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PORTRAYING THE ETHNOGRAPHIC LANDSCAPE OF THE TEA WORKERS' COMMUNITIES IN SYLHET: A MORPHOLOGICAL APPROACH

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Abstract

The historic tea estates are part of the cultural landscape of Sylhet and attract numerous tourists. However, most tea-workers living in these areas have lower social profiles and, to some extent, are isolated from mainstream society. The tea-workers communities have diverse ethnic backgrounds, mainly from the neighbouring country - India and different parts of Bangladesh. Initially, within the Tea estates, they were settled in housings developed as 'labour lines', and later those areas were modified and expanded by the communities. There are issues related to space crisis, municipal services, and other amenities such as health care and education in their housing areas, but their settlement patterns have inherent traditional features crafted by the vernacular adaptations. This study aims to identify and analyse their settlement areas' ethnographic landscapes and understand the relationships between their housing morphology and socio-cultural beliefs. We have selected three different communities from the three (03) major tea estates, i.e. Lakkatura, Malnichara and Khadimnagar estate. We developed a conceptual framework incorporating principles from ethnographic landscape and spatial morphology. For ethnographic analysis, we have investigated the socio-cultural profiles (including ethnic origin, demography, financial status, community participation and socio-cultural activities), housing policies and vernacular techniques through field surveys and secondary sources. For morphological analysis, we have adopted McCartney, 2018's framework that helped characterise the study areas' spatial dimensions. Finally, we have developed a typological understanding from the combined approach that outlines the ethnographic landscape of the selected tea-workers communities in Sylhet. Cross-cultural investigations in future can further explore how ethnic landscape changes with migration movements and aid in the planning and policy-making of informal settlements.

Keywords: Ethnicity, informal settlement, peri-urban landscape, vernacular architecture, spatial morphology

Introduction

Tea (*Camellia sinensis* L.), a widely consumed beverage, is among the ten core commodities recognised by the United Nations Conference on Trade and Development's (UNCTAD) integrated programme for commodities (IPC) (Adhikary et al., 2019; Saha et al., 2017)). The tea industry in Bangladesh has been a source of export earnings as a cash crop apart from fulfilling domestic consumption demands, contributing about 0.80 per cent

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of the country's annual GDP. Presently in Bangladesh, this industry comprises about 400 thousand people, of which 150 thousand are directly employed (BCS, 2008). The tea workers, locally known as 'Coolie', are the primary contributors to this industry. However, they are isolated from mainstream society due to their different ethnicity and social segregation strategies adopted by local administrations (Rahaman et al., 2021).

The commercial-scale tea cultivation in Sylhet commenced in the 19th century (Adhikary et al., 2019). The ideal climatic conditions, incessant rainfall and geological properties in Sylhet encouraged the British investors to commence this industry. The owners brought in workers from different parts of India and established tea gardens in massive areas termed 'tea estates' (Rahaman et al., 2021). One of the oldest and largest tea estates in this region is Lakkatura, established in 1860, with a plantation area of 1,600 acres. Presently, the Lakkatura tea garden produces around 500,000 kilograms of tea annually. Other significant tea gardens in Sylhet are Khadimnagar, Finlay, Duncan, and Malnichara, later established due to suitable environments and increasing consumer demands.

Ethnic communities are often distinguished by their indifferent socio-economic interests such as ethnic culture, occupational dependency, social trust, loyalty, etc. or even common socio-political identity such as religious belief, origin, political boundary, etc. They can also be formed by the direct fusion of fragmented civil society or cultural fusion of inter-ethnic groups (Fennema, 2004). The tea workers can be considered 'ethnic communities', as they share distinct socio-cultural interests and socio-political identities. Most of them were immigrants from tribal or lower-caste religious groups and subsequently got a new ethnic identity named – 'Coolie'. However, they were denied any legislative power and entitlement to the property. Their settlements generally had substandard and unsatisfactory living conditions, with insufficient space and a lack of hygiene in households (Das and Islam, 2006).

Nevertheless, their social and religious beliefs, ethnicity, and traditions had a typical character, reflected in their household and settlement formation. During the colonial period, the estate owners effectively applied the 'Divide and rule' strategy in the tea estates to control the workers (Rahaman et al., 2021). This strategy guided every settlement – initially forming row houses beside the road, called 'Coolie line' or 'Labour line' to accommodate the workers inside the tea estates. Recently, higher density around tea gardens and immigrated workers (i.e. Bengali community) negatively affected this remote community. As their settlement areas were practically limited to constrained land, higher housing demand and age-old personalisation had developed an informality and unique vernacular morphology.

However, recent urban agglomerations have threatened the informality of their settlements. Unfortunately, several tea workers' settlements were included in the municipal areas without municipal services. Besides, multiple handovers of estate ownerships also affected their settlements' various planning issues, such as physical infrastructures, hygiene, services, wastewater management system, and water supply system. Furthermore, the migration of different religious groups brought new concerns to their housing policies and privacy level. Later, as a result of frequent repairing of their self-built houses, different construction systems, structures & archetypes were developed. This study intended to identify the spatial planning issues e.g. space constraints for extension, limitations in housing policies, influence of urbanisation, and climatic issues. It also focused on the complexity between their native cultural identity and formal planning practice that impacted the settlements' organic growth.

Materials and Methods

In Sylhet city, the surrounding tea gardens in the peri-urban landscape are major areas of its cultural landscape, both socially and physically induced by its urban culture. These iconic places' environmental, socio-cultural, and economic stakes are high as they attract national and international tourism. In this study, the authors focused on the housing settlements spreading across the tea estates, their spatial morphology, and other socio-cultural factors related to these areas. Different communities of ethnic origins are, to some extent, isolated from the typical urban life and still have some deep-rooted cultural practices, which are essential to understand the complexity of human settlement (McCartney, 2012). Therefore, our objective was to understand the

growth and changes of the ethnographic landscape and the settlement pattern associated with it. We defined the socio-cultural aspects that influence the human settlement as 'non-spatial factors' and the existing physical structures as the 'spatial factors' of the communities to understand the ethnographic landscape and the dynamics of the spatial morphology. We collected two types of relevant data for this investigation. They were from secondary sources as well as from primary sources. We gathered these data through document surveys, questionnaire surveys, and interviews. Ethnography is meant to observe the specificities of a particular place or community (Macdonald, 2011). So, all questionnaire surveys and interviews were conducted in-situ by visiting the particular household of the existing communities. Parallelly, we mapped the surveyed households through community mapping, visual survey, and satellite images from Google maps (Figure 1).

We selected three major housing areas from three different tea estates: Khadimnagar, Malnichara, and, Lakkatura, across Sylhet city (Figure 2). We randomly selected the respondents from 473 households to participate in the questionnaire surveys and interviews - 148 from Khadimnagar, 190 from Malnichara, and 135 from Lakkatura. We developed a mixed method for this research by adopting principles from ethnographic investigation and spatial mapping. The ethnographic approach can effectively understand ethnically diverse communities' culture and socio-behavioural factors and their relationships with physical (urban) form (Rishbeth et al., 2018). Also, the ethnographic study can systematically unfold data from the stories told in different periods to help understand the social configuration of that place (Koster, 2020). Although we designed a cross-sectional study, this ethnographic approach added this temporal understanding necessary for analysing spatial growth. Initially, we developed a socio-cultural profile of the communities that includes the ethnic origin, demographic status, financial condition, social-cultural activities, housing policies, and vernacular techniques to understand the non-spatial factors.

We adopted and contextualised a framework of spatial analysis from the study by McCartney and Krishnamurthy (2018) (Table 1). They extensively reviewed previous attempts of morphological analysis, summarised six factors for formal urban settlement, and added four crucial factors for analysing informal settlements.

Table 1. The conceptual framework for analysing housing settlements of different tea workers' communities (adopted from McCartney and Krishnamurthy, 2018)

Factors of settlements' morphological analysis	Informal settlement	Quasi-formal settlement
Interaction between people as a factor of organising the place	Quality and configuration of adopted shared space Non-spatial factors that influence the site, shared spaces, and household units	Quality and configuration of pre-planned shared space and later modifications Non-spatial factors that influence the modifications of site, shared spaces, and household units
Circulation network	Spatial configuration, types, and extent of connectivity Negotiated circulation spaces (i.e. private space used as circulation) and their relationships with built forms	Spatial configuration and extent of connectivity Services of planned roads and their relationships with built-forms
Circulation space configurations	Control of access Negotiated movement Sense of public and private roads	Control of access Distinction between public and private roads
Situational factors	Land affordability and availability Municipal control/regulation Location of communal spaces and markets	Land allocation, affordability, and availability Location of communal spaces and markets

Site factors	Convenience of livelihood Environmental risks	Convenience of livelihood Environmental risks Infrastructural connections
Land parcels\ plot clusters	Space sanctions and future extensions Community governance and sense of ownership	Space sanctions with physical boundaries Community governance and sense of ownership
Topography of the site	Topography and its impact on the settlement	Topography and its relationship with the settlement
Land-uses	Existing fabric and land-use pattern	Existing and proposed land uses and zoning
Building typology	Building configuration, size, and vernacular techniques Material culture Self-built	Building configuration, size, and construction techniques Material culture Planned prototypes
3D built form	Three-dimensional organisation of household structures, including permanent and non-permanent structures	Three-dimensional relationship between built and unbuilt areas

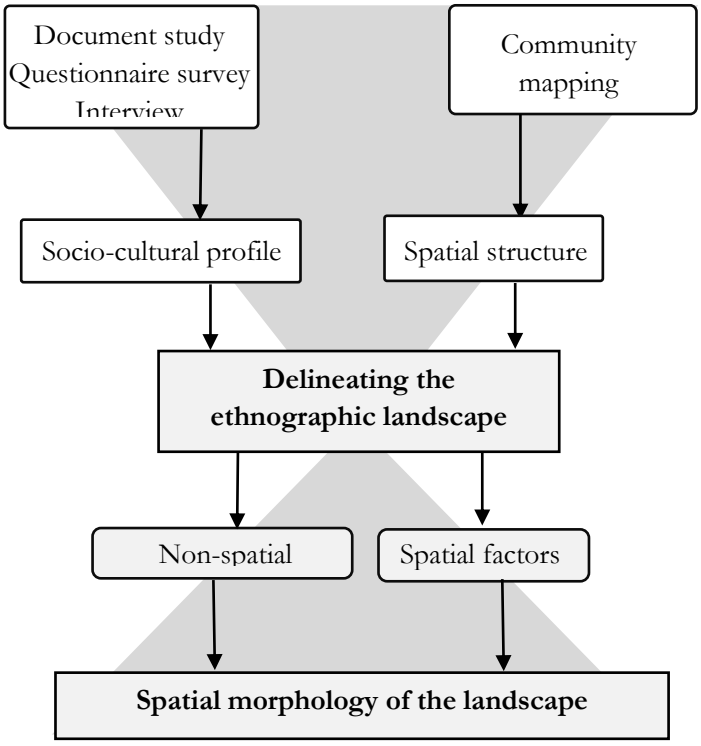


Figure 1. The methodology of the study. Source: authors.

Regarding spatial factors, the studied communities had apparent settlement patterns that were diverse and organic. We found that most structures fell between informal and quasi-formal housing types through the initial survey. In the quasi-formal housing, the core houses were provided by authorities with comparatively

permanent materials. The rest of the extensions were organically developed; in the informal housing, all the built forms are organically developed with vernacular techniques.

Results

Ethnographic landscape

The ethnographic landscape represents the system of meanings, ideologies, beliefs, and values shared by a group of people (Hardesty, 2000). It may sound similar to the term 'cultural landscape', which is represented by the significant cultural resources of a place. However, the difference is that the 'Ethnographic landscape' is defined by the cultural groups associated with the place (Evans et al., 2001).

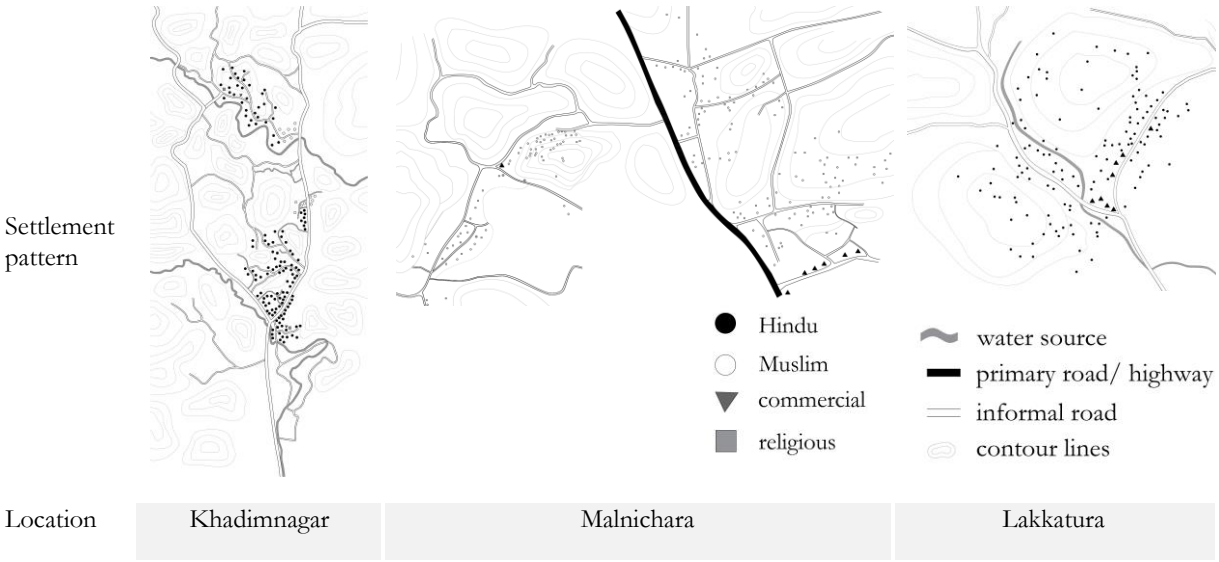


Figure 2. The settlement patterns of the ethnic communities. Source: authors.

Our study identified several community clusters defined by ethnic groups (Figure 2). In Malnichara, two major clusters were named 'Boro lane' and 'Notun para'. The workers established the 'Boro Lane' and have lived there, the largest housing settlement at Malnichara tea estate since the British colonial period. After the independence of Bangladesh in 1971, a new settlement named 'Notun para' was established by workers who arrived from different districts of Bangladesh. On the other hand, the Lakkatura tea estate had five different labour colonies named 'Doldoli', 'Barisal Lane', 'Comilla Lane', 'Uria para' and 'Chatal lane'. 'Barisal lane' is the most occupied and densely inhabited colony in Lakkatura tea estate, with around 200 households. 'Doldoli' is the second largest settlement under Lakkatura tea estate supervision, with around 65 households. The Khadimnagar site had four clusters: ' Uttar lane', 'Boroitola', 'Mrittinga' and 'Lalichora'. People from a single ethnicity did not solely occupy all clusters. Instead, they had a certain level of ethnic diversity and a distinct sense of inter-ethnic community. In the following section, we explained more about their ethnic origins.

Ethnic origin

The estate owners brought the marginal and economically insolvent people of diverse ethnic origins earlier from different states of British India and later during the post-independence from several districts of Bangladesh. In 1860, while founding the Khadimnagar tea estate, the British investors persuaded those ethnic communities to migrate there. A substantial percentage of the current workers were carrying the ethnicity of their predecessors and living in the labour lines. Similarly, in 1857 when the Malnichara tea estate started

production commercially, initially, they brought workers from different states of India, most prominently from Odisha, Uttar Pradesh, Madras, Bihar, Burdwan and Shillong. The 'Boro lane' settlement mostly consisted of people from those origins. Bengali immigrants from different districts mostly occupied the 'Notun para' settlement. Therefore, they possessed the skills to socialise and associate with other occupations. The 'colonies' in the Lakkatura estate were smaller groups formed by immigrants. The workers from these colonies had mostly migrated from the Odisha state of India and the floodplain deltaic regions of Bangladesh e.g. Barisal, Cumilla, and Faridpur, to seek better employment opportunities. Unlike the other settlements in Lakkatura, 'Doldoli' is significantly detached from the peripheral urban fabric. The migration movements and percentages of tea workers' communities from ethnic origins are shown on the map and in the diagram (Figure 3).

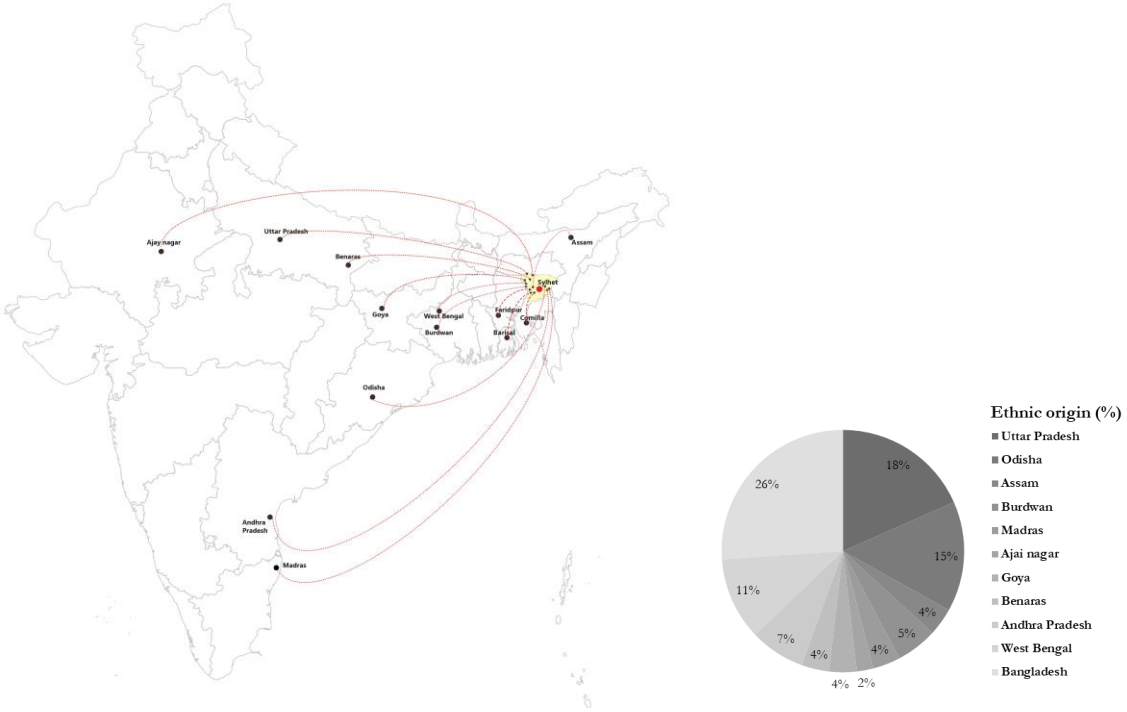


Figure 3. Migration movements of ethnic communities from their origins. Source: authors.

Demographic status

The tea workers in Sylhet used to live in a patriarchal society, preferably in nuclear families. Our study found that the tea workers' average number of family members was 4.70, which was comparatively less than the national average, 4.80 (BCS, 2008). The average productive member in a family was 2.56, which constituted almost 54%. The dependency ratio, the ratio of the sum of the younger group under the age of 15 years and the elderly group over the age of 65 years to the productive group of 15-64 years, was found to be 0.83. The study revealed that male and female populations were almost identical, of which 60% belonged to the adult age group (15-64 years). These results reflected similarities with the other research conducted in Sylhet (Ahmad et al., 2015). Polygamy, child marriage and the dowry system were still widely practiced. Average marriage ages for males and females were about 25 and 16 years, respectively. Religious beliefs substantially impacted their social life and spatial organisation of the settlements. The dominant religious groups were Hindu (about 73%), along with some Muslim (27%) immigrants residing at Lakkatura and Malnichara (Figure 4).

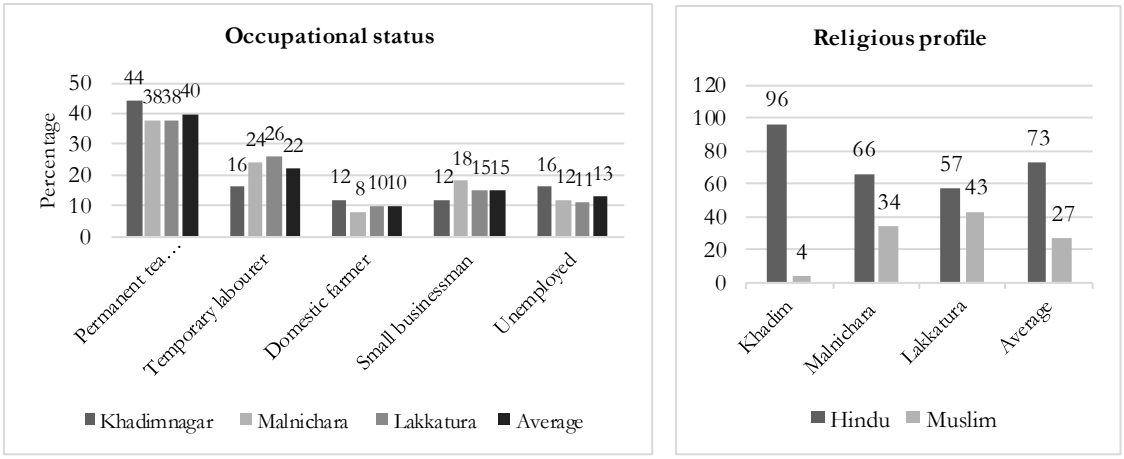


Figure 4. Demographic status of the ethnic communities. Source: Field survey (2021).

Financial condition

Table 2. Different wage structures of the permanent tea workers. Source: Field survey (2021)

Payment system	Daily	Weekly	Monthly
Wages in BDT	120	720	3000

Table 3. Monthly income and expenditure of an average-sized family. Source: Field survey (2021)

	Average monthly income			Average monthly expenditure				Average monthly savings
Purpose	Wage	Overtime	Part-time	Food	Education and health	Utility cost	Provident fund	1800
Amount in BDT	6000	1500	1400	6000	500	500	100	
	8900			7100				

On average, 40% of the total population worked permanently and 22% worked part-time (**Figure 4)**. This study observed that a significant percentage (61%) of the permanent tea workers were female (Field survey, 2021). Females also often worked in the backyards or kitchen gardens and in the small shops in front of their houses named 'tongs' for the additional income. Males mostly worked as temporary workers beside running small businesses, pulling rickshaws, raising domestic animals, collecting firewoods, etc., in spare time to achieve economic solvency.

There existed two wage structures for the tea workers – permanent or temporary. The temporary workers were paid on a daily basis, whereas permanent workers had two payment schemes – weekly and monthly (Table 2). A worker could only earn BDT 120 for plucking a minimum of 23 kilograms of leaves daily

and BDT 2.0 per additional kilogram. In addition, permanent workers were granted two annual festive bonuses, weekly rations and provident funds. A permanent worker had to work six days weekly. However, they would receive 20 days of paid leave per annum and a 14-day non-paid leave for building their houses. The female workers used to receive paid maternity leave of four months.

The affordability of an average-sized family (4.7 members with two earning persons) can be understood by breaking down their average monthly income and expenditure, shown in Table 3. Using data from Table 3, a family's annual income was derived as BDT 106,800 (excluding the festive bonuses) and annual expenditure as BDT 85,200. Thus, the annual savings of an average-sized family was obtained as BDT 21,600 only, which was a relatively inferior amount, considering other emergency and occasional expenditures such as repairing houses, marriage, purchasing cloth, medical expenses, and cremation.

Social-cultural activities and community participation

The permanent tea workers had a gruelling work schedule as their regular working hours started early at 8-00 am and ended at 2-00 pm. Furthermore, working overtime on morning sessions (6-00 am – 8-00 am) or afternoon sessions (2-00 pm – 5-00 pm) for extra income effectively reduced the opportunity to be involved in socio-cultural activities. After returning home, they either had to go for part-time professions or do household chores. Despite this, they could manage time to maintain their social lives and forge inter-dependencies. The tea workers could gather and gossip in the local shops and tea stalls in the evening. They depended on elderly neighbours during working hours to care for the children. Even they used to collectively arrange a weekly bazaar or haat for trading their homegrown products in every tea estate. Non-government organisations, including BRAC, ASA, IDEA, and FIVDB, were working for their social welfare by educating and training female and unemployed persons. Though Bangladesh Cha Sramik Union (BCSU) centrally monitored their professional rights, they unitedly formed Panchayat as the local governing body to resolve local disputes.

Hindu settlements comprised spacious central temples for celebrating the annual outdoor festivals such as 'Saraswati Puja' and 'Durga Puja'. Besides, 10-15 Hindu families often established family temples together by mutual understanding and self-finance. The shared family temples were used for indoor rituals such as 'Lakshmi Puja', 'Mansha Puja' and 'Dol Puja'. Ethnic communities used to perform an exclusive dance named 'Jhumur Nach' in their courtyards during a religious festival called 'Karam Puja'.

Housing policies and vernacular techniques

Vernacular houses			
Location	Khadimnagar	Malnichara	Lakkatura

Figure 5. Different vernacular houses of tea workers' communities. Source: authors.

During the colonial period, employers initially provided formal prototype houses to their workers. The settlements were formed with a series of single house-forms parallel to the connecting roads. That formal planning included artificial stormwater drainage systems linked to the natural streams. However, the surging population, the obligation for separate rooms for post-adolescent and adult members, and flowing migration movements caused demand for extensions and further constructions. Unsurprisingly, later constructions and

extensions, that the users built themselves, followed their indigenous knowledge of vernacular practices and respected the local microclimate. Natural resources such as mud, thatch, ikor and bamboo, abundant in nearby forests, became the prominent building elements for the extensions & new constructions (**Figure 5**). As part of the estate authority's housing policy, lands were allocated to new buildings based on users' demands and suitable locations. The land ownership remained to the estate owners, but the house ownership belonged to the users. Hence they had no rent to pay for the house. Local Panchayat held the legislative control to decide the plot size, generally around 3.50 decimal. The estate authority only provided one bundle of corrugated sheets, three septic rings and a sanitary pan cover for building houses. Sometimes they had to take loans from non-government organisations for house construction and repairing.

Spatial morphology

Interaction between people as a factor of organising the place

Shared spaces			
Location	Khadimnagar	Malnichara	Lakkatura

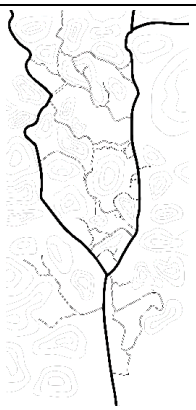
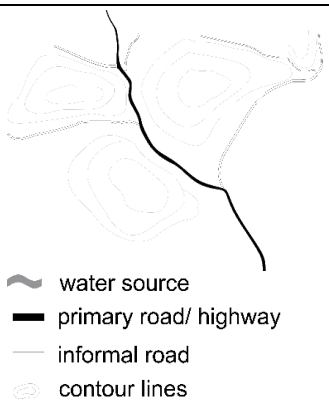
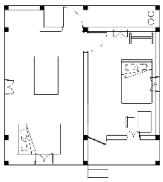
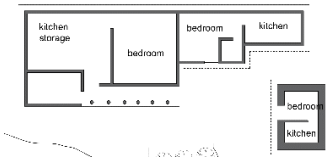
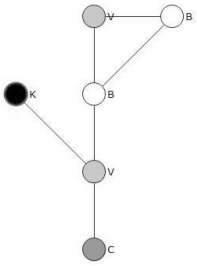
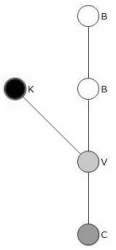
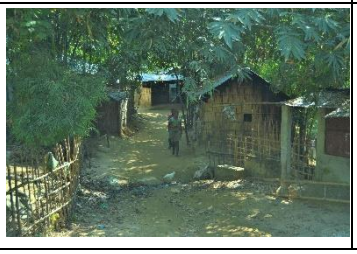
Figure 6. Shared spaces in tea workers' settlements. Source: authors.

Several non-spatial components influenced the morphology of the tea estate's informal settlements. The non-spatial components included social, financial, and political variables that indirectly shaped the morphology of the settlements. The sense of social security, the extent of shared spaces and connectivity were the dominant social factors that determined the character of their settlements. The shared areas were classified on a low (authority-built) to high (custom-built) scale. We found that the higher shared spaces were the kitchen, courtyards, temples, pavements, dug-wells, etc. where the settlements formed as clusters (**Figure 6**). In Khadimnagar, multiple households shared courtyards, and the family temples were occasionally shared as well. In Malnichara's case, the pavements between two houses were used for social interaction, and mutual understanding of using a shared kitchen was also developed. The low sharing characteristics were found in Lakkatura's case, where the settlements were sparsely placed on the hills. Rather situational, financial, and political variables influenced them more. The lack of financial affordability, the threat of eviction, poor physical connectivity and the absence of formal infrastructure forced them to build semi-permanent and temporary houses. On the other hand, legal house ownership, sense of social security and sound connectivity persuaded the dwellers to form clusters with more permanent houses in Khadimnagar and Malnichara.

Circulation networks

We studied circulation networks as two-dimensional physical layouts such as road networks, accessibility, and connectivity (Table 4). The primary formal roads were transected by multiple secondary and tertiary informal networks, thus providing more connectivity and accessibility in Khadimnagar and Malnichara. However, in Lakkatura, the ethnic communities preferred the less accessible sites for settlements, as the tree-like connectivity was limited to only primary and secondary roads. The contoured landscape caused the irregular and organic patterns of the road networks. The internal circulations were dominated by the negotiated private spaces between dwellers, such as courtyards, corridors, verandas, etc. We also investigated the accessibility

Table 4. Circulation networks and circulation space configurations of the tea workers' settlements

Location	Khadimnagar	Malnichara	Lakkatura
Road networks			
Accessibility			
Justified graph			
Negotiated circulation			

within the built-forms using justified graph analysis in space syntax. Compared to traditional urban dwellings, the internal areas in those informal buildings were deemed more accessible. Because of the simpler functional arrangements and less complex circulation in floor layouts, most spaces could be accessed within four to five steps.

Circulation space configurations

The analysis of circulation space configurations considered the non-physical dimensions such as control of public and private access, choice and depth, negotiated movement, and grey space. The distinction between public and private access was somewhat non-existent or blurred due to the informality of zoning. In Lakkatura and Khadimnagar, the private built areas, such as corridors between two houses, were often used as public circulation spaces because the sense of land ownership was more social than legislative (**Table 2**). Due to those grey spaces, the settlements could accommodate frequent through movement and multiple choices. However, the presence of public highway roads in Malnichara impacted residents' control of direct access to private space, as they had developed physical boundaries to control external movement and informal pedestrian connectivity for internal movement.

Situational factors

For the situational factors, we studied the settlements' location in the city according to their affordability and scope for informal growth. The tea-worker communities in all three estates were settled in the urban fringe or peripheral areas as those areas were relatively affordable and less developed. Violation of local zoning ordinance was frequent due to the remoteness and weaker administrative controls. The dwellers took these advantages to form informal settlements. The proximity of economic and social infrastructures, such as distance from the workplace, market, temple, etc., was considered in the land parcel's preference. The topological distance, determined by the number of turns or nodes, was accounted for while selecting the plots instead of metric distances. However, the primary roads were well-connected to the highway roads that led to the city's core. As a result, the friction of distance was reduced in all three cases.

Site factors

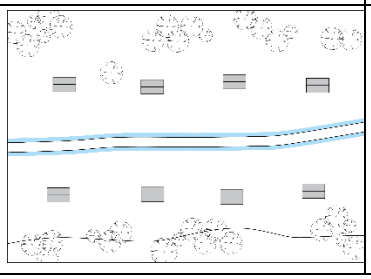
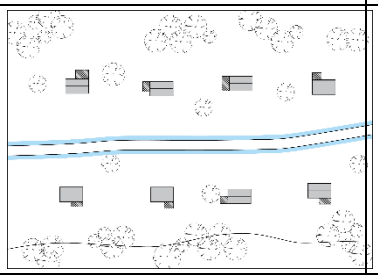
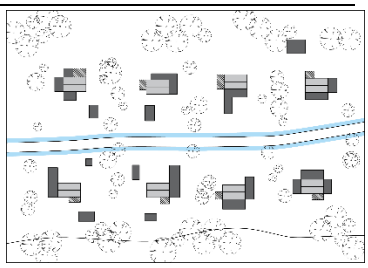
The site factor, apparently similar to previous situational factors, slightly has a different focus on the convenience of the community's livelihood. The site factors are associated with the variable site forces and external constraints. The uneven topography had been a significant constraint. These places were often vulnerable to natural disasters such as erosions, mudslides, lightning, etc. Highways, water bodies, natural forests, service corridors, disaster vulnerability, and other external constraints were among the others. The Malnichara area, compared to the other two locations, is now close to the city and has better urban facilities. A vital highway connecting the airport to the city's core had intersected the two communities in the Malnichara tea estate. Consequently, the two communities' social interaction and informal connectivity were disrupted.

On the other hand, highway markets and street commerce have recently developed along the highway. Natural forests and water bodies acted as the restricted areas for urban developments and thus encouraged the tea workers to build informal but inexpensive settlements. They also encouraged people to become more reliant on natural resources. The Lakkatura area was the most inconvenient site due to the contoured topography with less space for expansion. On the other hand, the Khadimnagar area was less densely populated and situated on flatlands. It also possessed more rural characters than the other two sites.

Land parcels/plot clusters

We found that subdivision regulations or zoning ordinances were absent in those fringe areas. The boundaries of land parcels were flexible to constant change and determined by the social negotiations between individuals. Local Panchayet, as the only institutional control, held the legislative power to decide the land allotment. Initially, the tea workers were provided with around 18m2 of land for building a house. However, the lot lines

Table 5. Morphology of housing clusters in different development phases

	Initial	Intermediate	Existing
Cluster Morphology			

were later extended according to the dwellers' needs. The lots could be distinguished by vegetation and circulations in the absence of legal boundaries. Social negotiations also determined the morphology of the land parcels. The chronological development of the lots could be divided into three phases – initial, intermediate and existing phases (Table 5). The initial phases commenced with establishing the authority-built modular houses for the nuclear families. Additional living spaces were extended sideways for the adolescent children, adjacent to the core built-form in the intermediate phase. The current phase consisted of separate built-forms added to the core house to accommodate joint or multiple families.

Topography of the site

The dynamic terrains and moderate undulations in the topography of the tea gardens resulted in informal settlements in vertical layers. The verticality provided a sense of privacy and reduced the risk of abrupt land-use change. Although, the instability of landform due to erosion and intrusion could be catastrophic in case of landslides and heavy stormwater. Also, the topographical restriction restricts the settlements' horizontal expansion, resulting in a scarcity of water sources on the plateau. The availability of surface water sources is essential in determining the informal settlements' landscape. The organic settings of the natural streams characterised the growth, linear pattern and density of the informal settlements located along with the water sources in Khadimnagar and Lakkatura tea estate. However, in Malnichara, the absence of natural water sources compelled the dwellers to establish a clustered pattern and apply vernacular storage techniques in dug-wells.

Land uses

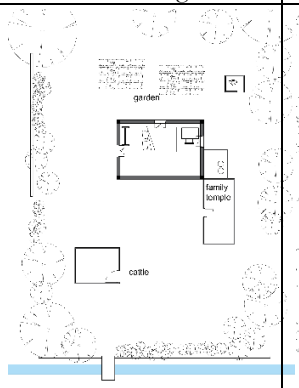
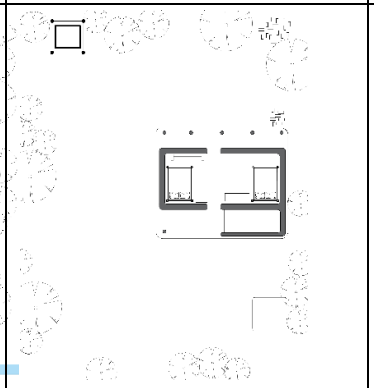
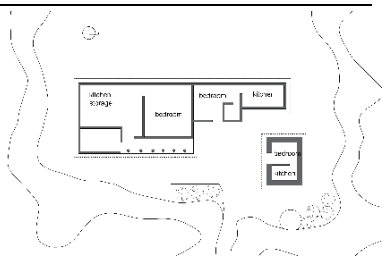
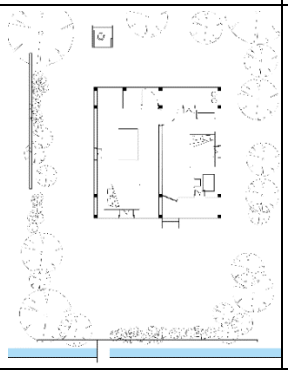
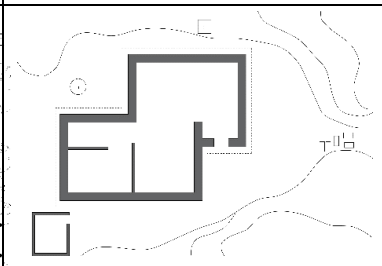
Diverse and organic types of land use can be found in the existing settlements of the tea estates due to the absence of any formal zoning or proposed land-use planning (Figure 2). Most of their settlements belonged to the agro-forests or tea plantations because of their direct reliance on natural resources for fuel and food. Due to the surging population and the expansion of households, the agro-forest lands gradually reduced. Informal and quasi-formal residential land use was prevalent in their existing land use. Commercial use was sparsely found adjacent to the junction of the primary roads (in Khadimnagar and Lakkatura's case) or along the highways (in Malnichara's case), where communication was relatively more accessible. Religious zones were a special feature in their settlements, even often found inside some family households. The existing fabric was relatively more flexible and possessed the changing capabilities according to the dwellers' needs. Recent changes in land use introduced small-scale commercial activities in front of large-scale residential plots to provide internal trading facilities and more financial stability.

Building typology

The building typologies are often determined by their materiality, vernacularism, temporal morphology, shared spaces and orientation. The vernacularism of the houses was scaled from owner's-built to self-built attributes

(Table 6). In most cases, the owners-built houses followed a basic module of two bedrooms, a kitchen, and a veranda. Those houses are often facilitated with non-contextual foreign building elements such as chimneys and fireplaces (in Malnichara), which are inappropriate for the humid climatic condition of the region. The authorities initially built indoor kitchens (mud stoves) at the corner of the rear veranda (in Khadimnagar). The house plans were predominated by indoor living spaces lacking service spaces or semi-outdoor spaces for domestic activities. In Khadimnagar's case, all the initial houses were provided with a worship space on the rear side. Later, Muslim inhabitants transformed those spaces into domestic spaces or stores. The self-built houses were developed to accommodate growing family members. They inherited the regional vernacular elements such as extended chowchala (pitch) roof, cattle shed and semi-outdoor space in the plan and considered the local microclimate and regional climate by providing more openness and natural ventilation. The kitchen and ancillary service areas were developed outside the primary house at a certain distance.

Table 6. Different types of houses in tea workers' settlements

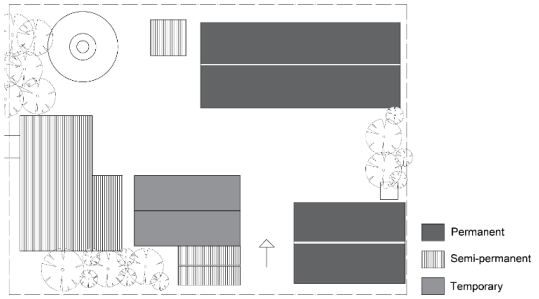
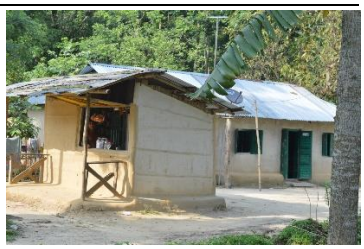
Location	Khadimnagar	Malnichara	Lakkatura
Self-built			
Owner's-built			

Apart from vernacularism, spatial orientation was accounted for in this study. Two types of spatial orientations were found in the households. The street-front houses, used mainly by the Hindu and ethnic communities, were oriented facing the access roads and approached directly from the outside. They had maintained their privacy level by installing semi-perforated bamboo mats or organic fences and sparse vegetation around their premises. On the contrary, Muslim communities have adopted a more conservative and indirect approach. Their house forms were inwardly oriented and reversely faced to the roads. To ensure privacy, the entrances were hidden by a built-form or high fencing from outside.

3D Built form

The 3D-built forms were studied based on built and unbuilt areas. The built forms could be classified as

Table 7. Three dimensioanl house forms in tea workers' settlements

Typical Structure			
3D-house forms			
Location	Khadimnagar	Malnichara	Lakkatura

permanent, semi-permanent and temporary based on their materiality (Table 7). The authority provided the permanent houses as an incentive after the workers became permanent employees. The substructures were made of shallow brick foundations. The superstructures were mainly built of brick masonry walls with light roofs made of corrugated sheets. The semi-permanent built-forms were the self-built extensions of their houses, made of locally available materials such as ikor, bamboo-mat, mud plaster, etc. The temporary houses were the initial houses, built and used by the inhabitants during their temporary employment. Those houses were primarily made of mud, straw and thatch. Their temporariness was due to the seasonal utilisation when the authority used to hire an additional workforce during the peak tea collection seasons. The temporary houses were often placed in front of the permanent households on large plots or outside the labour lines.

Discussion and conclusion

This study of the tea workers' communities searched and found the qualitative factors that invoked the sense of community. Their social interactions could be considered the prime factor in community-building and place-making. The study of informal settlements should insist on ethnographic engagements with the place and community needs (Macdonald, 2011). In this study, the non-spatial components of the ethnic landscape directly affected the spatial morphology of their informal settlements. For example, ideologies, social values, and religious beliefs also played an active role, as Kanashiro et al. (2012) suggested. These non-spatial measures also indirectly influenced several spatial measures, including circulation space configurations, situational factors, land parcels, land uses, building typologies and 3d built-forms. Social negotiation and mutual ownership determined the configurations of the private and public circulations. Informal and fragile administrative controls persuaded the dwellers to settle in fringe areas. Mostly, in informal settlements, growth occurs on unexpected land areas, e.g. setbacks of highways, rail lines and flood plains. In our study area, the studied housings were developed on the less suitable sites for tea gardening within the estates. Less attractive environmentally leftover locations were offered to the workers. The authors also found that tea workers or 'coolie' communities were strategically segregated by locating them in deeper areas of the estates. Therefore, after decades it is still hard to connect those areas with municipal services, e.g. drainage and permanent roads. The later subdivision and growth of their land parcels followed irregular patterns and incremental characters

according to their affordability and needs. On the other hand, Political and administrative variables characterised their preference and permanence of the three-dimensional structures.

The study highlighted cultural adaptation as an indicator in characterising the morphology and archetype of the built forms. The formal row houses, subsidised primarily by the estate owners, overlooked environmental and cultural context to a greater extent. Moreover, many foreign characteristics were imposed on the initial prototype houses, such as the use of chimneys and indoor kitchens. Traditionally the workers were accustomed to semi-outdoor or open kitchens, which were ignored in the new prototype. As a result, those prototypes failed to respond socially and culturally to the users. However, the ethnic communities of Indian origins applied their native skills and cultural beliefs in the later constructions. Religious beliefs and health considerations to keep the living spaces dry and hygienic influenced them to place bathrooms and toilets separately. Dug-wells were also introduced as alternative water sources as found in their cultural practice (Singh et al., 2009). The ethnic communities of West Bengal and Odisha origin were over-reliant on forest resources. They built a comparatively less number of small windows due to spiritual beliefs and cultural practices (Table 7). Similar to their ancestors, they ornamented exterior walls with floral paintings in white, red, and ochre colours (Kisku and Santra, 2017). Immigrants from Central and Northeast India used to build their native mud houses that required constant repairing. They also widely used bamboo walls plastered with processed mud and steep roof, a Northeast Indian construction technique (Singh et al., 2009).

Besides, contextual adaptation techniques also were developed later as tea workers' communities surged with time. Climatically displaced people from different floodplain flatlands migrated to the hilly tea estates. Those immigrants had adapted to the climatic and topographical changes and applied their native flatland culture, practice & expertise during construction in hilly lands. They had to utilise locally available materials and natural resources, such as mud, thatch, ikor, and bamboo, as they received no further subsidies from their employers. Their dwellings still preferred the north-south orientation and south-facing courtyards similar to traditional floodplains houses. Muslim communities arranged courtyards indirectly for gender-specific use. Irrespective of religious groups, the courtyard, a regional typology in Bangladesh's floodplains, was developed to serve as a multi-purpose space and accelerate airflow (Ahmed, 2012).

This research explores the dilemma between the socio-cultural spaces of a marginalised ethnic community and the formal planning of workers' housing informed by different stakeholders. Previous research for informal settlements also adopted similar qualitative frameworks incorporating either spatial or social dimensions. However, the significance of this research could be the adoption and the contextualisation of both spatial and non-spatial dimensions in a single framework for an in-depth study of informal settlements. Similar approaches could be effectively applied to determine the migration movements and, as a result, how the ethnographic landscape changes. Future studies may explore cross-sectional or cross-cultural investigations of ethnic settlements within different socio-political boundaries. This study can aid in solving various planning-related issues and policy-making in workers' housing and informal rural settlements. Adopting a similar method, the social morphology of space in both physical and social environments may be explained. However, further study on typo-morphology is recommended to examine the ethnographic landscape thoroughly. Improvement could be achieved by introducing a more detailed consideration of housing affordability and land ownership patterns.

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References

Adhikary, S. , Khan, M. , Arobe, S. , Dey, S. and Billah, S. (2019). Soil Chemical Analysis of Kazi and Kazi Organic Tea Garden and Compared to Ordinary Tea Gardens of Bangladesh. *Open Journal of Soil Science*, *9*, 91-102. DOI: 10.4236/ojss.2019.96006

Ahmad I., Yasin M., Rowshon A., and Rafikul, A. K. M. (2015). Study on Socio-Economic and Educational condition of Tea Worker at Sylhet in Bangladesh. *Journal of Tea Science Research, 5*(5), 1-8. DOI: 10.5376/jtsr.2015.05.0005

Ahmed, I. (2012). The Courtyard In Rural Homesteads Of Bangladesh. *Vernacular Architecture, 43*(1), 47-57. DOI: 10.1179/0305547712Z.0000000005

BCS Annual Report (2008). Bangladeshyio Cha Sansad. Agrabad Commercial Area, Chittagong.

Das, T. K., Islam, S.M., and Zakirul, H. (2006). Human rights of the tea gardeners: case study of selected gardens in Sylhet. *Asian Affairs*, *28*(*3*), 25-39.

Evans, M. J., Roberts, A., and Nelson, P. (2001). Ethnographic landscapes. *CRM-WASHINGTON*, *24*(5), 53-56.

Fennema, M. (2004). The concept and measurement of ethnic community. *Journal of Ethnic and Migration Studies*, *30*(*3*), 429–447. DOI: 10.1080/1369183040001682025

Hardesty, D. L. (2000). Ethnographic Landscape. In Alanen, A. R. and Melnick, R (Eds.), *Preserving Cultural Landscapes in America*. Johns Hopkins University Press : Baltimore.

Kanashiro, M. , Olak, A. S. , and Abreu, E. C. R. (2012). Atlas of Ethnographic Landscape in RMC - Metropolitan Region of Curitiba. In 15º IPHS CONFERENCE - International Planning of History Society, São Paulo. *1*, 11.

Kisku, A. K. and Santra, A. (2017). Understanding Santal Identity through their Architecture. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS), 22*(*9*), 24-29. DOI: 10.9790/0837-2209052429

Koster, M. (2020). An ethnographic perspective on urban planning in Brazil: Temporality, diversity and critical urban theory. *International journal of urban and regional research*, *44*(*2*), 185-199. DOI: 10.1111/1468-2427.12765

Macdonald, S. (2011). Ex-siting and insighting: ethnographic engagements with place and community. In G. Welz, A. Davidovic, & A. Weber (Eds.), *Epistemische Orte. Gemeinde und Region als Forschungsformate* (pp. 29–43). Frankfurt a.M.: Universität Frankfurt Institut für Kulturanthropologie und Europäische Ethnologie.

McCartney, S. C. (2012). *At the limit: Vulnerable morphologies in urban areas* [Doctoral dissertation, Harvard University]. Harvard University Press: Cambridge, MA.

McCartney, S. and Krishnamurthy, S., (2018). Neglected? Strengthening the morphological study of informal settlements. *SAGE Open*, *8*(*1*), 1-11. DOI: 10.1177/2158244018760375

Rahaman, M. S., Reza, S. M. A., Rahman, M. M., and Chowdhury, M. S. (2021). A deplorable community in Bangladesh: tea garden workers. *Journal of Enterprising Communities: People and Places in the Global Economy*, *15*(*4*), 548-566. DOI: 10.1108/JEC-10-2020-0176

Rishbeth, C., Ganji, F., and Vodicka, G. (2018). Ethnographic understandings of ethnically diverse neighbourhoods to inform urban design practice. *Local Environment*, *23*(*1*), 36-53. DOI: 10.1080/13549839.2017.1385000

Saha, J. K., Acharje, D. C., and Rahman, M. M. (2017). A study to assess the socio-economic status of tea workers in selected tea estates of Sylhet district. *Journal of Bangladesh Agricultural University*, *15*(*2*), 297–303. DOI: 10.3329/jbau.v15i2.35079

Singh, M. K., Mahapatra, S., and Atreya, S. K. (2009). Bioclimatism and vernacular architecture of north-east India. *Building and Environment*, *44*, 878-888. DOI:10.1016/j.buildenv.2008.06.008