PANCHAKOTesSAYS

# Environmental Impact on Rural Settlement and its Housing Architecture in Baghmundi Block, Purulia, West Bengal

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#### Abstract:

Society and culture are outcomes of human reaction in response to the natural environment. Being a symbol of different spheres of nature-culture interaction, microgeographic as well socio-cultural differences are reflected through the most concrete expression of human occupancy i.e. human settlements. As the way of life is reflected in various forms of socio-cultural traditions, the knowledge of perceiving resources or making choice regarding site and situation of settlements varies among different communities. Differences in terms of natural as well as socio-cultural environment in Baghmundi C.D. Block of Purulia District, West Bengal have an influential role on shaping a range of variations rural settlement in terms of its location and distribution. In this study, an attempt has been made to understand the role of natural as well as sociocultural environment in the spatial distribution of rural settlements and architecture of rural houses with particular reference to four settlements inhabited by three tribal communities like Santhals, Mundas, Birhors and one non-tribal community, Mahatos, in the Baghmundi C. D. Block.

**Key words:** Natural Environment, Nature-culture Interaction, Human Occupancy, Sociocultural Traditions and Rural Settlements.

### 1.1 Introduction

Human settlements are considered as the most concrete representative of the intimate bond between habitat and culture in response to the surrounding environment (Blij and Murphy, 2003). The idea of a settlement includes permanence, habitation and interaction (Ghosh, 1998). Ekistics, the science of human settlements, considers both the principles which man takes into account to build up his settlements and the evolution of human settlements throughhistory in terms of size and quality (Doxiadis, 1970). Ethnical, socio-economic as well as techno-cultural aspects lead to spatio- temporal variation in shape, size, spacing and pattern of settlements (Singh, 1998). People seldom reside in isolation. They live in settlements which vary greatly in size, composition, location, arrangement and function. Settlements exercise a powerful influence in shaping the world's different cultural, political, and economic systems. Accordingly, the patterns of settlement across earth's surface differ markedly from region to region, place to place and

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from time to time (Khan and Ahmad, 2014). The first settlers, with their necessarily limited knowledge, made more or less rational judgements concerning choice of sites for their villages. The best defensive site and the need of social cohesiveness in response to the security needs, settlement sites would be chosen in conjunction with the other factors (Everson and FitzGerald, 1969). Origin and evolution ofsettlement system in rural areasis basically a result of interactions between both centrifugal and centripetal forces (Chandel, 2013). Every rural settlement is a complex ecosystem which has its productive, living, and ecological functions (Chisholm, 1979). Kinshipor chieftaincy throne, inter-communal conflicts, land disputes, neighbourhood effect etc., any of these, can initiate a fresh out migration and may lead to the founding of anew settlement breaking the age old tradition (Omofonmwan and Kadiri, 2007). Agricultural practices, govt initiatives leading to themodification of the structure and organisation of the landscape which lead to intensification of some areas and abandonment of others (Poudevigne et.al., 1997). Administrative changes on land allocation, accessibility to basic facilities, servicesand development opportunities also influence in settlement dynamics (Robinson, 2003). Thus land use has direct and indirect effects on the environmental conditions, which play a major role in the dynamics and changes in landscape of rural settlement (Kim et. al., 2002). Tourism-induced growth in rural areas has greater implications on changing characteristics of rural settlements (Nepal, 2007). As human settlements are the physical expression of economic and social activity with a certain spatial dimension, no creative act can takes place without being influenced by settlement conditions (Sen and Sen, 1989). Hence, the creation of workable human settlements inevitably becomes an objective of, an indicator of and a prerequisite for social and economic development (Sarkar, 2010).

In India, tribal clusters are mainly found in the forested uplands. Social isolation from caste Hindus as well as British's Policy of exclusion of tribes and the need of social cohesiveness among themselves, have led to different kind of interaction with the natural environment. This nature-culture linkage is reflected in their settlement patterns and layout of houses (Vidyarthi and Rai, 1976). Even within tribes, differences of perceiving the environment (depending upon their location of residence) can be observed. For this reason, rituals of purification of households, decisions about the direction of windows, doors, holy gods and goddess, overall housing designs as well as settlement patterns vary from one tribe to another (Tribhuwan, 2005). In theforested uplands, *Rarh* Bengal, tribes are found to contributea distinct socio-cultural trait for utilizing the nature based products in the context of lagging socio-economic background. Santhals, Mundas and Birhors all have their own way to make and decorate their houses with natural elements (Ghosh, 1976). In the Post Independence Period, many projects and schemes have

been taken to develop the rural areas; particularly the tribal dominated rural areas. Different trends of modernisation have a major role in making change to the lives and livelihoods of the rural or more specifically of the tribal people (Gurulingaiah, 2007). Education, health as well as housing schemes, taken by different govt. and non-govt. agencies have made tremendous change in the lifestyle of Birhors, a semi nomadic Primitive Tribal Group, residing in western parts of Purulia District (Bhowmick, 2013). Identification and measurement of the environmental capabilities and available services are the initial steps in the process of planning and development of settlement sites (Ali et al., 2013-2014). Policyimplications from the proposition of mutual influence between community, ecology and built system pressures and the systemic view of human settlements, include the need for new understanding of the complexities regarding the surrounding settlements. It involves an alternative approach to the current Government policies for balanced regional development (Seemann and Marinova, 2010; Khan and Ahmad, 2013).

## 1.2 Location of the Study Area

Baghmundi C. D. Block of Purulia District is situated within the extension from  $23^{\circ}00'00''$  N to

23°30'00'' Nand 85°86'00'' E to 86°20'00'' E (Map No.1). The C. D. Block shares its administrative boundary with some parts of Jharkhand and Odisha District in the West and in the South West. the North In



Jhalda-I and Jhalda-II Map No. 1: Location Map C.D. Blocks of Purulia are situated. Arsha and Balarampur C.D. Block of the district make its Eastern and South-eastern boundaries respectively. For detailed study, four settlements have been taken as case study among which three settlements namely, Bhunighra, Vidyajara (Andhra Alias Hasthinda), Bhupatipalli (Matiala) and Haridi are inhabited by the tribal communities like Santhals, Mundas, Birhors and a non-tribal community i.e. Mahatos respectively. First two settlements are situated in the forested uplands of Ajodhya G.P. Bhupatipally and Haridi are situated in Baghmundi and Sindri G.P. respectively (Map No. 1).

# 1.3 Objectives

Major objectives of the study are as follows.

- To understand the influence of natural and socio-culturalenvironment on human habitation with respect to distribution, concentration and location of rural settlements.
- 2. To find out the environmental impact onarchitectural aspects of the rural houses.

# **1.4Materials and Methods**

In this grass root level study, both primary and secondary data sources have been used to satisfy the need of the objectives of the study. Major sources of primary data are (i) face to face interview and questionnaire survey with different tribal as well asnon-tribal communities of selected settlement units and (ii) direct field observation. Total forty four families have been surveyed considering eleven families from each of the settlements Topographical Map No. 73E/15, 73E/16, 73 I/3, 73I/4; Census of India, 2011; Advances Space Born Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (GDEM), 2011 from Google Explorer,2011; Land Use and Land Cover Map of Baghmundi C.D. Block prepared by Land and land Revenue Department of West Bengal have been used as secondary sources of information. Data and information collected from primary and secondary sources have been accumulated, tabulated and computed. After analysis of the quantitative as well as qualitative information, the issue has been represented through various cartographic and statistical techniques. The quantitative techniques are as follows.

- **a)** Relative Relief = Maximum Relief (m.) Minimum Relief (m.)
- **b)** Stream Frequency/Sq. km. = No. of Streams/ Total Area in Sq. km.
- c) Percentage of Forest Cover = Area under Forest Cover in Sq. km. /Total Area in Sq.km.
- **d)** Settlement Density = Total no. of Inhabited Villages/ Total Area in Sq.km.
- e) Household Density = Total no. of Households/ Total Area in Sq.km.
- **f)** Location Quotient (LQi) =  $\frac{Pij/Pi}{Pj/P}$

where, LQ<sub>i</sub>= Location Quotient for Segment i,

Pij = Population of Area in J<sup>th</sup> Category,

- Pj = Total Population of J<sup>th</sup> Category,
- Pi = Total Population of All Categories of Area,
- P = Sum Total Population in the entire Pi.
- **g)** Bernard's Index of Concentration (C) =  $H.A/S^2$  where, H = No. of Houses, A = Area in sq.km. and S = No. of Settlements (Khan, 2013)
- h) Z-Score = (Score- Mean)/ Standard Deviation

i) Pearson's Product Moment Correlation

The work has been done with the help of M.S. Word, 07 and M.S. Excel, 07. Maps have been made with the help of Arc GIS 9.3.

### **1.5Results and Discussions**

# **1.5.1.** General Pattern of Settlement Density, Household Density and Concentration of Settlements

Before analysing the influence of some selected natural as well as socio-cultural variables on the human settlements of Baghmundi Community Development Block (C.D. Block), general pattern of the rural settlements in respect to settlement density

(density of inhabited villages), household density and the nature of concentration of settlements have been studied . Ajodhya G.P. and Tunturi Suisa G.P. show the extreme two cases where all z-score values of the concerned

variables are positive and negative



Fig. No. 1: Z-Scores of Settlement Related Attributes

respectively where as remaining all G.P. show a combination of both positive and negative composite Z-score values. Though Ajodhya G.P. consists of numerous inhabited villages, the household density is less here. It signifies the least

concentration of settlements in this G.P. The concentration of settlements is highest in Sindri G.P. which is situated all most at the centre of the C.D. Block (Fig. No.1). The composite scores of all aforesaid three parameters shows the lowest value in Ajodhya

G.P. (less than -1.80) and



Map No. No. 2: Composite Z-Score ment Related

highest value in Serengdih G.P. The values seem low (-1.80 to 0.20) in G.P. s like Burda Kalimati, Baghmundi, Matha and Birgram whereas moderate Z-score values have been identified in Sindri G.P. and in Tunturi Suisa G.P. (Map No. 2).

# **1.5.2.** Influence of Natural and Socio-cultural Environment on Rural Settlement

Human choices of location for settling down are primarily governed by the natural environment.

Baghmundi C.D. Block is an appropriate example of micro-geographic differences





regarding selected attributes of natural environment like relative relief, forest cover and natural streams of different orders (Fig. No. 2).

Socio-cultural features like population density, literate population, cultivators, agricultural labours, household industry workers are less in the areas of high relative relief, densely forested areas and vice versa. On the other hand, percentage of tribal population and other worker (mainly forest economy based) are comparatively high in the areas having comparatively high relative relief, dense forest and high stream frequency and vice-versa (Fig. No. 2 and 3). The combination (composite Z-Scorevalue) of natural determinants shows a general decrease in values from east to

west where as the composite Z-score value of selected socio-cultural determinants shows a general increase from east to west (Map. No. 3 and 4.)



Fig. No. 3: Z-Scores of Selected Socio-cultural Determinants



Map. No. 3: Spatial Pattern of Natural Determinants

Map. No. 4: Spatial Pattern of Socio-cultural Determinants

Sindri G.P. lies in the zone of low natural barriers of settlement concentration (-1.80 to 0.20) where as composite value of socio-cultural attributes is highest in this centrally located G.P., influencing the high concentration of settlements. In Serengdih G.P. lower level of natural barriers influences the highest score of settlement related attributes. In case of Ajodhya and Matha G.P., control of natural environment is higher than socio-cultural attributes, forming dispersed type of settlement pattern (Map No. 3, 4 and 5).



Map No. 5: Land Use and Land Cover Map of Baghmundi C. D.

Map No. 6: Concentration of ST Population

From the land use map of the Baghmundi C.D. Block, it is evident that forest cover decreases towards the West where more agriculturally suitable and relatively lower elevation zone are situated (Map No. 3 and 5). G.P.s like Tunturi Suisa, Srerengdih and Birgram are totally agricultural tracts which have natural favour of irrigation facilities. Burda Kalimati, Sindri and Baghmundi G.P. are favoured with a combination of forested uplands and agriculturally fertile tracts. Moreover these are the gate ways of reaching the beautiful tourist spots located in Ajodhya hills. In case of Sindi G.P. (located at the centre of the C.D. Block) *Chhau* mask making art of Chorda village has made it a place of tourist attraction which leads to an increase in settlement concentration here (Map No. 5). Concentration of tribal population is high in Ajodhya and Matha. High relative relief, dense forest and animal hazards (attacks of elephants as well as other wild animals) are major causes that tribes of these two areas give major emphasis on kinship bonding and community living in formation of their households. That is why in these areas dispersed settlement patterns have been formed (Map No.2 and 6).

Combination of high raltive relief, dense forest and high stream frequency have acted as a natural barrier of forming dense and concentrated pattern of settlement



**Determinants and Settlement Related Attributes** 



(e.g. Ajodhya and Matha G.P.). For this reason it shows a high negative correlation value (r=-0.754) in case of relationship between natural determinants and settlement related attributes. But the tribal people residing in the two highly nature dominated areas have made their own signature in forming nature friendly habitation unit (Fig. No. 4 and Map No. 7).



Map No. 7: Impact of Environment on Rural Settlement

On the other hand combination of high population density, low ST population, other workers as well as non workers and high percentage of cultivators, agricultural labours as well as household industry workers, have acted as a favourable factor for high settlement density, household density and concentrated type of rural settlements in case of G.P.s like Tunturi Suisa, Serengdih, Birhram and Sindri G.P. Moderate influence of both natural and socio-cultural determinants have resulted in moderate to low concentration of settlement, settlement density as well as household density in Burda Kalimati and Baghmundi G.P. (Fig. No. 5 and Map No. 7).

# **1.5.3.** Micro Level Understanding of Rural Settlement in the Context of Diversified Space and Culture

# 1.5.3.1.Effect of Socio- cultural Differences on Location of Rural Settlements

A grass root level inquiry on the choice of location of settlements shows the difference of opinions among different tribal and non-tribal groups residing in different parts of the study area. Moreover, influence of modern factors (T.V.) has been observed here. In each of the settlements excluding Bhupatipalli and Haridi, most of the families have been residing there for more than fifty years or from thirty one years to fifty years. In Matiala only 27.27% and 36.36% of the Birhor families have been residing there for less than thirty one years to fifty years are residing there for less than thirty years (mostly ten to twenty years). Also in Haridi, some families have been residing there for less than thirty area from surrounding areas of Jharkhand (Fig. No. 6). It is cleared that, in case of Bhunighra and Andhra



Fig. No. 6: Duration of Residence





Alias Hathinda, settlements have been developed by the ancestors of Santhal and Munda communities (Fig. No. 7). No option has been left to them for sustaining their life and livelihoods but to reside in the forested uplands because of community

conflict with Mahatos i.e. a non-tribal community in the British Period. Santhals are considered as agrarian tribes, as they have engaged themselves in agricultural activities from very early days. For this reason, when they have been compelled to leave their fertile lands, they choose the location which is favourable for agricultural activities (Plate No. 1). Mundas of Andhra Alias Hathinda have chosen the location in dense forest, so that they can get at least the food as well as forest products from the forest to sustain their livelihoods (Plate No. 1). Birhors are the most primitive tribal groups who did not have permanent residence. They used to lead their livelihoods depending upon nearby forested areas. That is why they are not able to cope up with many so called civilised activities. To take them back from the hunting and gathering stage to the main stream Indian society and economy different Govt. and non-govt. agencies have taken ample initiatives in several times. They have been provided with *pucca* houses with small land for cultivation (Plate No. 2). Most of the Mahatos have resided in Haridi because of nearness to water source and arable lands for continuing their agricultural practices (Plate No. 2).

# **1.5.3.2.**Characteristics of Traditional Nature-based Architecture of the Rural Houses

The climatic specificities i.e. low rainfall, high temperature and draught proneness play major role in determining the general architecture of the rural houses. More over micro geographic differences have made sound contribution on the architectural knowledge of different communities residing there. Housing structure, wall material, roof material, floor material, security plans, all reflects the aesthetic sense, socio-economic as well as cultural activities of the concerned dwellers. Impact of natural environment can be assessed in terms of the following aspects.

- i). Roof Material: Locally available natural resources like Salleafs, thatches, tiles (locally named as Khapra) which are made up of burned clay, are used as roof materials of rural houses. Sal woods and bamboo are used for supporting the roof (Plate No. 3, 4and 5).
- ii). Internal Structure of the Roof: Internal structure of a thatched roof or a *Khapra* roof is made up of *Sal* woods or bamboo. A crisscrossed structure is made to support the roof in a better way. A space for ventilation is kept between the upper end of the wall and inner portion of the roof (Plate No. 4).
- iii). Outer Structure of the Roof: Whatever may be the roof material (thatch or *Khapra*), outer structure is made sloppy for easy passing of the rain water. In case of *Khapra Chal,Khapras* are arranged systematically to provide maximum support and maximum thermal comfort (Plate No. 4).

- **iv). Wall Material:** Locally available red *Kankar* soil is basically used as wall material. Red dust soil is often used to colour the walls. Cow dung is used for cleaning the wall (Plate No. 3).
- v). Size and Position of Window and Doors: Micro geographic differentiation of the location of dwellings leads to the spatial variation in position of window. In Vidyajara and Bhunighra, no window is found in any of the tribal houses because attack of elephants is a common incident when grains are stored in rooms. In Bhupatipalli and Haridi window size is found to be very small and located high on the wall to resist the heat flow called *Loo* in the high summer. Doors are also made in comparison with the micro-geographic differences. Doors in Santhal village are always found as opposite to the main road or path (Plate No. 5).
- vi). Floor Material: Mainly clay or mud and stones are used as floor material of the rural dwellings irrespective of whatever community the dweller belongs to (Plate No. 6).
- vii). Fencing around the Dwelling Unit: Bamboo, dry woods, rope are used to make the fencing for security purpose (Plate No.3).

# **1.5.3.3.** Impact of Changing Socio-cultural Environment on Architecture of the Rural Houses

Change in socio-cultural environment can easily be traced through analysing changes in architectural aspects of dwellings (plate No. 6). If the predominant material of roofs is taken into consideration, then the change from nature to culture can be



Fig. No. 8: Predominant Material of Roof

easily identified. In a typical Birhor village (named Bhupatipalli), the use of asbestos and brick are identifiable because in different govt. initiatives of low cost *pucca*houses have been provided to settle down the semi nomadic primitive tribe, Birhors. In other villages use of asbestos or brick is in search of better living which is

basically resulted from the influence of economic up-gradation and penetration of global culture as well as commercialization through T.V. and other means of entertainment (Fig. No. 8).



Fig. No. 9: Predominant Material of Wall

In case of predominant material of wall, the same picture is revealed. In Bhupatipalli most of the houses are made of burnt brick with chemical cementing as these have been provided to the Birhors in different govt. schemes. In Haridi some Mahatos have become self sufficient in agricultural activities and they made their wall with brick and chemical cement (Fig No. 9). Analysis of predominant material of floor reveals that in Bhupatipalli, brick is more used than the other materials like mud and stone. Even in Haridi, Bhunighra and Vidyajara use of brick as floor material can be easily identified.



Fig. No. 10: Predominant Material of Floor

From the above discussion, it can be said that there is a tendency of having change in terms of roof material, wall material and floor material. The change is more prominent in the non-tribal settlement i.e. Haridi and in Bhupatipalli i.e. a Birhor settlement (Plate No. 6).

### Conclusion

At the end of the study it can be said that the distributional features of the rural settlements in Baghmundi C.D. Block of Purulia District primarily have been influenced by the surrounding natural environment. This man-environment interaction is being sustained by the people through generation after generation particularly by the tribal people. Moreover, socio-cultural differences play influential role on settlement distribution among the communities. Architectural aspects of the rural dwellings are also influenced by the natural and socio-cultural environment as well. Many development activities have influential role on the distribution pattern and architectural style of rural settlement especially in tribal communities. The exsitu factors lead a question of sustainability of the ecological as well as traditional socio-cultural environment which in turn has a significant role in development of the socio-ecologically compatible settlement complex. So, for the betterment of the concerned ecosystem as well as socio-cultural matrix, nature specific, need specific and community specific planning should be given utmost priority.

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### List of Photographs





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Plate No. 6

