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Identifying the Sustainable Practices from the Vernacular Architecture of Tribes of Central India

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ABSTRACT

What once called a “house of all seasons” has now been christened “climate-conscious”, “bioclimatic”, “energy-efficient”, or “sustainable” architecture. These terminologies are just not a welter but have definite meaning with respect to context at given point of time. In the present work the sustainable practices are identified by documenting the tribal settlements and habitat of Central India to understand the concept of indigenous habitat and its integration with nature. The study comprises of typology of settlement pattern with reference to physiographic features, site selection with appropriateness to respond to local climate and spatial organization of settlement to suit the functional need. Habitat study concentrates upon structural stability, climatic responsiveness to achieve physical comfort with the given building materials and technology. The underlying principles of sustainability of the settlement and habitat are studied and are compiled so that they can be applied in the modern context of course after necessary modifications to suit the present need and in order to achieve sustainable design solutions.

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1. Introduction

The art, architecture and tradition of tribal settlements are great indigenous vernacular expression of the diverse culture of India. Tribal people have through their efforts, over thousands of years, created rich and colorful styles of vernacular architecture, responding to local environments. This reflects an evolved response to geography, climate, distribution of ethnic peoples and sustainable habitats. (Wang and Cai, 2006). The tribal population of India is scattered throughout the country and about eight percent of Indian population is tribal. The percentage of tribal population is high in the geographically remote areas, the islands in south, south-west and the mountain ranges of north and small & isolated states of north east. The reason for more percentage of tribal in the states can be attributed to the geographical locations like islands, rivers and mountain ranges. In Central India the state of Madhya Pradesh has the highest population of tribes, which, as per 2001 census constitutes the 20.26 % of the total population of the state.

The state of Madhya Pradesh which is the Central India is termed as heart of India due to its geographical conditions and it is also lung of India as its 40 percent area is under forest cover. The state straddles the Narmada River, which runs east and west between the Vindhya and Satpura mountain ranges; this ranges and the Narmada are the traditional boundary between the north and south of India. The tribes of Central India have the simplest of lifestyles with a rich culture still untouched by modernity and traditions as old as their origin.

The Central India was taken as the region for study and the tribes selected are Gond, Bhil, Korku and Bharia. The tribes were selected from varied geographical locations of Narmada River basin. The basin can be classified as upper and lower hilly areas which are dense forests, upper middle and lower plain with fertile soil suitable for cultivation. The present paper is an attempt to identify the sustainable practices of the tribal settlements as well as architecture of their houses on which the impact of local niche is obvious.

2. Location and Occupation

The geographical aspect of the region has been a prominent decider on the distribution of tribal communities in the state. The Tribes are widely spread on both the banks of Narmada in the Vindhyan and Satpura mountain ranges in the dense forests, thus making them impervious to any

outside intrusions. This helped them maintain their culture and customs safe and continue till present day. They indulge in various activities to earn their livelihood. Earlier they were semi nomadic people but most of them have now settled down and have chosen their occupation. The tribes are an agro-silvicultural community and their forest dependency is high, in the hilly tracts, most of the tribes cultivate their land and in springs they migrate to Narmada river plains for harvesting where they are engaged as laborers. As they are a bailiwick of their topography, few tribes like bhils were employed as hunters in the pre-independent India. In that age of history, they were also recruited in the armies of kings and served as soldiers. The forests are home to them and provide sustenance in the form of forest produce, water, grazing grounds and habitat for shifting cultivation (Sarin, 2005).

3. Climatic Condition

The climate varies from place to place with physiographic features. The hilly regions with forest coverage are extremely cool whereas the open lands are comparatively hot. The minimum temperature goes up to 4°C and a maximum of 28 – 30°C in the hilly regions whereas in the plain land, the minimum temperatures ranges 8 – 10°C and has a maximum of 42°C. Winter starts in October and ends till March, summers starts from April and extends till June and monsoons starts from July and ends in October. This climate facilitates two crops during the year. The climate at micro-region is more important for study as the thick vegetation, water body and topography plays a significant role on habitat.

4. Settlement Pattern and Habitat

This diversity and independence of tribes has encouraged the development of unique and varied ethnic culture and habitat. Overall, the spatial pattern corresponds to the topographical character of the areas they have chosen for settlement. The settlement pattern varies from tribe to tribe as it is determined by location, sociological circumstances, occupation and ethnicity. The size of settlement is considerably small, cluster size is three to four houses and maximum number of houses in a settlement is 100-150. Tribes follow all together different pattern within the same geographical location and tribes often mingle among themselves. This variation is mainly due to

topography, microclimatic condition and their occupation.

At present the majority of the traditional village had undergone changes due to spatial arrangement patterns of the active response of the society. These changes arise from the development paradigm and the new innovations, so that the growth in the field of social, economic and culture is experienced (Alit, 2004; Chiri and Giovagnorio, 2012). However the development in the tribal areas is not at the pace of their urban or even rural counterpart. To analyze the settlement pattern of tribal of tribal areas which are unconsciously planned, function is to be studied as “function is an analogy between social life and organic life” (Mandal, 2001). The tribal communities consists of cluster, all arranged to form a social structure and their inter relation in terms of social contiguity.

One of the major functions in case of tribes is agriculture. They are engaged in ploughing, sowing, and harvesting in the fields and return to dwellings for relaxation. This daily up down movement is either by walking or on carts and creates an intimate relation between house and farm.

During harvesting period they prefer to live in temporary huts built in the field itself and animal yard is also erected nearby (Nath, 1989).

4.1 Typology of Settlements

On the basis of morphological study the settlements are classified into three typologies. The typologies are worked on the basis of size and structure. The first typology is a village predominantly of farmers. These villages are located on plains and the occupants are mainly associated with agriculture and the average size of village is 1000-1500 houses, Figure 01 represents one such plan. These villages cannot be termed as tribal settlements as the inhabitants are from other communities. Still they are studied as they become the nucleus for the small tribal settlements which are in the periphery at the distance from 2 to 10 km. The growth of village is organic and the distinct impression is made by the road which connects the village with other villages. This road acts as a line of division between the old village and the new development. The old village consists of non uniform dwelling units placed with respect to landform in a manner that the streets allow to drain the rain water during monsoon. While all the public buildings are clubbed

together around open space. This open space is multifunctional. It is the center place where the market, fairs during festival and rituals are performed throughout the year. The clusters of the dwellings along the streets are formed on the basis of ethnicity. The dwelling units of this village are advanced, more spacious and comfortable than that of tribes. The tribal people who are engaged as labors are accommodated in these houses on temporary basis. The streets passing through the farms lead to smaller tribal settlements. In present days, tribal have started building their houses on the outskirts of villages. However the houses are very small compared to that of the villagers.



Figure 1: Settlement typology.1

The second type of settlement is comparatively smaller the number of dwellings goes up to 150. These settlements are satellites of the nucleolus village described above. They are linear i.e. a row of houses facing each other along a street. It is interesting to know that the liner street is not a well conscious effort but the left over space between two houses facing each other, the plan of linear village is shown in Figure 2. The houses are so placed that the street becomes the place of social cohesion and the back yard is connected to their farm. Once the settlement reaches maximum number of houses a new settlement in the vicinity is set up.

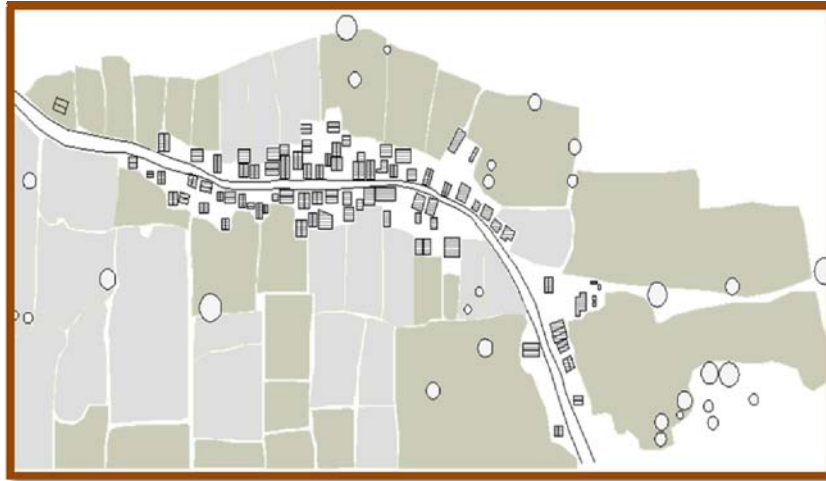


Figure 2: Settlement typology 2.

The third typology is of the tribes inhabited in the hilly areas. They depend upon forest produce for their livelihood. They are also engaged in terrace farming. Unlike the tribal living in plain areas their dwellings are scattered (see Figure 3). They lived in clusters of three to four houses as shown in Figure 3 and even these clusters are at different levels at certain distances because of undulating land form. These clusters are not connected by defined pathways as the houses are constructed in the fields itself.

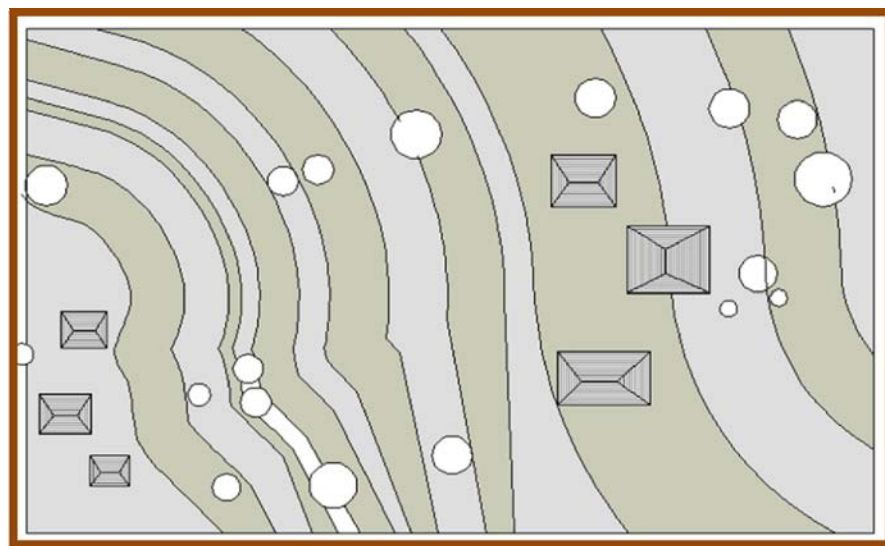


Figure 3: Settlement typology 3.

The aspect of sustainability entails use of natural resources, land, water, and forests. In context of development, sustainability refers to optimal utilization of resources whereas tribes are using minimal resources. The land occupied by them for dwelling is limited and keeps on changing from place to place, thus posing no harm to landforms. The settlements have single resource of water which is a river, waterfall, spring or a community well. There is no provision of sewerage in those settlements. The waste water is directed into the backyard. The waste from animals is collected in the outskirts for preparation of organic manure. The nucleus villages, houses people from various communities. It includes people from various occupations to fulfill their needs such as people like carpenter, blacksmith and potter. The festivals are incomplete without the involvement of tribal community. The festivity is the essence of tribal life. The simple and straight community enjoys festivals with great fervor and joy. Music, painting and artifacts have become a source of income for them. Their knowledge about herbs and other forest products is helping in conservation of biodiversity.

4.2 Typology of Habitat

Empirical study from tribal groups of India suggests that there are values, integrating into the spatial, social and ritual perspectives and ultimately leading to their habitat. Their lifestyle is amply represented in their dwelling which varies depending upon the location, occupation, community and the micro climate. For analyzing, typologies can be worked out on the basis of spatial configuration, use of materials and building technology & form. However for the sake of simplicity typology has been worked on the basis of spatial configuration. The first type of dwelling unit shown in Figure 4 is habitat type Model-I, which is from the nucleus village. This is essentially the house of farmer and not the house of tribes, who inhabits them. It is the richest in terms of size, hierarchy of spaces and use of material (see Figure 4). This house has an enclosure for protection. It has a formal open courtyard used for social activities, semi enclosed private space which is used for guests, a covered living space which is sometimes two storied and cooking space with rear courtyard. The enclosure which is semi open is used as animal yard. The tribes engaged as labors are allotted one room or allowed to live in the animal yard. The house is elongated along the major axis and is geometrically symmetrical. The roof type is lean to for semi open space and double lean to for covered and private spaces. The inner private spaces are elevated. The central

place is the highest and sometimes mezzanine floors are also constructed. The walls are 60 to 90 cm thick mud walls. The roofing is done with earthen tiles supported by timber framework. For supporting roof of semi open spaces timber columns are used. The openings have door panels only on the external walls. For ventilation small vents are provided on the external walls.

The second type of house Model-II which is shown in Figure 5 is found in linear pattern and follows the hierarchy of semi open, covered and semi open spaces. In this case the house is elongated along the major axis and there are no openings on side walls. Bamboo baskets or the grain storage made up of mud are used for creating partitions in living spaces. The house is of mud walls with pitched roof with earthen tiles, reeds are used for partitions. For cattle a temporary structure is erected either in front of the house or along the side walls.

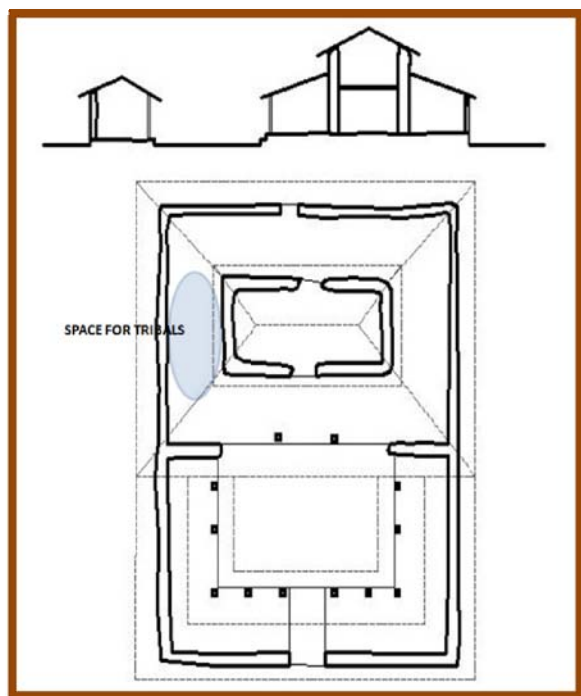


Figure 4: Habitat type Model –I.

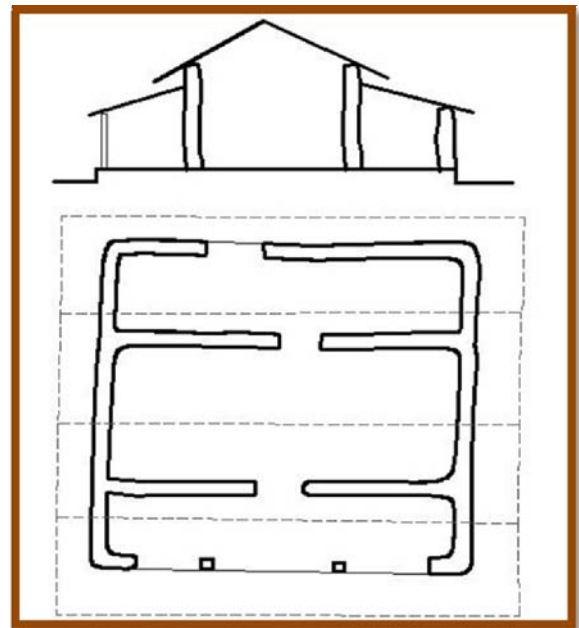


Figure 5: Habitat type Model –II.

The third type of houses, the Model - III is found in clusters. The unit appears to be one rectangular block with a sloping roof. Within the rectangular plan partition walls are erected to separate living from cooking space. The walls are directly exposed to sun and very small openings are provided for ventilation. The plan of Model III is shown in Figure 6. The animal

yard is constructed nearby. In the fourth typology i.e. the Model IV, the plan of which represented in Figure 7 is a house, elongated along the horizontal axis. The spatial hierarchy has semi open spaces adjoining the covered space. The entire dwelling unit is enclosed with walls and in under one roof. The entry is through a semi open space. On entrance a temporary shed is provided or a separate enclosure with thatch roof is provided for cattle. In the third and fourth typology the house appeared to be one unit.

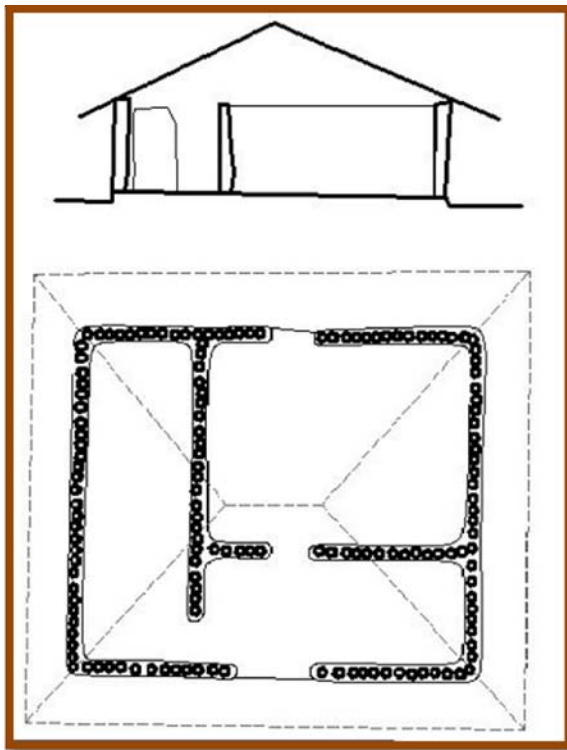


Figure 6: Habitat type Model –III.

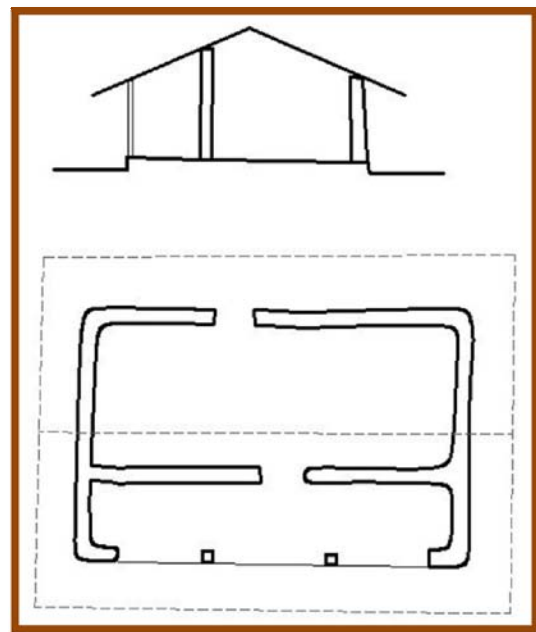


Figure 7: Habitat type Model –IV.

The main building material used for constructing the load-bearing walls of the dwellings was adobe, since earth is the most plentiful resource in the region. Adobe units were made of earth, which could be found on site, mixed with straw along with water. Stones were used to reinforce the wall. In the case of houses in hilly terrain where bamboo is plentiful, the walls are made of split bamboos. The walls are often made of bulrushes, maize stalks (Shah, 1943). The roofs are hipped, double lean and lean to roof. The roofing is done with earthen tiles. The earthen tiles are

supported by a timber framework. The timber used is crude and undressed, the straws or bamboo strips are used to provide the support to earthen tiles. This make the roof perforated and allows ventilation. The load-bearing walls support the roof frame placed above. The Eaves of the roofs are projected along with the length of the house. This projection protects the erosion of mud wall during rains and also provides sunshade. The temporary structure for cattle is constructed with four wooden post and flat thatch roof; reeds are also used for partition walls. The lintels were of timber planks. For ventilation circular voids were left in wall. Bamboos were used as grill in case of large openings. The mezzanine floor of the dwellings consists of the wooden logs or the beams that bear the wooden floor placed right above the timber ties. They make huge storage bins for grain storage. Generally, the bins are quite tall and square in shape. (Aashi, 1996) Cow dung and mud is applied for finishing and surfacing of flooring and walls. The houses are decorated by painting the figures of animals, birds and vegetation. Relief work is also seen which is done by using rice husk and mud.

5. Sustainable Practices

Due to natural physical barriers tribes have little access to the outer world. They seek help from other fellows for cultivation and protection from wild animals. The spatial planning is mostly governed by the social groups formed due to ethnicity, topography, availability of fertile land and shared community facilities like water sources and movement channels. The transformation of clusters is an outcome of increase in the number of family members (Hinani *et al.*, 1993). In the absence of external forces, growth in traditional settlements was mostly driven by the daily needs of users and mechanisms that emerged from a symbiosis between the social norms, occupation and religious customs (Besim, 1994; Akbar, 1988).

There has been a considerable amount of research that defines and characterizes the form for a sustainable city, and which urban forms may be more sustainable (Mike *et al.*, 2010). It is a complex issue. The physical dimension may include its size, shape, land use, configuration and distribution of open spaces - a composite of a multitude of characteristics including a city transport system and urban design features. However its sustainability depends on abstract issues like environment, social and economic. It would be unfair to analyze the tribal settlements on above

parameters as they are not comparable with any urban form in terms of scale, magnitude and character. However the settlements are being analyzed on the five dimensions of sustainability.

These dimensions are physical, social, economic, cultural and environmental. Physical sustainability of the tribal settlements it is evident from the close proximity of their workplace and natural resources most importantly water with respect to their dwellings. The initial setting up of these settlements was in harmony with their bioregion and is being preserved through their community practices. The luminosity of tribal settlements is restricted to day lighting and the orientation of their settlement is such that they get maximum ventilation and minimum solar radiation. The streets are leftover spaces between houses and serves as natural drains. The pattern of the settlement, linear or clustered is derived out of the land form. The structure is legible because of the sizable scale of the settlements.

The tribes or depending upon the agrarians for their livelihood and the farmers depend on tribes for supporting activities, this interdependency leads to social cohesion amongst them. Music, painting and other art forms are integral part of their life. The festivals, religious rituals and social functions are attended by other communities as well. The settlement consists of persons varied occupation i.e. carpenter, blacksmith and potter making the community self sufficient. Also there exists a group of distinct cultural identity which leads to setting up of a living and working community that reflects the diversity of the settlement and a better social cohesion. The houses facing each other share common community spaces and are a focal point for various community activities raising social value. The economic dependency of the settlements is mainly upon agriculture and forest products and maintains the biodiversity.

The climatic responsiveness in terms of urban architecture can be defined as the satisfied need of human being in terms of thermal comfort, luminosity and acoustics (Maria, 2009). The conventional definition of sustainable architecture may not fit for tribal habitat, the sustainability in terms of tribal habitat needs to be redefined. The present study of tribe reveals that the habitat emerged from the complex mix of considerations including climate, economics, socio cultural factors and religious purposes. The morphology of built form and spatial order of the clusters

dwelling unit reflect the concern for function and indicate other socio cultural characteristics. (Saleh, 1999).

The climate of central India is tropical. However for thermal comfort, climate and microclimate plays a significant role. Typically thermal comfort requires low solar gain, ventilation and adequate natural light in day time. During the night time in winters the heat gain inside the house needs to be retained. In monsoon protection for dwellers as well as the cattle is required. The habitats on plains have moderate climate as compared to the hilly regions. In hilly regions the days are warmer and the nights are cooler. The houses on plains shown in Model I and II follow hierarchy of open, semi open and covered spaces. This helps in reducing the solar gain, in covered areas. The semi open spaces lower downs the temperature of air before it enters into covered spaces. The pitch roof of covered space allows hot air to escape from the perforation and joint of the roofs and creates air draft. The thermal gain in the covered space is retained during winters. The inhabitants prefer to sleep in open courtyard in summers, in semi open areas during monsoon and particularly when the humidity is high and in covered spaces in winter. The open courtyard, low height semi open spaces and covered spaces with pitched roof modulates the air movement. The elongated house plans with minimum internal partitions or partitions created by storage bins, allows an easy passage for cross ventilation. The multileveled floor and the strategic staggering openings help in enhancing the air velocity. On the contrary Model III and IV which are located on hilly terrain have single roof cover and a wall all around the unit. This is done intentionally to catch up the wind of higher velocity. The pitched roof typical in all tribal houses shows an understanding of stack effect. Hot air rises by buoyancy and is infiltrated out via gap in between the earthen tiles.

The projected eaves, semi covered spaces around the main living area and the cattle sheds adjoining the houses reduces the exposure of sun on walls and also protect the mud walls from rains. The ventilators, circular in shape, which are above the lintel level allows diffused sunlight and maintains privacy of inhabitants. In all instances local material was used, the material was used in its crude natural form. The size, strength and bearing capacity of the material was a guiding factor for the structure's dimensions and formulation of spaces. The material used for wall mud, straw, reeds and the earthen tiles or thatch roof provided thermal insulation. The

building material used have definite life period which differ for various material, they need to be replaced periodically. Even the routine maintenance is required, mud floor needs to be plastered daily with cow dung, and the earthen tiles need to rearrange before every monsoon. However, the waste thus generated doesn't have any adverse effect on environment.

6. Conclusion

Buildings, as their design and use today contribute to serious environmental problems because of excessive consumption of energy and other natural resources. It is also important that the local building wisdom and culture be explored and the precious heritage of vernacular architectural culture be passed on (Jun H. L. *et al.*, 2012). The tribal populations in the geographically remote areas are still following the indigenous vernacular style for their settlements and habitat. These habitats provide them the needed thermal and visual comforts at reduced level of resource consumption. These practiced can be effectively adopted and integrated into the present days building design.

The settlement pattern of the tribal habitats suggests that the size should be finite to achieve sustainability. The structure or shape of the settlement should be with respect to the topography. The natural drains works as streets, the ridges, the valleys and the vegetation affects the microclimate and should be considered before placing the building blocks. The streets and courtyard in between the cluster modulate the airflow for proper ventilation and also reduces thermal gain in tropical conditions. The individual houses don't have sewerage. The waste water from the houses is disposed on the streets which dry up in the sun. The organic waste from the settlement is dumped at one place and is used as manure.

The buildings are oriented to minimize the solar gain during summers ensuring adequate daylight and protection from rains. The spatial configuration allows thermal comfort and sufficient privacy and interactive spaces amongst the habitat. The materials used for construction is low embodied energy and provides thermal insulation. The semi open spaces around the core of the building helps in reducing the thermal gain whereas the open courtyards are used to catch the

sun for agricultural related purposes.

The tribal settlements and habitat demonstrate an economical use of native natural building resources, and respond to climatic conditions using eco friendly design principles that provide human comfort. These design principles are consistent with the form, orientation and materiality of the buildings. Their combination of social, functional and environmental reveals life full with color, flavor fervor which, instead of imposing on the nature it emanates from it.

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