of equal status for women in every sphere of life was enshrined as one of the main objectives of Indian constitution. Right from the five years plan the issue of providing equal status to women has been sharply focused in the development process. While the first four plans focused on organizing various welfare activities and giving priority to women's education, the fifth and sixth plans witnessed a shift in approach from welfare to overall development of women with a three pronged thrust on health, education and employment of women. The seventh plan laid stress on efforts to identify and promote beneficiary oriented programme with the intention of extending direct benefits to women. The eight five-year plan made a significant shift from 'development' to 'women's empowerment'.

A. Demographic status of women

Demographic status of a country describes composition and distribution of population in its geographical space. Here, attempt has been made to understand important statistics on population characteristics from a gender perspective. To describe the demographic composition with a gender perspective sex ratio is the best way to express it. Sex ratio is used to define the number of females per 1000 of males. As per census data (2011), India's population was 121.06 crores and females constituted 48.5% of it and the sex ratio was 943 females per 1000 of males. The major cause of the decrease of the female birth ratio in India is considered to be the violent treatments meted out to the girl child at the time of the birth. Several other reasons are adduced to explain the consistently low levels of sex ratio and their further decline in the country. Some of the important reasons commonly put forward are neglect of the girl child resulting in their higher mortality at younger ages, high infant and maternal mortality, sex selective abortions, female infanticide, preference of male child, lack of education, poverty, dowry, patriarchal structure of society etc. The sex ratio in India had been rather better during the period of the years of independence, but thereafter it started showing gradual signs of decline. Although, in 1951 the population of India was about 36.20 crores which increased almost thrice and it become 121.06 crores in 2011 during last 60 years. In 1951, the sex ratio was 946, which declined to 941 in 1961 and 930 in 1971. But year 1981, got a slight improvement in sex ratio that become 934 females/ 1000 males and then there was a significant decline during 1981 to 1991 to reach its lowest 927 females/1000 males. Since 1991 last two decades, show a slow but consistent increase 933females /1000 males (2001) and 943/1000 males (2011).

While, the composition of sex ratio has been different during the same period of time in rural and urban spaces, where rural spaces felt declining trend of sex ratio. In contrast, urban spaces showed gradual improvement in it with some fluctuations. As the data reveals the sex ratio of urban India in1951, was only 860 females/1000 males which improved in 2011and it became 929 female/1000 males, improvement added 69 females in the sex ra-

tio. But, rural spaces had fair sex ratio in comparison to urban spaces 965 females/1000 males in 1951. It showed declining trend during the same period. In 2011 the sex ratio of rural India was only 949/1000 male which declined by 16 number of women in the last 60 years. It is also interesting to know that the sex ratio of 0-6 age group was 976 females/1000 males in 1961, it has been showing consistent declining trend in sex ratio of girl child and reached its lowest in 2011, 919 females/1000 males of the same age group that become a matter of serious concern.

The reasons for the increase in sex ratio are family migration to urban areas, urbanization, improvement in socio-economic condition, better living condition, impact of educational status, active participation of women in income generation, government initiatives, strict laws against foeticide, dowry death and crime against women with the availability of better medical facilities has led to greater survival of both male and female children along with decline in infant and maternal mortality in urban areas. Moreover, certain social change leading to somewhat greater attention towards the girl child in recent years also increased sex ratio to some extent. But, the rural areas are lagging behind in backing the sex ratio because of patriarchal stereotype, regressive socio-cultural traditions, lack of basic infrastructure supporting women empowerment, unemployment, male dominance, unawareness among women about their human rights along with absence of better medical facilities making things bad to worse. However, the sex ratio showed slow but consistent improvement in last decades that was 949 females/1000 males in 2011 but it is still less than 965 females/1000 males of 1951 which was 16 points higher than the latest one. Therefore, the sex ratio either in rural or urban space has been increasing for last two decades but it is still far from satisfactory.

The geographical distribution of sex ratio is not homogeneous everywhere. Various physiographic and socio-economic factors control it therefore it varies from region to region or state wise. Indian states can be divided into three categories on the basis of sex ratio composition of different states. (a)States or Union territories where sex ratio is positive (b) States or Union territories where sex ratio is above national average (943) (c) States or Union territories where sex ratio is below national average (943).

(a) States or Union territories where sex ratio is positive are only two Kerala (1084 females/1000 males) and Union territory of Puducherry (1037 females/1000 males), the reason behind the positive sex ratio is that both the states are highly urbanized 47.72% and 68.33% along with high literacy 94.00% and 85.85%, respectively with better infrastructure facilities and high level of living standard.

(b) States or Union territories where sex ratio is above national average 943 are fifteen along with one union territory in descending order namely, Tamil Nadu (996), Andhra Pradesh (993), Chhattisgarh (991), Meghalaya (989), Manipur (985), Orissa (979), Mizoram (976), Goa (973), Karnataka (973), Himachal Pradesh (972), Uttarakhand (963), Tripura (960), Assam (958), West Bengal (950), Jharkhand (948) along with union territories of Lakshadweep (947). In the following states data reveals that states Tamil Nadu, Mizoram, Goa, Karnataka, West Bengal and union territories of Lakshadweep have higher rate of urbanization and literacy than average Indian

urbanization rate (31.16%) and literacy rate (74.04%), which is positively related to their sex ratio. But states Tripura, Uttarakhand, Himachal Pradesh, Manipur and Meghalaya are just below the average national urbanization rate because these are hilly states and due to this urbanization remain low but their literacy is significantly higher than the national average which has its positive correlation with sex ratio of these states. Assam, Jharkhand, Odissa and Chhattisgarh are below the national average of urbanization and literacy rate both but they still have fair sex ratio than national average (943) that is because Assam with 34.22% minorities population (sex ratio in Muslim is 951females/ 1000males) along with significant tribal population (sex ratio among STs is 990females/ 1000males) remaining three states have significant proportion of tribal population despite the common belief that urbanization and education will improve attitude to female children, the data shows that India's least urbanized and least educated social groups are those with better sex ratio. The only exception of this is Andhra Pradesh where urbanization is above the national average but education is below average national literacy rate despite the state has fair sex ratio than national average.

(c) States or Union territories where sex ratio is below national average (943) are twelve states along with five union territories in descending order namely, Arunachal Pradesh (938), Madhya Pradesh (931), Nagaland (931), Maharashtra (929), Rajasthan (928), Gujarat (919), Bihar (918), Uttar Pradesh (912), Punjab (895), Sikkim (890), Jammu and Kashmir (889), Haryana (879) among union territories Andaman and Nicobar Islands (876), Delhi (868), Chandigarh (818), Dadra and Nagar Haveli (774), Daman and Diu (618). In the states, Maharashtra, Gujarat, Punjab and Haryana along with union territories of Andaman and Nicobar, Delhi, Chandigarh, Dadra Nagar and Haveli have higher urbanization and literacy rate in comparison to remaining states the reason associated with low sex ratio in these states are various because these states are highly industrialized and urbanized except Andaman and Nicobar where people prefer multiple employment opportunities with other associated facilities therefore, pull factor of migration works here. Male migration from undeveloped states is common phenomenon along with neglect of the girl child, son preference, sex selective female abortions, female infanticide, high infant and maternal mortality, low fertility rate, gender selective family planning, violence, honor killings and rapes, prevalence of dowry system etc, are main regressive forces that hinder the sex ratio in these states. Nagaland and Sikkim are two states where urbanization is less than national level but literacy is better in comparison to national level. More or less above mentioned reasons are also responsible for low sex ratio in these two states. States of Arunachal Pradesh, Madhya Pradesh, Rajasthan, Bihar, Uttar Pradesh, Jammu and Kashmir are the most backward states of India along with low level of urbanization and literacy rate due to, continuous functioning of traditional socio-cultural practices, anti-feminist stereotypes, highest Infant and Maternal mortality, lack of proper medical infrastructure and resources, delivery by untrained functionary, poverty, maltreatment and malnourishment, violence against women, poor living condition, son preference, sex selective abortion, neglect of girl child etc, are major constraints in the path of improving the sex ratio pattern in these states.

B. Educational Status of Women

Educational attainment is the first and foremost step towards improving the quality of life in society. Better literacy and educational level definitely have a positive impact on the health as well as on other aspects of life. In a country like India, literacy is the main foundation for social and economic growth. In 1951, where the total literacy rate was 18.33% at all India level, for female and male it was 8.86% and 27.15%, respectively. At that point of time, in rural areas literacy rate was only 4.87% and 19.02% and for urban areas, it was 22.33% and 45.6% for female and male, respectively. As per Census 2011, the literacy rate at all India level was 74.04%. The literacy rate for females and males were 64.63% and 80.9%, respectively. Since 1951, there has been a consistent increase in literacy rate at both rural as well as in urban areas. In 2011, in rural areas literacy rate was 57.93% and 77.15% and for urban areas it was 79.11% and 88.76% for female and male, respectively. While combined rural literacy rate was 67.77% and for urban it was 84.11%.

Over the years, India has changed socially, economically, and globally. After the 2011 census, literacy rate was 74.04%. Though this seems like a great accomplishment, it is still a matter of concern that still so many people in India cannot even read and write. Now, if we consider female literacy rate in India, then it is lower than the male literacy rate as many parents do not allow their female children to go to schools. They get married off at a young age. Many families, especially in rural areas believe that having a male child is better than having a baby girl. So the male child gets all the benefits. The female literacy rate as per 2011 census was 65.46% where the male literacy rate was over 80%. But it is interesting to know that Indian rural female literacy rate has shown significant rise in the last decade by 24%.

As per Population Census of India 2011, the Literacy rate of India has shown improvement of almost 9.2 percent. It has gone up to 74.04% in 2011 from 65.38% of 2001 in last decade. Since, literacy rate varies spatially from state to state due to multiple geographical and socio-economic reasons seventeen states along with all seven union territories are above the national literacy rate in descending order namely Kerala ranks first in the country with a literacy rate of (93.91%), followed by Lakshadweep (92.28%), Mizoram (91.58%), Tripura (87.75%), Goa (87.40%), Daman and Diu (87.07%), Puducherry (86.55%), Chandigarh (86.43%), Delhi (86.34%, Andaman and Nicobar (86.27%), Himachal Pradesh (83.78%), Maharashtra (82.91%), Sikkim (82.20%), Tamil Nadu (80.33%), Nagaland (80.11%), Manipur (79.85%), Uttarakhand (79.63%), Gujarat (79.31%), Daman and Diu (77.65%), West Bengal (77.08%), Punjab (76.68%), Haryana (76.64%), Karnataka (75.60%) and Meghalaya (75.48%). The states and union territories with literacy rates below the national average which is 74.04% are Jammu and Kashmir, Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Jharkhand, Odissa, Assam and Bihar with a literacy rate of 63.28% ranks last in the country preceded by Arunachal Pradesh (66.95%) and Rajasthan (67.06%). In contrast, these ten states namely Kerala, Lakshadweep, Mizoram, Tripura, Goa, Daman and Diu, Puducherry, Chandigarh, Delhi and Andaman and Nicobar have achieved lit-

eracy rate of above 85%.The states and union territories which have literacy below the national average in respect of all the three categories *i.e.*, persons, males and females are Arunachal Pradesh, Chhattisgarh, Madhya Pradesh, Andhra Pradesh, Bihar, Rajasthan, Jammu and Kashmir, Jharkhand and Uttar Pradesh. Kerala holds the first rank in the country in female literacy with 91.98%. Rajasthan 52.66% has recorded the lowest female literacy rate preceded by Bihar 53.33%. Similarly, the state and union territories with female literacy rate below the national average 65.46% are Odissa, Chhattisgarh, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh, Jammu and Kashmir, Jharkhand and Rajasthan. The reasons behind disparity in literacy rate among different states, where those states which have literacy rate above national average are more urbanized, industrialized, with better educational infrastructure and other associated facilities, better socio-economic conditions, liberal mindset, awareness about education etc. In contrast rest of the states where literacy rate is below national literacy rate are very backward and poor with absence of educational infrastructure, unawareness about the importance of education, social and cultural hindrances etc play major role in their low level of literacy rate.

C. Health care condition of women

A healthy population being the basic necessity for development, it is essential to assess its variability in terms of various health indicators with gender perspective. After education, healthcare facility is one of the basic requirements for development of a country. India is among the fast emerging economy in the world scenario where attainment of universal health care access is the present goal of the Indian health service system. As per, the Sample Registration System (SRS) 2016 estimates show the Crude Birth Rate (CBR) is defined as the number of live births per 1000 population which was 21, for rural and urban it was 22.7 and 17.4, respectively. Nine states and one union territory have CBR above the national average, those states in descending order namely, Uttar Pradesh (27.0), Bihar (25.9), Madhya Pradesh (25.7), Dadra and Nagar Haveli (25.6), Rajasthan (25.4), Meghalaya (24.1), Jharkhand (23.8), Chhattisgarh (23.4), Assam (22.4), Haryana (21.2) and rest of the states are below the national average of CBR. The lowest Crude Birth Rate has been recorded in Goa (12.9) followed by Lakshadweep (14.0), Manipur (14.6), Kerala (14.8). Another health indicator is Infant Mortality Rate (IMR) is the number of deaths under one year of age per 1000 live births. It was 39 at all India level, for rural and urban it was 43 and 26, respectively in this eight states have IMR above the national level those states in descending order namely, Madhya Pradesh (52), Assam and Odisha (49), Uttar Pradesh (48), Rajasthan and Meghalaya (46), Chhattisgarh (43), Bihar (42), and the lowest IMR was recorded in Manipur (11), followed by Kerala (12) and Puducherry and Nagaland (14). Total Fertility Rate (TFR) refers total number of children to be born by a woman in her life time, it was 2.3 at all India level, for rural and urban it was 2.6 and 1.8, respectively. TFR was high for illiterate women both in rural and urban areas. Eight states and one union territory were above the national level of TFR namely Dadra and Nagar Haveli (3.3), Bihar (3.2), Meghalaya (3.1), Uttar Pradesh (3.1), Madhya Pradesh (2.8), Arunachal

Pradesh, Rajasthan and Jharkhand (2.7), Chhattisgarh (2.5) and the lowest TFR was recorded in Andaman and Nicobar and Manipur (1.5), followed by Goa, Jammu and Kashmir and West Bengal (1.6), Delhi, Punjab and Andhra Pradesh (1.7). The Maternal mortality rate (MMR) is the annual number of female deaths per 100,000 live births from any cause related to or aggravated by pregnancy or its management has declined from 254 in 2004-06 to 167 in 2011-13. Major Indian states where Maternal Mortality Rate was above the national MMR in descending order namely, Assam (300), Uttar Pradesh and Uttarakhand (285), Rajasthan (244), Odisha (222), Madhya Pradesh and Chhattisgarh (221), Bihar and Jharkhand (208) and the lowest MMR was listed in Kerala (61) followed by Maharashtra (68) and Andhra Pradesh (920).

The states where all the indicators (CBR, IMR, TFR, and MMR) are above the national level are Uttar Pradesh, Bihar, Madhya Pradesh, Chhattisgarh, and Rajasthan, whereas in case of Jharkhand (CBR,TFR, and MMR) and other states like Assam (CBR, IMR, and MMR), Meghalaya (CBR, IMR, and TFR), Odisha (IMR and MMR), Dadra and Nagar Haveli (TFR and CBR), Haryana (CBR), Arunachal Pradesh (TFR), Uttarakhad (MMR) are above the national level and rest of the states are below the national level in concerned indicators. The reasons behind the regional disparities in Crude Birth Rate (CBR), Infant Mortality Rate (MMR), Total Fertility Rate (TFR) and Maternal Mortality Rate (MMR) in Indian states are following the states where these indicators are above the national average are also highly rural and below the national urbanization rate (31.16%) except Haryana and Dadra and Nagar Haveli, in case of literacy these states are also below national level (74.04%) except Haryana, Uttarakhand and Dadra and Nagar Haveli these are the two major reasons associated with poverty, agriculture based economy, Inadequate supply of family welfare services, unawareness about family planning and contraceptives, early marriage, son preference, religious superstition, unemployment, lack of recreational facilities, absence of better medical facilities and amenities, illiteracy etc. which lagging these states behind national standard rate. In contrast those states which are below the national average in all these indicators are more urbanized, industrialized, with better educational and medical facilities, have fair sex ratio, awareness about family planning and contraceptives, high living standard etc.

D. Economic Participation of Women

The economic activity may be classified as organized and unorganized, each of which may be in the formal or informal sector. Participation of women in economic activities in formal sectors of industries, services and agricultural sector is measurable, but activities of women in informal sectors such as house works, training and education of children, activities in agricultural sectors and household services are difficult to measure. Although women constitute a little less than the half of the economically active population, their contribution to economic activity is far below the potential. The progress toward gender equality in respect of participation in economic activities seems to be very slow. The number of women in work force as a proportion of the total population provides an indicator of their workforce participation.

As per the NSSO data 2011-12, the com-

bined workforce participation rate in India was 39.79%, for females and males it was 25.51% and 53.26%, and for rural and urban work force participation rate was 41.8% and 35.31%, respectively. While there was no considerable rural-urban gap for males work participation it was almost 53% .In contrast there was considerable rural-urban gap for females it was 30% for rural and15.4% for urban. While, 59.3% of the female workers in rural India were self employed and in urban areas the corresponding figure was 42.8% the same was for male workers 54.5% in rural areas and 41.7% in urban areas were self employed. Whereas, in rural areas the share of regular wage/salaried employees is less for both females 5.6% and males 10% as compared to urban areas females 42.8% and males 43.4%. Thus, a considerable gender gap exists in both rural and urban areas and the gap is higher in urban areas. The average wage/ salary received per day by regular wage/ salaried employees of age 15-59 years for females (rural: Rs.201.56, urban: Rs.366.15) is lower than that of males (rural: Rs.322.28, urban: Rs.469.87). Thus, wage gap is more in both rural and urban areas. Irrespective of education level and residence (rural/ urban), the average per day wage/salary earned by a female is less than that by a male.

In India, social factors play significant role in reducing women's work force participation. Husbands and relatives often discourage women from working, while, in many parts of the country, restriction are imposed even on their movements outside the household. After all these restrictions and constraints, women play crucial role in Indian economy. In rural areas except, little regular wage/salaried employment which is only 5.6% of total working women force, women often participate in agricultural activities as self employed workers to supplement their families' income. Although the growth of agriculture sector is almost stagnant yet the self employed female workers in agriculture and related sector is still increasing. In this context, it is notable that workforce participation is particularly low among educated urban women the section that is, in fact, less likely to be constrained by social factors. The proportion of those attending domestic duties (and therefore out of the work force) was higher among urban females with graduate degrees or higher in comparison to rural women with primary or middle school education. The reasons behind the low participation of women are lower wages than man, sexual harassment at work place, increasing violence against women in urban areas associated with the sheer absence of suitable employment opportunities etc. Creating more jobs and ensuring better working conditions for women accelerate the pace of greater participation in the economy. The workforce participation rate varies state to state due to various socio-economic and geographical reasons, sixteen states in India along with two union territories were above the national average of workforce participation rate 39.79%, their workforce participation rate in descending order namely, Himachal Pradesh (51.85%), Sikkim (50.47%), Daman and Diu (49.86%), Nagaland (49.24%), Chhattisgarh (47.68%), Andhra Pradesh (46.61%), Dadra and Nagar Haveli 45.73% Karnataka (45.62%), Tamil Nadu (45.58%), Manipur (45.09%), Mizoram (44.36%), Maharashtra (43.99%), Rajasthan (43.60%), Madhya Pradesh (43.47%), Arunachal Pradesh (42.47%), Odisha (41.79%), Andaman and Nicobar Islands (40.08%), Tripura (40.00%)

and Meghalaya (39.96%).These all states except Daman and Diu with Andaman and Nicobar had higher level of men workforce participation rate associated with rural work force participation above national workforce participation whereas except Himachal Pradesh and Nagaland, all states had women workforce participation below national workforce participation associated with small size of urban workforce participation rate rest of above mentioned states all were below the average national workforce participation rate the three bottom states in workforce participation level were Uttar Pradesh (32.94%), Bihar (33.36%) and Jammu and Kashmir (34.47%).

Women's empowerment dimensions in Indian context

No.	Dimensions	Rural	Urban	Total at India level
1.	Demographic (sex ratio, Number of female/ 1000 male, Census of India, 2011)	(a) Sex ratio was 949. (b) Sex ratio for 0-6 age group was 923. (c) Sex ratio (1951) was 965, in 2011 it become 949.	(a) Sex ratio was 929. (b) Sex ratio for 0-6 age group was 905. (c) Sex ratio (1951) was 860, in 2011 it become 929.	(a) Sex ratio was 943. (b) Sex ratio for 0-6 age group was 919. (c) Sex ratio (1951) was 946, in 2011 it become 943.
2.	Educational (Literacy rate as per census of India, 2011)	(a) Literacy level was 67.8% and for male and female 78.57% and 58.75%, respectively.	(a) Literacy level was 84.1%, and for male and female 89.67% and 79.92%, respectively.	(a) Literacy level was 72.98% and for male and female 80.9% and 64.43%, respectively.
3.	Health (Data as per Sample Registration System, Registrar General of India, 2016).	(a) Crude birth rate (CBR) was 22.7. (b) Total fertility rate (TFR) was 2.6. (c) Infant mortality rate (IMR) 43, for male and female 42 and 45, respectively.	(a) Crude birth rate (CBR) was 17.4. (b) Total fertility rate (TFR) was 1.8. (d) Infant mortality rate (IMR) 26, for male and female 24 and 28, respectively.	(a) Crude birth rate (CBR) was 21. (b) Total fertility rate (TFR) was 2.3. (d) Infant mortality rate (IMR) 39, for male and female 37 and 40, respectively.
4.	Economic (As per census of India 2011 and NSSO data 2011-12).	(a) The workforce participation rate was 41.8% whereas for female and male it was 30.3% and	(a) The workforce participation rate was 35.31% whereas for female and male it was 15.4% and	(a) The workforce par ticipation rate was 39.79% whereas for female and male it was 25.51% and

	53.0%, respectively. (b) The self employed for female and male workers it was 59.3% and 54.5%, respectively. (c) Regular waged/ salaried employee for female and male worker it was 5.6% and 10.0%, respectively.	53.76%, respectively. (b) The self employed female and male workers were 42.8% and 41.7%, respectively. (c) Regular waged/ salaried employee for female and male worker it was 42.8% and 43.4%, respectively.	53.26%, respectively.

References

Antrobus, P., 2004, The Global Women's Movement: Origins, Issues and Strategies, Zed Books Ltd., London.

Apte, J.S., 1998, Education and Women's empowerment in Sushma Sahay's Women and Empowerment: Approach and Strategies, Discovery Publishing House, New Delhi.

Batliwala, S., 1995, Women and Empowerment, Gyan Publishing House, New Delhi.

Bhasin, K., 2016, Women's Empowerment in the Indian Context, *Yojana*, Vol.60, pp.7-11.

Bisnath, S. and Elson, D., 2001,Women's Empowerment, (Revised), University of Manchester press, U.S.A.

Boserup, E., 1970, Women's Role in Economic Development, Allen and Unwin, London.

Chaudhary, A.R., Chani, M.I. and Pervaiz, Z., 2012, An Analysis of different Approaches to Women Empowerment: A case study of Pakistan, *World Applied Sciences Journal* Vol.16, No. (7) pp.971-980.

Ganguli, B., 2015, Empowering Women, Kurukshetra *A Journal on Rural Development*, Vol. 63, No. (5) pp.36-39.

Griffer, V., 1987, Women development and empowerment, A pacific feminist perspective (ed.), Asian and Pacific centre, Kaulalumpur, pp.117-118.

Guha, P., Gomes, V. and Janu, A., 2016, Women's well being and development in Himachal Pradesh: A district level analysis, *The Transactions*, Institute of Indian Geographers, Vol. 38, No. (2), pp.239-247.

Gupta, K. and Yesudian, P.P., 2006, Evidence of Women's empowerment in India: A study of socio-spatial disparities, *Springer*, Vol.65, No. (4) pp.365-380.

Kabeer, N., 2005, Gender Equality and Women's Empowerment: A critical analysis of the third Millennium Development Goal, *Gender and Development*, Vol. 13, pp.13-24.

Kishor, S. and Gupta, K., 2004, Women's empowerment in India and its states: Evidence from the NFHS, *Economic and Political Weekly*, Vol.39, No. (7) pp.694-712.

Kumar, H. and Varghese J., 2005, Women's Empowerment Issues, Challenges, and Strategies: A source book, Regency Publication, New Delhi.

Massey, D., 1994, Space, Place, and Gender, University of Minnesota Press, Minnepolis.

Malhotra, A., Schuler, S. and Boender, C., 2002, Measuring Women's Empowerment as Variable in International Development, Draft, PRMGE, The World Bank, Wanshington, DC.

National policy for women Articulating a vision for empowerment of women.,2016, Ministry of women and child development, Draft.

Paraveen, G.,2011, Empowerment of Women in India, Manak publications, New Delhi.

Pillai, J.K., 1995,Women and Empowerment, Gyan Publishing House, New Delhi.

The Millennium development goals report., 2015, United Nations, New York.

Pittman, A., 2014, Fast-Forwarding Gender Equality and Women's Empowerment?, UNDP Report, New York.

Rani, G. S., 2012, Development of Women, Discovery Publishing House Pvt. Ltd., New Delhi.

Raju, S., 2005, Limited Options-Rethinking Women's Empowerment 'Projects' in Development Discourses: A Case from Rural India, Gender, *Technology and Development*, Vol. 9, No. (2) SAGE Publications, New Delhi and Thousand Oaks London.

Raju, S., 2006, Contextualising gender empowerment at the grassroots: a tale of two policy initiatives, GeoJournal, Vol.65, pp.287-300.

Saharan, V., 2015, Women empowerment: Issues and concerns in empowering women the Indian perspective (ed.) Authors Pride Publishers, New Delhi.

Schuler, S.R., Islam, F., and Rottach, E., 2010, Women's Empowerment Revisited: A case study from Bangladesh, Taylor and Francis Group, Vol.20, No. (7) pp.840-854.

Sharma, A., 2011, Women empowerment milestones and challenges, *Kurukeshetra A Journal of Rural Development*, Vol. 59, No. (11) pp.10-16.

Sharma, S., 2015, Gender Equality and Women Empowerment, *Kurukshetra A Journal on Rural Development*, vol.63, No.(5) pp.12-17.

Singhal, C.S., 2016, Policies and Programmes for Rural Development (ed.), Vaishnavi Graphics, Hyderabad.

Thomas, J.J., 2013, A women-shaped gap in the Indian Workforce, The Hindu.

http://www.mospi.gov.in/national-sample-survey-office-nsso.

http://ncrb.gov.in. http://eci.nic.in/eci/eci.html.

http://censusindia.gov.in. http://www.unifem.org

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Female Education and Fertility Differentials by Religion in Murshidabad District, West Bengal

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Abstract

Education is one of the most important factors indirectly affecting fertility behaviour and believed to be the single most important variable accounting for a large reduction in fertility. The present paper tries to investigate the relationship between female education and religious fertility differentials in Murshidabad district, West Bengal. The study is based on primary sources of data collected through a household survey. Mean Child Ever Born (MCEB) is one of the measures of fertility, which is applied to find out fertility rates by female education and religion (Muslim and Hindu). Choropleth maps and bar graphs have been prepared to highlight spatial patterns of fertility. The finding reveals that advancement in female education helps in reducing the fertility rate in Murshidabad district.

Key words: *reproductive female education, fertility rate, fertility rate by religion, mean child ever born and correlation.*

Introduction

Literacy rate refers to the total percentage of the population of an area at a particular time aged seven years or above who can read and write with understanding (Census 1991). Education of females enhances their capabilities, such as the freedom to participate in political and economic processes, protects oneself against exploitation, exercises personal mobility, attains high social status, increases child and maternal well-being. At the heart of the gender gap are the fact that many of the benefits of female education are societal such as more productive workforce, lower fertility and lower infant mortality. Whereas, the costs are private, which include tuition fees, uniforms, transport and most importantly, opportunity costs in the shape of foregone child labour (King and Hill, 1993). Education is one of the most important social variables that have drawn a substantial attention from researchers engaged in the study of fertility differentials. Education as an

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achieved status of an individual does not change over time like any other variables and it is expected to give individual an alternative source of new normative direction as opposed to traditional ones.

There is a strong need to stabilize the growth of population in India by controlling the fertility rate, which is high in India. Human fertility is a socio-economic process and as a biological one (Robinson and Kanter (1988). It is largely influenced by a number of socio-economic, cultural, demographic and psychological factors. Education is an important instrument of social change of any society, which can change our thoughts, behaviors and make use of full utilization of resources. The World Bank calls woman's education as the single most dominant investment that can be made in the developing world. There are so many countries, which support the female education not only in economic growth but also to promote smaller families, increase modern contraceptive use and adaptation of family planning programmes. Female with more schooling tends to have smaller family size. Throughout the world, more education is associated with smaller family size. In a number of less developed countries, women with no education have about twice the number of children as women with ten or more years of schooling. Female with more education usually makes a later, healthier transition into adulthood. They have their first sexual experience later, marry later, want smaller families and are more likely to use contraception than their less educated counterparts. Jejeebhoy (1995) explains that fertility rate and level of women's education differentiate from country to country. This study concludes that more developed countries have higher female literacy levels; high education is consistently associated with lower fertility. In the poorest countries, however, less education may have little effect on fertility levels.

Kim (2016) explains that the negative correlation between women education and fertility is strongly observed across regions and time in both developed and developing countries; better-educated women have fewer children than less-educated women. The female education can reduce fertility because better educated women earn more and may raise their children more effectively. Education also improves maternal and child health, thereby, increasing physical capacity of women to give birth and reducing the necessity for more children. Glewwe (1999) also found that higher female literacy in Ghana is associated with lower fertility because time spent in school had a strong impact on fertility over and above the effect of literacy alone. Sharma and Retherford (1990) based on 1981 Census for 326 districts in India explained that female literacy would have a significant negative impact on fertility. Therefore, female literacy is necessary for fertility reduction, but without an overall development, the female literacy alone will not affect significant reduction in fertility. Using the Indian census data of Indian districts for 1981 and 1991, Jeanand Mamta (2000) examined that women's education was the most important factor for determining fertility differences across the country over a period. The author further pointed out that female literacy rate is negatively correlated with fertility. The low level of child mortality and son-preference also contributed to lower fertility. Rajan (2005) analyzed the determinants of fertility behavior in South India. He discusses that Tamil Nadu and

Kerala village had a higher literacy rate and lower fertility than Andhra Pradesh and Karnataka. Nag and Singhal (2013) indicate an inverse relationship between the level of education and fertility. It is also observed that moderately educated women are more likely to discuss control of their family size. Güne? (2013) investigates the causal relationship between female education and fertility by using a change in the compulsory schooling law in Turkey. The results show that extra year of female schooling reduces teenage fertility by 0.03 births.

Keeping in view the above discussion, the authors' approach is tri-focal. Firstly, it deals with block-wise distribution of female literacy and educational level by religion in Murshidabad, secondly by it analyses block-wise fertility differentials by religion and thirdly, observes the relationship between female education and fertility rate in Murshidabad district.

Database and methods

The present study is based on primary sources of data collected through a direct field survey from 52 sampled villages of 26 blocks (two from each block) and 7 municipalities of Murshidabad district in the year 2014. A stratified and purposive random sampling design has been used to collect the data. The sampled villages have been selected based on the number of households and those villages which are having both Muslim and Hindu population. Two villages from each block and one ward from each municipality have been selected and ten percent households have been taken into account for data generation. Further, to measure fertility, Mean Child Ever Born (MCEB) per woman is calculated in general and particularly on the basis of education and religion.

MCEB refers to the total number of live births to all women in the age group 15-49 is called mean child ever born. The average of the data calculated is set out to represent the block. The data arranged by blocks have been categorized into high, medium and low grade through mean and standard deviation methods. Maps and diagrams are drawn to highlight variations at block level in literacy rate, fertility rate and religious composition. The relationship between MCEB and female educational level has also been calculated through simple correlation coefficient method.

The study area

The Murshidabad district is the north-western district of the Presidency division of West Bengal, lying between 23º 43' 30" and 24º 50' 20" North latitudes and 87º 49' 17" and 88º 46º 00" East longitudes (Fig 1).

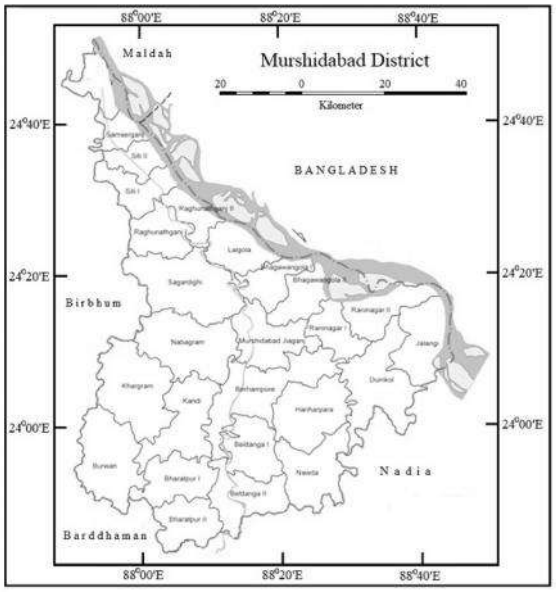

Fig 1

It covers an area of about 5324 km2. Murshidabad with its headquarters at Berhampore belongs to the mature deltaic part

(except Kandi sub-division) of larger Ganga drainage system of India. Bhagirathi, the tributary of the Ganga flows almost in southern direction along the middle portion of the district, dividing it into almost two equal parts having distinct characteristics in terms of physio-geological characteristics (O'Malley, 1914). The western portion of the river is locally known as *Rarh* while the eastern portion is named as *Bagri*. The district has 26 Community Development Blocks distributed over seven sub-divisions. According to the 2011 Census, Murshidabad district has a total population of 7,103,807, among which 3,627,564 are males and 3,476,243 are females. The population density of Murshidabad district is 1,334 per km^2. The average literacy rate of Murshidabad in 2011 was 66.59 percent, with male (69.95 percent) and female (63.09 percent) literacy rate, respectively.

Reproductive female educational status

To study married female education status an attempt has been made to analyses this in two-way process: literacy rate and level of female education. There are a considerable inter-block variations in distribution of married female literacy rate in general and according to the religion in Murshidabad district (Table 1 and Fig 3C). The literacy rate is marked with notable variations in its distribution among the rural blocks in the district. It varies from 38.89 percent in Samserganj to 63.16 percent in Berhampur with the district average of 57.86 percent. It may be seen that twelve blocks out of twenty-six blocks have registered relatively high level of literacy rate than the district average. The remaining blocks are recorded below the district average, with two blocks, namely Bharatpur-I and Samserganj at the bottom of scale with less than 50 percent literacy rate. The female literacy rate (above 60 percent) is higher in the central part of the district, *i.e*. Berhampur, Beldanga-I and Murshidabad-Jiaganj, and lowest in the central parts of the district. These blocks are predominantly located in areas which are considered to be part of the city region as focus of administrative, economic and educational institutions. Berhampur is one of the most significant places for silk production and Murshidabad-Jiaganj was the capital of India during Nawab Sirajuddaula. On the other hand, Samserganj (38.39 %) block has registered lowest female literacy rate followed by Bharatpur-I and Lalgola blocks.

The literacy rate among the Muslim and Hindu female population are considerably different. The literacy rate of Muslim female is comparatively lower than the Hindu female literacy rate of 60.75 percent, *i.e.*, 5.67 percent higher than that of the Muslim female literate. Like-wise, the average range of variation among Muslim and Hindu female literacy rates is also wide. It is considerably lower among the Muslim female as it ranges from 33.33 to 60.00 percent, whereas, Hindu female ranges from 44.44 to 66.67 percent (Table 1). The block-wise distribution shows that centrally located blocks (Berhampur, Beldanga-I, and Murshidabad-Jiaganj) have registered high female literacy rate among both Muslim and Hindu females (Fig 3A and B). On the other hand, Lalgola, Raghunathganj-II, Bharatpur-I and Samserganj blocks have recorded low literacy rate. Geographically, these blocks are located in south-western and north- eastern parts of the district.

Table 1. Block-Wise Distribution of Reproductive Female Educational Level in Murshidabad District, 2014

Name of Blocks	Literate			Below Primary			Primary			Secondary			Gracuate and Above		
	M	H	T	M	H	T	M	H	T	M	H	T	M	H	T
Farakka	58.82	62.00	60.40	11.76	14.00	12.87	27.45	26.00	26.73	15.69	14.00	14.85	3.92	8.00	5.94
Samserganj	33.33	44.44	38.89	11.11	11.11	11.11	11.11	22.22	16.67	11.11	11.11	11.11	0.00	0.00	0.00
Suti-I	51.61	60.00	55.74	12.90	13.33	13.11	29.03	30.00	29.51	9.68	13.33	11.48	0.00	3.33	1.64
Suti-II	54.05	61.11	57.53	13.51	16.67	15.07	24.32	30.56	27.40	13.51	11.11	12.33	2.70	2.78	2.74
Raghunathganj-I	56.41	63.16	59.74	7.69	10.53	9.09	28.21	28.95	28.57	17.95	18.42	18.18	2.56	5.26	3.90
Raghunathganj-II	47.06	58.82	52.94	5.88	17.65	11.76	23.53	23.53	23.53	11.76	11.76	11.76	5.88	5.88	5.88
Lalgola	48.00	56.52	52.08	12.00	8.70	10.42	24.00	26.09	25.00	12.00	17.39	14.58	0.00	4.35	2.08
Sagardighi	53.66	59.46	56.41	9.76	10.81	10.26	26.83	27.03	26.92	14.63	16.22	15.38	2.44	5.41	3.85
Bhagwangola-I	50.00	57.89	53.85	10.00	10.53	10.26	25.00	26.32	25.64	15.00	15.79	15.38	0.00	5.26	2.56
Bhagwangola-II	56.25	60.87	58.51	10.42	10.87	10.64	27.08	28.26	27.66	14.58	17.39	15.96	4.17	4.35	4.26
Raninagar-I	57.50	63.16	60.26	7.50	15.79	11.54	27.50	26.32	26.92	20.00	15.79	17.95	2.50	5.26	3.85
Raninagar-II	57.14	62.86	60.00	8.57	11.43	10.00	28.57	28.57	28.57	20.00	17.14	18.57	0.00	5.71	2.86
Jalangi	52.50	60.00	56.25	10.00	10.00	10.00	27.50	27.50	27.50	12.50	17.50	15.00	2.50	5.00	3.75
Domkal	56.25	58.06	57.14	9.38	9.68	9.52	31.25	29.03	30.16	12.50	12.90	12.70	3.13	6.45	4.76
Murshidabad-Jiaganj	58.82	63.64	61.19	11.76	12.12	11.94	26.47	27.27	26.87	14.71	15.15	14.93	5.88	9.09	7.46
Nabagram	50.00	59.09	54.55	9.09	13.64	11.36	27.27	27.27	27.27	13.64	18.18	15.91	0.00	0.00	0.00
Khargram	53.85	59.46	56.58	12.82	8.11	10.53	28.21	29.73	28.95	10.26	16.22	13.16	2.56	5.41	3.95
Kandi	57.45	61.36	59.34	10.64	11.36	10.99	27.66	25.00	26.37	17.02	20.45	18.68	2.13	4.55	3.30
Berhampur	60.00	66.67	63.16	10.00	11.11	10.53	27.50	22.22	25.00	15.00	19.44	17.11	7.50	13.89	10.53
Hariharpara	57.38	59.65	58.47	13.11	12.28	12.71	26.23	28.07	27.12	14.75	15.79	15.25	3.28	3.51	3.39
Nowda	53.85	58.33	56.00	7.69	12.50	10.00	26.92	20.83	24.00	19.23	20.83	20.00	0.00	4.17	2.00
Beldanga-I	59.57	63.64	61.54	12.77	11.36	12.09	25.53	25.00	25.27	14.89	15.91	15.38	6.38	11.36	8.79
Beldanga-II	55.56	60.53	58.11	11.11	7.89	9.46	25.00	31.58	28.38	13.89	15.79	14.86	5.56	5.26	5.41
Bharatpur-I	40.00	54.55	47.62	20.00	9.09	14.29	10.00	18.18	14.29	10.00	18.18	14.29	0.00	9.09	4.76
Bharatpur-II	52.38	59.09	55.81	9.52	9.09	9.30	28.57	27.27	27.91	14.29	13.64	13.95	0.00	9.09	4.65
Burwan	55.26	61.54	58.44	10.53	10.26	10.39	26.32	30.77	28.57	15.79	15.38	15.58	2.63	5.13	3.90
Murshidabad	**55.08**	**60.75**	**57.86**	**10.72**	**11.57**	**11.14**	**26.64**	**27.22**	**26.92**	**14.79**	**16.12**	**15.44**	**2.93**	**5.84**	**4.36**

Source: Based on Field Survey, 2014 , * M-Muslim, H-Hindu, T-Total

Educational level

The educational level of a society cannot be judged only from its literacy rate; however, it is an important indicator for making a difference between literate and illiterate. Therefore, it is also important to analyze the educational attainment of the population. Educational attainment refers to acquiring education in a systematic way through formal and informal means of education. There are different levels of education, but in the present study, these are arranged under four slabs *i.e.*, below primary, primary, secondary, graduate and above. The level of education has comparatively improved from primary to graduate and above in general and also among both the religious groups. Fig 2 depicts that considering the level of education, the proportion of Muslim female education is comparatively lower than the Hindu females. About 11.14 percent of the female has only education below primary, out of which 10.72 percent is Muslim females and 11.57 percent are Hindu females.

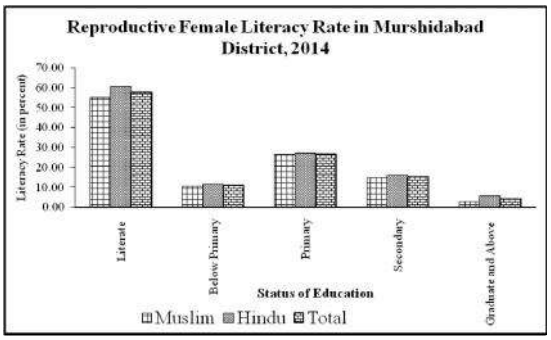

Fig 2

The primary level of education comprises 26.64 percent Muslim and 27.22 percent Hindu females, which together accounted for 26.92 percent of females who are educated upto the primary level. More females are educated under primary school. At the secondary level (high school and secondary school), the average is 15.44 percent, comprising of 16.12 percent of Hindu females and 14.79 percent of Muslim females of the district. The lowest proportion of females is reported at the graduate and above category in both religious groups in the district with Muslim (2.93 percent) and the Hindus (5.84 percent) and district average of 4.36 percent.

It is evident from the preceding discussion that block-wise female literacy rate is highly uneven. It is highest in Berhampur (63.16 percent) and lowest in Samserganj and Bharatpur-I blocks. The educational qualification among the married females has sharply declined from primary level education to graduate and above level education throughout the district. Further, the distance of school, lack of transport facilities and cost incurred in education generally influence the educational level in rural areas. Consequently, most of the guardians do not send their children (especially girls) outside the village or far off distance. It is also observed during the field survey that parents of marginal family are unable to send their children to school outside the village.

Distribution of fertility

There are several measures of fertility, but in this paper Mean Children Ever Born (MCEB) is taken into consideration for analyzing the fertility status of women in Murshidabad district. The mean child ever born varies widely among the blocks in Murshidabad district. It ranges from 2.25 to 3.31 children per women in the child-bearing age of women, whereas, the district average is 2.84 children per women. Fertility (MCEB) rate by religion at block level in Murshidabad district as shown in Table 2 can be grouped into three, of high

Table 2. Block-Wise Distribution of MCEB by Reproductive Female Educational Level in Murshidabad District, 2014

Block Name	Literate			Below Primary			Primary			Secondary			Graduate		
	M	H	T	M	H	T	M	H	T	M	H	T	M	H	T
Farakka	2.87	2.45	2.66	3.17	2.71	2.92	3.21	2.54	2.89	2.38	2.43	2.40	1.50	1.75	1.67
Samserganj	2.33	2.75	2.57	3.00	3.00	3.00	2.00	3.00	2.67	2.00	2.00	2.00	0.00	0.00	0.00
Suti-I	2.94	2.67	2.79	3.50	3.00	3.25	3.00	2.78	2.89	2.00	2.25	2.14	0.00	2.00	2.00
Suti-II	2.90	2.64	2.76	3.40	3.00	3.18	3.11	2.73	2.90	2.20	2.00	2.11	2.00	2.00	2.00
Raghunathganj-I	2.55	2.33	2.43	3.00	2.75	2.86	2.73	2.55	2.64	2.14	2.00	2.07	2.00	1.50	1.67
Raghunathganj-II	2.63	2.50	2.56	3.00	3.00	3.00	2.75	2.50	2.63	2.50	2.00	2.25	2.00	2.00	2.00
Lalgola	3.08	2.85	2.96	3.67	3.00	3.40	3.17	3.00	3.08	2.33	2.75	2.57	0.00	2.00	2.00
Sagardighi	3.09	2.77	2.93	3.50	3.25	3.38	3.27	3.20	3.24	2.67	2.17	2.42	2.00	1.50	1.67
Bhagwangola-I	2.70	2.36	2.52	3.00	3.00	3.00	2.80	2.40	2.60	2.33	2.00	2.17	0.00	2.00	2.00
Bhagwangola-II	2.89	2.57	2.73	3.20	3.20	3.20	3.00	2.69	2.85	2.86	2.13	2.47	1.50	2.00	1.75
Raninagar-I	2.39	2.17	2.28	3.00	2.50	2.67	2.64	2.30	2.48	2.00	1.83	1.93	1.00	1.50	1.33
Raninagar-II	2.60	2.32	2.45	3.00	2.75	2.86	2.80	2.40	2.60	2.14	2.00	2.08	0.00	2.00	2.00
Jalangi	2.86	2.38	2.60	3.50	2.75	3.13	3.00	2.55	2.77	2.20	2.00	2.08	2.00	2.00	2.00
Domkal	2.61	2.39	2.50	3.33	3.00	3.17	2.60	2.56	2.58	2.25	2.00	2.13	2.00	1.50	1.67
Murshidabad-Jiaganj	2.15	1.95	2.05	2.75	2.50	2.63	2.22	2.11	2.17	1.80	1.60	1.70	1.50	1.33	1.40
Nabagram	2.73	2.46	2.58	3.00	3.00	3.00	3.00	2.50	2.75	2.00	2.00	2.00	0.00	0.00	0.00
Khargram	2.67	2.27	2.47	3.00	2.67	2.88	2.73	2.36	2.55	2.25	2.17	2.20	2.00	1.50	1.67
Kandi	2.78	2.48	2.63	3.20	3.20	3.20	3.08	2.73	2.92	2.13	2.00	2.06	2.00	1.50	1.67
Berhampur	2.25	2.00	2.13	2.75	2.50	2.63	2.27	2.13	2.21	2.17	2.00	2.08	1.67	1.40	1.50
Hariharpara	2.86	2.38	2.62	3.50	2.86	3.20	3.00	2.50	2.75	2.22	2.00	2.11	2.00	1.50	1.75
Nowda	3.07	2.64	2.86	3.50	3.33	3.40	3.14	2.80	3.00	2.80	2.20	2.50	0.00	2.00	2.00
Beldanga-I	2.43	2.14	2.29	2.67	2.80	2.73	2.50	2.45	2.48	2.29	1.86	2.07	2.00	1.20	1.50
Beldanga-II	2.55	2.26	2.40	3.00	2.67	2.86	2.67	2.42	2.52	2.20	2.00	2.09	2.00	1.50	1.75
Bharatpur-I	2.75	2.00	2.30	3.00	3.00	3.00	3.00	2.00	2.33	2.00	1.50	1.67	0.00	2.00	2.00
Bharatpur-II	2.82	2.54	2.67	3.50	3.00	3.25	3.00	2.67	2.83	2.00	2.33	2.17	0.00	2.00	2.00
Burwan	2.86	2.58	2.71	3.25	3.25	3.25	3.00	2.75	2.86	2.50	2.17	2.33	2.00	1.50	1.67
Murshidabad	**2.71**	**2.40**	**2.55**	**3.18**	**2.89**	**3.03**	**2.86**	**2.56**	**2.71**	**2.27**	**2.06**	**2.16**	**1.81**	**1.62**	**1.68**

Source: Based on Field Survey, 2014, *** M-Muslim, H-Hindu, T-Total**

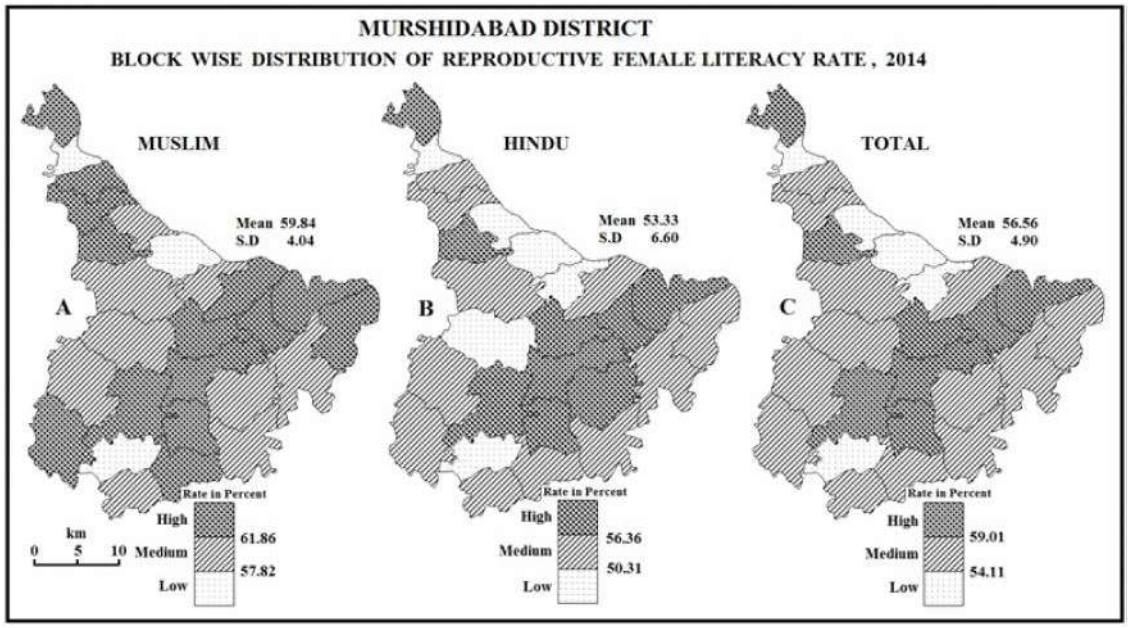

Fig 3

(above 2.98), medium (2.72-2.98) and low (below 2.72) MCEB. It may be pointed out that the blocks of high MCEB are generally scattered. There are nine blocks, which lie under high MCEB, out of these seven blocks, experiences high MCEB ranging between of 3.0 and 3.31 children per women, two blocks having registered three children per women. The blocks under the above MCEB range are Lalgola (3.31), Sagardighi (3.21), Nowda (3.20), Suti-I (3.08), Burwan (3.08), Suti-II (3.07), Samserganj (3.06), Bhagwangola-II (3.00) and Nabagram (3.00). Further, seven blocks that have shown low MCEB occupy the central and southern part of the district (Fig 4C). These blocks are Raninagar-II (2.71), Bharatpur-I(2.71), Beldanga-II (2.68), Raninagar-I (2.56), Beldanga-I (2.47), Murshidabad-Jiaganj (2.34) and Berhampur (2.25). The remaining blocks belong to medium MCEB.

Muslim / Hindu fertility rate

Muslim and Hindu fertility rates are unequally distributed in the district. The Muslim MCEB varies from one block to another with a maximum of 3.48 children per women in Lalgola and minimum of 2.40 in Berhampur block with an average of 2.97 children per women among the Muslim women (Table 2). Lalgola along with other eight south-western blocks, *i.e.*, Nowda, Sagardighi, Suti-I, Suti-II, Nabagram, Burwan, Bharatpur-II and Bhagwangola-II are showing high fertility rate among Muslim (Fig 4A). The low MCEB are found in central and south-eastern part of the district. These blocks are Raghunathganj-I (2.82), Khargram (2.82), Domkal (2.81), Beldanga-II (2.81), Raninagar-I (2.70), Beldanga-I (2.66), Murshidabad-Jiaganj (2.47) and Berhampur (2.40). About one-third blocks lies under medium MCEB, which ranges from 2.85 to 3.11 children per women.

Table 3. Block-wise Muslim MCEB and Reproductive Female Literacy Rate in Murshidabad District, 2014

Mean Child Ever Born					
Female Literacy Rate	Muslim	High (Above 3.12)	Medium (3.12-2.85)	Low (Below 2.85)	No. of Blocks
	High (Above 56.36)		Farakka, Hariharpara, Kandi	Raghunathganj-I, Raninagar-I, Beldanga-I, Murshidabad-Jiaganj, Berhampur	9
	Medium 50.31-56.31	Nowda, Bharatpur-II, Sagardighi, Suti-I, Suti-II, Burwan, Bhagwangola-II	Jalangi, Raninagar-II	Khargram, Domkal, Beldanga-II	11
	Low (Below 50.31)	Lalgola, Nabagram	Samserganj, Bharatpur-I, Raghunathganj-II, Bhagwangola-I		6
	No. of Blocks	9	9	8	

On the other hand, mean child ever born ranges from 2.08 to 3.13 children per Hindu women with an average of 2.70 (Table 2). The MCEB of Hindu female is lower than the Muslim female in rural parts of the district. The MCEB of Muslims is 0.27 higher than Hindu females. The low Hindu fertility rate is observed in seven blocks, located in central part of the district (Fig 4B). These blocks are Raninagar-II (2.57), Beldanga-II (2.55), Bharatpur-I (2.45), Raninagar-I (2.42), Beldanga-I (2.27), Murshidabad-Jiaganj (2.21) and Berhampur (2.08). Lalgola shows highest MCEB in the district among the Hindu females and accounts for 3.13 children per women, followed by Sagardighi (3.03), Samserganj (3.00), Nowda (3.00), Burwan (3.00), Suti-II (2.94), Suti-I (2.90) and Bhagwangola-II (2.87), located mostly in the north and south-western parts of the district. There are eleven blocks out of twenty-six which are confined to medium fertility rate and ranges from 2.63 to 2.82 children per women.

The Nexus between MCEB and female education level

The educational attainment has a consistently inverse relationship with fertility almost all cases. A number of studies have been conducted to assert this fact (Siddiqui and Jamal, 2012; Siddiqui and Yadav, 2009; Dwivedi and

Sograwl, 2008 and Veron). According to Srivastava (1998), educational attainment has a significant impact on fertility.

Block-wise association of MCEB and female literacy rate shows high MECB of above 2.98 children per women as registered in nine blocks. Out of total seven blocks are under medium category (54.11% - 59.01 %) and two blocks lie under the low category (below 54.11 %) as shown in Table 5. There are ten blocks which fall under medium range of MCEB, three of them lie under high literacy rate (above 59.01 %), five medium and two below low category. The low MCEB of below 2.72 children per women is confined in seven blocks. The high literacy rate is witnessed in five blocks having low MCEB. Religion-wise MCEB and literacy rate nexus is shown in Table 3 for Muslims and Table 4 for Hindus. Table 3, reveals that high MCEB of above 3.12 children per women is nil in high category of literacy rate (above 56.36 %) among Muslim female. However, in seven blocks, medium literacy rate (56.36-50.31 percent) is observed and two blocks with low Muslim female literacy rate of below 50.31 percent. There are about nine blocks, which lie under medium category of MCEB (2.85-3.12). They are trifurcated into three blocks of high, two blocks of medium and four blocks of low Muslim female literacy rate. There are five blocks confined to high female literacy rate with low MCEB and three blocks with low MCEB and medium female literacy rate.

Table 4 shows the Hindu MCEB and female literacy rate. It is observed from the table that MCEB is totally absent among high MCEB and high female literacy rate and medium MCEB with low female literacy rate. High MCEB above 2.85 children per women is found in eight blocks, six of them lie under medium female literacy rate varying from 57.82 percent to 61.86 percent and remaining two blocks are under low literacy rate (below 57.82

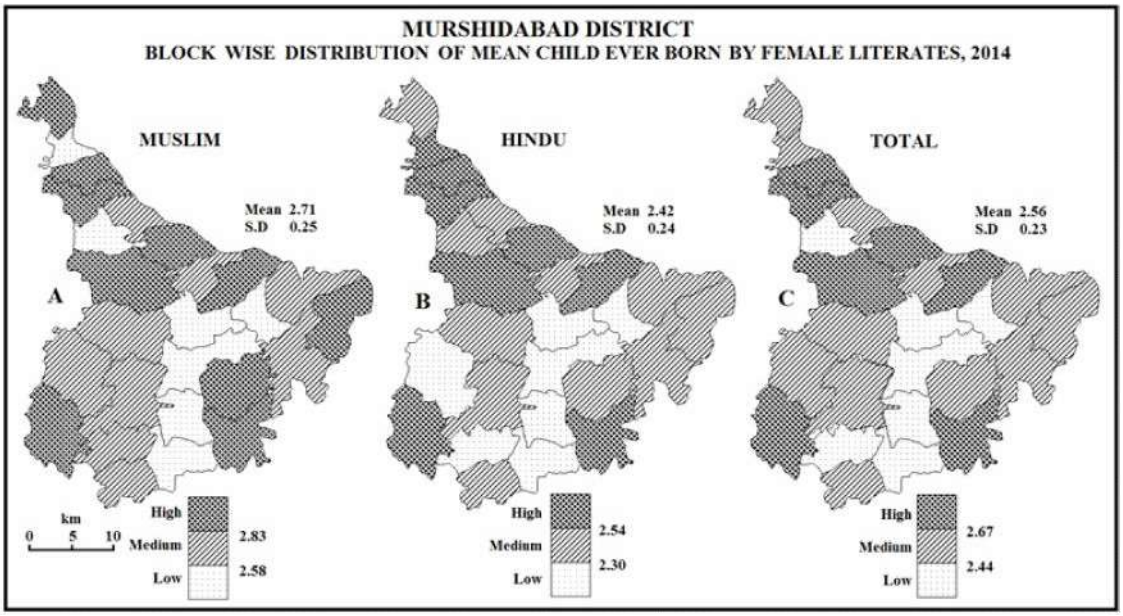

Fig 4

percent). On the same hand, medium MCEB ranges from 2.58 to 2.85. Further, in eleven blocks, two are from high literacy rate above 2.85 and nine blocks lying under medium literacy rate varying from 57.82 percent to 61.86 percent, respectively. The low MCEB below 2.58 children per women is observed in seven blocks, five from high literacy rate, one from medium rate and one from low literacy rate.

Table 4. Block-wise Hindu MCEB and Reproductive Female Literacy Rate in Murshidabad District, 2014

Mean Child Ever Born					
Female Literacy Rate	Hindu	High (Above 2.85)	Medium (2.58-2.85)	Low (Below 2.58)	No. of Blocks
	High (Above 61.86)		Farakka, Raghunathganj-I	Raninagar-I, Raninagar-II Beldanga-I, Murshidabad-Jiaganj, Berhampur	7
	Medium (57.82-61.86)	Nowda, Sagardighi, Suti-I, Suti-II, Burwan, Bhagwangola-II	Nabagram, Jalangi, Kandi, Bharatpur-II, Domkal, Bhagwangola-I, Hariharpara, Khargram Raghunathganj-II,	Beldanga-II	16
	Low (Below 57.82)	Lalgola, Samserganj		Bharatpur-I	3
	No. of Blocks	8	11	7	

Female education is negatively correlated with the number of children. The result shows that all the blocks in Murshidabad are showing decline in fertility (MCEB) rate (Fig 5). Education level has increased from below primary to higher educational level (Fig 5).

But the rate of decline is not uniform in all blocks taking into consideration the same educational level. About 11.14 percent females have registered under below primary level with 10.72 percent Muslim women and 11.57 per-

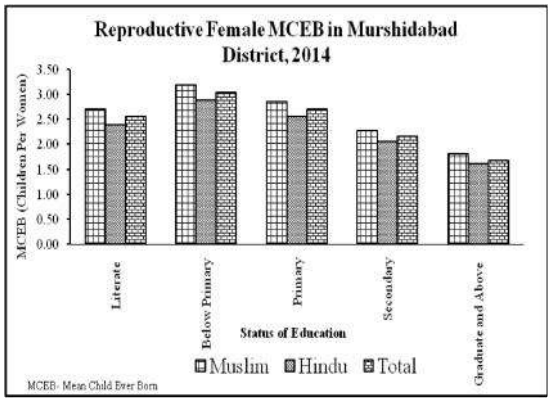

Fig 5

cent Hindu women, whereas, MCEB rate is 3.18 for Muslim women and 2.89 for Hindu women. This means that the female literacy rate below primary level of education has infact no impact on fertility. Female literates upto primary level constitute of 26.64 percent with 2.86 children per Muslim women, whereas, Hindus constitute 27.22 percent with 2.56 children per women with an average of 26.92 percent females at district level accounting for 2.71 children per women.

Table 5. Block-wise MCEB and Reproductive Female Literacy Rate in Murshidabad District, 2014

Mean Child Ever Born					
Female Literacy Rate	Total	High (Above 2.98)	Medium (2.72-2.98)	Low (Below 2.72)	No. of Blocks
	High (Above 59.01)		Farakka, Raghunathganj-I, Kandi,	Raninagar-I, Raninagar-II Beldanga-I, Murshidabad-Jiaganj, Berhampur	8
	Medium (54.11-59.01)	Nowda, Sagardighi, Suti-I, Suti-II, Burwan, Bhagwangola-II, Nabagram	Jalangi, Bharatpur-II, Domkal, Hariharpara, Khargram	Beldanga-II	13
	Low (Below 54.11)	Lalgola, Samserganj	Raghunathganj-II, Bhagwangola-I,	Bharatpur-I	5
	No. of Blocks	9	10	7	

At the secondary level of education, about 15.44 percent females have 2.16 children per women at the district level. The Muslim females consist of about 14.79 percent with MCEB of 2.27, whereas, 16.12 percent Hindu females have 2.06 children per women. Graduate and above level of education largely influence MCEB among both the Muslim and Hindu women. There is about 2.93 percent Muslim females, which lie in this category of education with their fertility rate of 1.81 children per women. However, the proportion is sharply high of among the Hindu females, which constitute 5.84 percent females with MCEB of 1.62 children per women, but it represents 4.36 percent females with 1.68 children per women at the district level.

Above discussion reveals, that female education is major influencing factor for reducing fertility differentials among different SRCs (Socio-Religious Categories). A negative relationship is found between female education and MCEB among both Muslims and Hindus. The result further shows that women cumulative fertility can substantially be reduced by encouraging female education. In other words, educational attainment among both the communities shows a strong inverse relationship with their fertility rate. But proportion at different level of education shows high rate among the Hindu females as compared to Muslim females. It is also found that declining rates of fertility rate are observed from below primary to graduate and above in both religious communities. However, the level of decline is more gradual among the Hindu females than in compare to Muslim females at the district level.

Table 6. Correlation between the Variables of Educational level (X1-X5) and Mean Child Ever Born (Y_1) in Murshidabad District

Variables		Muslim (Y1)	Hindu (Y1)	Total (Y_1)
Literacy Rte	X_1	-.753**	-.836**	-.801**
Below Primary	X_2	.406*	.421*	.568**
Primary	X_3	-0.202	-0.011	-0.143
Secondary	X_4	-.702**	-.692**	-.730**
Graduate and Above	X_5	-.857**	-.889**	-.910**

*Correlation Significant at 0.05 Level.
**Correlation Significant at 0.01 Level.

Source: Calculation Based on the Data collected through Field Survey, 2014.

The relationships of total Mean Child Ever Born (MCEB) of Muslim and Hindu by educational status have been calculated and tested at 0.01 and 0.05 levels of significance (Table 6). The independent variable literate (X1) is negatively correlated with dependent variable Y1 at 0.01 level of significance, while below primary level of education (X2) is positively correlated with other dependent variable Y1. It means low levels of education does not influence to minimize fertility rate. Primary education indicates the negative degree of relationship, but the values so obtained are very weak.

It seems to be observed among Muslim, Hindu and total women with secondary education (X4) and graduate and above level of education (X5) are negatively correlated with dependent variable Y1 (MCEB) at the 0.01 level of significance. Educated women are more aware about family planning methods, gap between pregnancies, number of children and late age at marriage leading to fertility decline.

Conclusion

After the foregoing detailed analysis, it may be concluded that in Murshidabad district as a whole shows a well-established decline in fertility levels between both Muslim and Hindu religion with increasing level of women education. It confirms that at higher levels of educational status, the effect of religion ceases to operate, and it is socio-economic status that matters. Results show that fertility rate is de-

clining from secondary level of education to graduate and above level of women's education in general and by religion. But this rate of declining is not same among the Muslim and Hindu. Muslim MCEB is comparatively higher than the Hindu women in a different level of education. The socio-economic status of Muslims is indeed lower than that of other communities, as documented in the Sachar Committee Report (Government of India 2006); a sincere effort should be made to lighten their condition. Increase women educational attainment, which may ultimately promote their socio-economic status. Since education was found to have a diminishing effect on fertility rates, there is abundant scope for reducing the fertility rate of Murshidabad district in general and among the Muslims and Hindus, and especially Muslim girls and women. The government of India has launched many programs to promote parents to send their girls to school, but repeatedly, due to lack of knowledge of such schemes, people fail to take advantage of them. There is need to publicize these programs more widely so that more people can benefit. In the long run, this will help India reach its population goals. Educating women means not only imparting knowledge, but also empowering them to make their own decisions. There is also a spread out the effect of educated women for others, less educated women. The presence of a few educated women in a village or society helps increase other women's knowledge of family planning, contraceptives, government incentives, and so on in rural areas.

References

Drèze, J. and M, Murthi, 2001, Fertility, Education and Development: Evidence from India, *Population and Development Review*, 27 (1): pp. 33-63.

Dreze, J. and Murthi, M., 2000, Fertility, Education and Development, Discussion Paper No: DEDPS 20, pp. 1-31.

GOI, 2006, Social, Economic and Educational Status of the Muslim Community of India: A Report. Prime Minister High Level's Committee. New Delhi, India.

Güne, P. M., 2013, The Impact of Female Education on Fertility: Evidence from Turkey. GCC Working Paper Series, GCC pp. 13-01.

Jejeebhoy, S.J., 1995, Women's Education, Autonomy, and Reproductive Behavior: Experience from Developing Countries, Oxford, UK, Clarendon Press, 1995.

Kim, Jungho, 2016, Female Education and its Impact on Fertility, IZA World of Labor, pp.1-10.

King, E. M. and Hill, M. A., 1993, Women's Education in Developing Countries: Barriers, Benefits and Policies. Johns Hopkins University Press, Baltimore.

Nag, A. and Praveen, S., 2013, Impact of Education and Age at Marriage on Fertility among Uttar Pradesh Migrants of Ludhiana, Punjab, India, *Anthropologist*, 15 (2): pp. 225-230.

O'Malley, L.S.S., 1914, Bengal, District Gazetteers-Murshidabad, The Bengal Secretariat Book Depot, Calcutta, p. 2.

O'Malley, L.S.S., 1914a, Bengal, District Gazetteers-Murshidabad, The Bengal Secretariat Book Depot, Calcutta, p. 3.

P. Glewwe, 1999, School Quality, Student Achievement, and Fertility in Developing Countries" in Critical Perspectives on Schooling and Fertility in the Developing World, C. Bledsoe, J. Casterline, J. Johnson-Kuhn, and J. Haaga, eds. (Washington, DC: National Academy of Science Press, 1999): pp. 128-131.

Ruhela, S.P., 1998, Religion, Social Class and Educational Opportunity: Case Studies of Eight Muslim Girls' in S P Ruhela (ed), Empowerment of the

Indian Muslim Women, MD Publications, New Delhi, pp. 1-21.

Siddiqui, F.A., 2009, Examining Dimensions of Income - Rural Fertility Nexus in Aligarh District, Uttar Pradesh, *Population Geography*, 31 (1-2): pp. 1- 10.

Siddiqui, F.A. and Jamal, A., 2012, Fertility Differential by Religion and Education in Dhanbad District, Jharkhand, *The Arab World Geographer*, 15 (3): pp. 226-242.

Siddiqui, F.A. and Yadav, S., 2009, Female Education and Fertility Differentials in Koil Tehsil, Aligarh-A Village Level Survey, *The Geographer*, 56 (2): pp.7-13.

Sharma, O.P and Retherford, 1990, Effect of Female Literacy on Fertility in India, Occasional paper No.1of 1990, office Registrar General of India, New Delhi.

Srivastava, H. C., 1998, Fertility Transition in India: State Level Analysis Based on SRS Data, 1971-1991, Monograph, IIPS, Mumbai.

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