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Exploring the Built Environment and a comparative study of Malayali Tribal Settlements at Eastern Ghats, Salem, India

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This research explores the rich architectural heritage of Malayali tribal communities residing at Eastern Ghats, Salem, Tamil Nadu, India. This research study is a comparison of three Malayali tribal settlements at Jarugumalai, Shervarayan Hills, and Kalvarayan Hills at Salem. The study focuses on the challenge of lack of integrated planning by various stakeholders regarding the structural integrity of indigenous houses, which often results in the replacement of traditional structures with concrete buildings that disregard the cultural, environmental, and social context of communities. By restoring and documenting the indigenous construction knowledge, this research will protect and conserve for establishing help for academic use and future generations. advocating for a more inclusive and participatory approach to housing solutions in tribal areas.
Keywords: Architecture Heritage, Malayali tribals, Eastern ghats, integrated planning, stake holders, Indigenous houses, traditional structures.

1. Introduction

Vernacular architecture is an indigenous knowledge of tribals based on local materials, climates, and cultural traditions, representing an invaluable repository of sustainable and cultural resonant construction practices. Among indigenous communities, such as the Malayali tribes of the Eastern Ghats in Salem, Tamil Nadu, these practices embody the relationship with nature and a profound understanding of environmental and social contexts. It was said that the anatomy of dwellings functioned like vital organs in order to facilitate the comfort and activities of occupants as well as to maintain a harmonious holistic balance with both the physical environment/public world without the spiritual /private world with in [1]. However, the increasing use of new industrially-produced and standardized materials led to the homogenization of the different used construction approaches, and spawned a universal

architecture that in many cases is out of the environment context and is very dependent on energy and other resources [2]—often perceived as superior in terms of structural integrity and social status—has led to the gradual erosion of these traditions.

This research study explores the settlement and architectural heritage of Malayali tribes in Eastern Ghats stretch of Salem at Jarugumalai, Shervarayan Hills, and Kalvarayan Hills, aiming to document and analyse their traditional construction practices. Through this study, the documentation and restoration of vernacular construction practices are positioned as critical steps toward fostering sustainable and culturally inclusive housing strategies and sustainable settlement development.

2. RESEARCH OBJECTIVES

A. To document indigenous knowledge of tribal settlements: spatial organization, materials, and construction techniques used in Malayali tribal houses, highlighting the diversity and commonalities across the selected villages.

B. To analyze the traditional built environment: spatial systems of these traditional dwellings and adaptation to the local environmental conditions.

C. To propose revitalization measures with integrated indigenous knowledge and contemporary practices

3. HYPOTHESIS

Malayali tribal settlement's Cultural and social aspects, such as rituals and communal living, significantly influence the spatial organization and construction methods in which are not considered in modern concrete housing.

4. RESEARCH METHODOLOGY

A. Malayali tribal settlement's Cultural and social aspects, such as rituals and communal living, significantly influence the spatial organization and construction methods in which are not considered in modern concrete housing.

B. Approach and Framework: This study employs a mixed-methods approach, integrating quantitative (from interviews and surveys) and qualitative(from documentation) techniques to comprehensively document and analyze Malayali tribal settlements. The methodology combines literature review, field documentation, and analytical frameworks to explore both natural and man-made aspects of the villages, ensuring a holistic understanding of their spatial and cultural dynamics.

C. Data Collection Techniques: Data collection includes primary, secondary, and tertiary data. It starts with a literature review for context, followed by site visits using quantitative (mapping, measurements) and qualitative (surveys, interviews) methods. An ethnographic approach bridges outsider and insider perspectives, enabling architects to integrate indigenous views through community collaboration.[3]

D. Analytical Methods:

Approach 1: The analysis involves applying the Ekistics Grid to evaluate settlement pattern-spatial elements like land use, circulation, and built forms.

Approach 2:a) Analysis through comparative case study approach across Jarugumalai, Kalvarayan Hills, and Servarayan Hills at eastern ghats stretch in Salem. To show similarity and differences in settlement patterns, tangible and intangible aspects. b) to provide insights into the adaptive strategies and cultural heritage of the communities.

Approach 3: through digitalization and technology. through photogrammetry, remote sensitive data, application though IOT.

5. SITE SELECTION AND JUSTIFICATION

In the research study, selected three key sites in Salem, Tamil Nadu, specifically focusing on the tribal settlements of Jarugumalai, Shervarayan Hills, and Kalvarayan Hills in eastern ghats stretch in Salem(marked in the fig. in the red colour area). Salem district, known for its significant tribal population, has the highest concentration of tribals in Tamil Nadu. According to the Census of India, the recorded tribal population in Salem is 1,19,969, with 1,10,233 living in rural areas. Of these, 1,04,057 are identified as Malayali tribes living in rural Salem, highlighting the district's predominantly rural character [4]. The Malayali tribes, who have long resided in hill stations such as Jarugumalai, Kalvarayan, Pachamalai, Aranoothumalai, and Shervarayan, demonstrate diverse vernacular architecture that is shaped by the materials and resources available in their immediate surroundings.

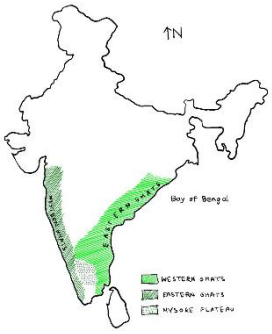

Fig.1 Eastern ghats

Fig.2 Salem hill ranges (source:google earth)

- Geographical and Vernacular Diversity: The selected sites, Jarugumalai, Kovilur, and Sembur, showcase unique construction techniques influenced by local resources and environment. Their proximity enables a comparative analysis of architectural practices and modernization's socio-cultural impact.

- Socio-Economic Transitions: Historically reliant on forests for sustenance and trade, tribal communities have shifted lifestyles due to improved road access and urban exposure.

Increased connectivity to Salem has driven migration for work and education, sparking aspirations for better housing and income opportunities.

- ITDP Pockets and Population Considerations: The Integrated Tribal Development Program (ITDP) supports areas with at least 50% tribal populations, improving education, healthcare, and infrastructure through MoTA and ITDAs. In Salem, ITDP pockets include Yercaud, Kalvarayan, Aranoothumalai, and Pachamalai, but Jarugumalai was excluded due to population constraints. This exclusion makes Jarugumalai a unique study site, as its development differs from ITDP-supported areas. Its architectural and social evolution reflects the lack of formal support. [5]

6. MALAYALI TRIBALS -AN INTRODUCTION

1. Historical Overview

The word Malai denotes inhabitant of the hills (malai – hill or mountain). Etymologically, the word Malayali is derived from the word Malai and ali which means in inhabitants of the hills. The Malayali's have not; however, like the Toda's of the Nilgiris, any claim to be considered as an ancient hill tribe [6]. The Malayali's come under the Twenty fifth number in the list of Scheduled Tribes [7]. A majority of them are found in the hill areas are the Shervaroy, the Kalrayan, the Pachamalai and the Kolli Hills [8]. According to Thurston, the term Malayali has been derived from the words Malai meaning hill and al meaning person and is used to denote hill people. Etymologically the word is derived from Malai – Hills and ali – inhabitants [9].

Fig.3 Photograph of two men and two women of the Malaiyali tribe in the Shevaroy Hills in Tamil Nadu - 1860s[10]

2. Myth and mythology of Malayali tribal settlements

The most spoken and know history, The Vedar Kidnapping. In a third narrative from the Javadi hills, a conflict arose when some Vedars kidnapped seven young Vellāla maidens from Conjeeveram.

Seven Vellāla men, accompanied by their dogs, set out to rescue them but faced numerous challenges, including a flooded river. Upon successfully defeating the Vedars and rescuing the

maidens, the Vellāla men returned home only to find their wives had mourned them as lost and performed funeral rites. As outcasts, they married Vedar women and eventually became the ancestors of the Malaiali caste, transitioning from their former identity to establish a new community in the hills[11]. The Malayalis migrated to the Eastern Ghats centuries ago, thriving on agriculture, hunting, and gathering, with Punam cultivation central to their hilly lifestyle. Their communal social structure is clan-based, with kudis governing settlements and ooru (hamlets) forming cohesive units. Clan elders hold respect, leading in administration and rituals.

7. CASE STUDIES OF TRIBAL VILLAGES

The Malayalis established communities primarily in the Shevaroy Hills, Pachamalai, and neighboring mountain ranges. Over time, their migration across these regions contributed to their demographic and cultural expansion. Each settlement reflects their historical journey, with distinct cultural practices that have evolved over generations. This study focuses on three villages, each located in a different neighboring mountain range.

1. Melur (Jarugumalai)

- Village Overview

The etymology of the village Melur can be traced to its geographical distinction based on elevation. The term Melur derives from the Tamil words "mel" (upper) and "oor" (village), signifying "the upper village." Conversely, its counterpart Keelur is derived from "keezh" (lower) and "oor," meaning "the lower village." Melur is a tribal village located in the Jarugumalai region of the Eastern Ghats in Tamil Nadu, within the Salem Districtthe village is part of the Kuralnatham panchayat and lies within the Jarugumalai Reserved Forest, declared in 1926. Covering an area of 24,992 square meters, Melur comprises 90-100 houses and contributes significantly to the combined population of over 1,200 people in the region.

TABLE I PROXIMITY TABLE OF MELUR

Melur	
Landuse	distance(in meters)
Farm land	5.2
City[salem]	14.6
Forest	2.4
Religious temples	0.1
Near by village	0.85
Water	1.7
Local market	-
Town market	5.6
labour work	7
Education	10.3

Hospital	12.1
Public transport	1
Nearest Road	0
Main road	11.1

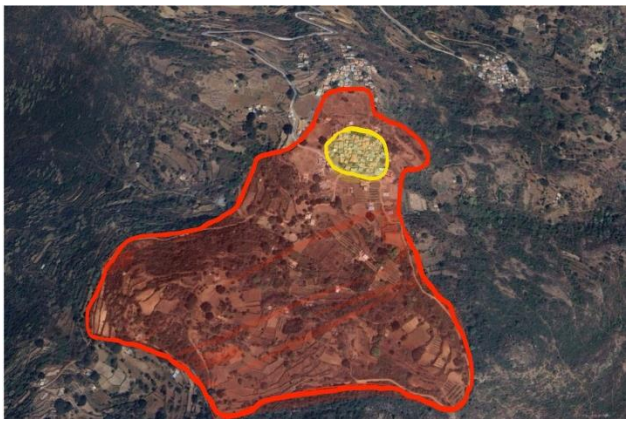

Fig.4 Melur, Jarugumalai settlement pattern (source:google earth)

Figure 4 illustrates that the red-marked area represents agricultural land spanning approximately 75 acres, of which only 3.1 acres are allocated for construction.

- Settlement Pattern and Spatial Layout

Melur's settlement pattern adapts to its hilly terrain, with houses built on available flat land, creating an irregular layout. Homes are spaced to ensure privacy, reflecting practicality and harmony with the environment. This organic design showcases the community's resilience in navigating rugged terrain constraints.

Fig.5 Melur, Jarugumalai settlement pattern

Fig.6 Melur Aerial view(aerial view)

- Construction Materials and Techniques

The primary building material for walls in Jarugumalai is locally sourced bricks from nearby brick kilns. These kilns utilize the region’s rich soil, which is ideal for brick-making. The use of stones for foundations enhances the durability and stability of the structures, especially in the hilly terrain. The roofing material is primarily made from Kenangu pul (Ophiuros exaltatus), a reed abundant in the region. These reeds provide excellent insulation, helping to maintain a comfortable indoor temperature by keeping the homes cool during hot months and

warm during cooler periods. Varieties such as palm wood, neem, teak, bamboo, and tamarind are used for making door and window frames, contributing to the strength and natural aesthetic of the structures.

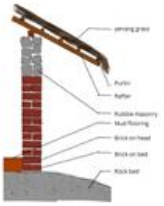

Fig.7 section of a wall documented in fig:4 (source:author)

Fig.8 House in Melur (source:author)

Fig.9 House in Melur (source:author)

Fig.10 House in Melur (source:author)

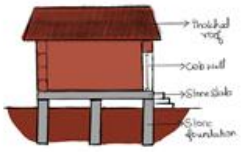

Fig.12 section of storage unit in Melur wall thickness (source:author)

Fig.11 Granary in Melur (source:author)

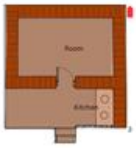

Fig.13 plan of a house in melur(source:author)

Figures 6, 8, 9, and 11 clearly demonstrate the absence of a specific architectural style. The materials are arranged in varying patterns, influenced primarily by their availability and the preferences of the users. The storage area is constructed on stone pillars, creating a raised structure with a gap beneath it. This design serves to minimize direct contact with the ground, effectively reducing the risk of water absorption through transpiration and preventing insect infestations, such as termite attacks.

- Infrastructure: plan, Sanitation, and Kitchens

In Jarugumalai, house layouts reflect the local climate and materials, ensuring practicality and sustainability. The warm, temperate climate influences design, with kitchens placed in verandahs or near courtyards to keep heat and smoke outside, enhancing ventilation and comfort.For drinage, the residents dig stone-lined drains, which allow rainwater to percolate into the ground instead of flowing downhill uncontrollably. This method helps prevent soil

erosion and reduces the risk of contaminating lower-lying areas.

Fig.14 Kitchen outside in Melur (source:author)

Fig.15 Kitchen outside in Melur (source:author)

Fig.16 Kitchen in veranda in Melur (source:author)

Fig.17 Bath area in Melur (source:author)

- Other characteristics

The village's primary occupation is agriculture, with groundnut and millets being the main crops. Historically, they reared large cattle herds (pattis) for ploughing, though this has declined over time. Traditional woodworking is another significant activity, and attire has evolved due to interactions with neighboring communities.

Fig.18 Women in Melur

Fig.19 well in Jarugumalai

Water was traditionally fetched from a well located approximately 2 kilometers away. However, advancements in infrastructure have introduced piped water connections to individual households, significantly improving accessibility and convenience.

Sembur (Kalvarayan Hills)

- Village Overview

Sembur is a small hamlet situated in the Kalvarayan Hills, near Karumandurai in Tamil Nadu, at an elevation of approximately 1,058 meters above sea level. The etymology of the place name "Sembur" can be traced to Tamil roots, combining "Sembu" and "Oor":"Sembu": Refers to a plant Colocasia esculenta, symbolizing the significance of flora in the area. In Figure 20, the spatial organization of Sembur is depicted, showcasing its settlement and agricultural zones. The yellow-shaded area corresponds to the settlement zone, occupying 3.5 acres, where residential and community activities are concentrated. Surrounding this is the red-shaded area, representing the agricultural land, which spans a substantial 200 acres.

Fig.20 Sembur kalvarayan hills settlement pattern (source:google earth)

TABLE 2 PROXIMITY TABLE OF SEMBUR

Sembur	
Landuse	distance(in meters)
Farm land	0.7
City[salem]	87
Forest	2
Religious temples	0.5
Near by village	2.6
Water	4
Local market	6
Town market	21.2
labour work	25
Education	20
Hospital	23
Public transport	12.6
Nearest Road	0
Main road	19.3

Near the Sembur settlement, dolmen caves have been identified, showcasing remarkable megalithic structures crafted using large rock slices extracted with primitive techniques.[13] Locally referred to as "Kullar Kugai" (short man's caves). They serve as sacred sites where locals hold festivals and offerings to deities.[14] During my exploration, I conducted a photogrammetry analysis of these dolmens, which unveiled their intricate geometric designs and structural layout. This analysis provides critical insights into their architectural and cultural significance, further enhancing the understanding of their role in ancient and modern contexts. These dolmens, merging history with living traditions, remain vital as both archaeological treasures and spiritual symbols for the communities around the Kalvarayan Hills.

Fig.21 Dolmen cave (act of deriving through photogrammetry scan) in kalvarayan hills (source:autor, scaninverse)

Fig.22 Dolmen cave in kalvarayan hills (source:autor)

Fig.23 Dolmen cave in kalvarayan hills (source:autor)

- Settlement Pattern and Spatial Layout

Sembur's settlement is built on flat terrain, featuring a well-organized street layout. Houses follow a row housing pattern, with common walls shared between neighbouring homes. This arrangement reduces construction material use and optimizes land utilization. The row housing design fosters a sense of community, with houses facing each other across the streets. This layout encourages social interaction, and in the evenings, residents often gather at the corners of the streets for casual talks, strengthening their communal bonds. The compact design of the homes ensures accessibility and efficient use of space, while the clear and linear streets provide structure and a defined flow for movement within the village, supporting a cohesive and functional settlement.

Fig.24 Sembur, Kalvarayan hills settlement pattern (source:author)

Fig.25 Sembur aerial view(aerial view)

Fig.26 Sembur, Kalvarayan hills common gathering space in the nodal point (source:author)

the street corner serves as a common gathering space, fostering community interactions and social activities integral to the settlement's cultural fabric.

- Construction Materials and Techniques

The walls in Sembur are built using mud sourced from the region's abundant red soil, known for its excellent thermal properties. To enhance insulation, an interlinked bamboo framework is covered by mud layers on both sides, with wattle-and-daub and cob wall construction [15] techniques further improving thermal insulation and wall strength. These tiles provide insulation and weather resistance, complementing the local climate by maintaining stable indoor temperatures. Timber from nearby forests, such as neem (Azadirachta indica), vengai (Pterocarpus marsupium), and vembu (Melia dubia), is commonly used for structural elements like beams, rafters, and door frames. These materials offer strength while reflecting the community's reliance on sustainable, locally sourced resources.[16]

Fig.28 wattle and daub wall documented (source:author)

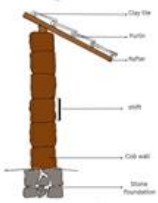

Fig.29 section of a wall documented (source:author)

Fig.30 Teak wood and burial area in Sembur(source:author)

Fig.31 Granary in Sembur (source:author)

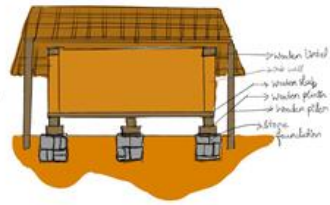

Fig.32 Section of the granary

Fig.33 chindrasu explaining the granarys's construction

In the granary, similar to the design observed in Melur, the slab is elevated above the ground. However, unlike in Melur, wood is predominantly used in the construction, with stone being limited to the foundation. An intriguing feature of this granary is the absence of a door; access is provided exclusively through the attic.[17]

- Infrastructure: Road Networks, Sanitation, and Kitchens

The cooler temperatures at this altitude make the use of mud walls a practical choice, providing insulation from the cold and helping maintain warmth within the home. The clay tile roofs also contribute to thermal efficiency, preventing heat loss and keeping homes warmer during colder months. The houses often feature an enclosed verandah, which offers additional living space protected from the wind and rain, essential in this high-altitude region. Inside the house, the kitchen is typically integrated into the living area, with a simple wall separating it from the bedroom. The verandah is often enclosed with wattle and daub walls, creating a semi-open space used for daily activities.

Fig.34 plan of a home in Sembur

Fig.35 Kitchen of a home in Sembur

Fig.36 Livng of a home in Sembur

Fig.37 Veranda in Sembur

Fig.38 Batharea of a home in Sem

Sembur's flat terrain allows for a unique drainage system where people bathe on raised platforms, allowing water to flow naturally toward nearby plants and small slopes they have created.

Other characteristics

Women in Sembur wear kambali, a thick garment with both utility and cultural significance. Water was traditionally sourced from natural springs, requiring a short walk. Agriculture, particularly plantations and sugarcane cultivation, has long been central to the village's economy.In earlier times, the village operated kilns for the production of jaggery, a traditional sweetener. This cottage industry contributed to their economic self-reliance. However, the practice has declined in recent years due to diminishing profitability, reflecting broader economic shifts and challenges in sustaining traditional crafts.[18]

Fig.39 women in Sembur

Fig.40 people collecting water from well in Sembur

Fig.41 sadaiyan explaining about the Jaggery kiln

Fig.42 Jaggery kiln in Sembur

Kovilur (Shervarayan Hills)

- Village Overview

The etymology of the name "Kovilur" can be traced back to the presence of the ancient temple of Vaaniswaran. The term "Kovil" in Tamil translates to "temple," signifying the settlement's historical and cultural significance as a religious center. The suffix "-ur," meaning "place" or "village," underscores its identity as a temple-centered locality. This linguistic root reflects the community's deep spiritual heritage and its association with the revered temple of Vaaniswaran.


(a)


(b)

Fig.43 Vaanirshwarar temple, Kovilur

Kovilur is a small village located in the Shervarayan Hills near Yercaud, Tamil Nadu, at an elevation of around 796 meters. Unlike the more tourist-centric parts of Yercaud. The village is situated on relatively flat terrain, with houses built on levelled platforms, a common practice in hill architecture to accommodate the gentle slopes of the land.

Fig.44 Kolivur, Shervarayan hills settlement pattern (source:author)

TABLE 3 PROXIMITY TABLE OF KOVILUR

Kovilur	
Landuse	distance(in meters)
Farm land	0.2
City[salem]	54.4
Forest	4
Religious temples	0.5
Near by village	2.2
Water	2
Local market	6
Town market	10.7
labour work	54
Education	10.9
Hospital	52

Public transport	10.7
Nearest Road	0.3
Main road	10

As illustrated in Figure 35, the spatial distribution of Kovilur's land use is clearly demarcated. The yellow-shaded area represents the settlement zone, covering 1.82 acres, which serves as the nucleus of residential and communal life. Surrounding this, the red-shaded area denotes the agricultural land, encompassing 90 acres

- Settlement Pattern and Spatial Layout

Kovilur follows a more organically developed settlement pattern, where houses are built in close proximity to each other but are arranged around the natural features of the land, particularly trees. The placement of homes takes into account the preservation of trees and other natural elements, fostering a harmonious integration between the built environment and nature.The village lacks a strict grid or formal street pattern, with only a loosely defined network of paths connecting different areas.

Fig.45 Kolivur, Shervarayan hills settlement pattern (source:author)

Fig.46 Kolivur, aerial view (source:author)

Fig.47 street in Kolivur, Shervarayan hills (source:author)

Fig.48 street in Kolivur, Shervarayan hills (source:author)

- Construction Materials and Techniques

In Kovilur, stone is the primary material for constructing walls. It provides excellent insulation, keeping interiors cool in summer and warm in winter, ideal for the village's elevated location and variable climate. This material is durable and naturally regulates temperature. The doors in Kovilur are made from wood collected from the nearby forests, including species such as neem, vengai, and vembu, which are commonly used for structural elements like beams and frames.

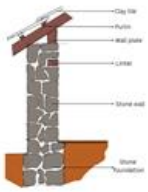

Fig.49 section of a home in Kovilur (source:author)

Fig.51 home in Kovilur (source:author)

Fig.53 thinnai, kovilur (source:author)

Fig.50 home in Kovilur (source:author)

Fig.52 home in Kovilur (source:author)

- Infrastructure: Road Networks, Sanitation, and Kitchens

Kovilur, situated at a slightly lower elevation , enjoys a milder climate. The traditional stone construction in the village plays a crucial role in maintaining thermal stability within the homes, keeping them cool during the warmer months and warm during cooler periods. In traditional House the walls are constructed with stones, Bamboo post and dried grass and it has a high thermal capacity due to additional layers increases the thermal time delay for about 10 hours [21]. A defining feature of Kovilur's infrastructure is the thinnai, a raised seating area attached to the exterior of the house. The thinnai offers a shaded, cool space for relaxation during the day. The kitchen in Kovilur is traditionally placed outside the main living area in a separate shed.

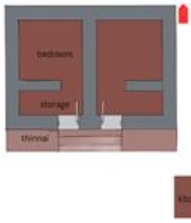

Fig.54 plan (source:author)

Fig.55 Murugesan's house, temple priest, kovilur (source:author)

Fig.56 Kitchen, kovilur (source:author)

- Other characteristics

Unlike neighboring settlements such as Sembur or Melur, Kovilur does not feature separate built structures for storage. griculture in Kovilur primarily revolves around the cultivation of millets, aligning with the region's ecological conditions and subsistence needs. The villagers historically utilized seeds from the fertile valleys nourished by the Vaniyaru River, ensuring sustainable irrigation and productivity.

Fig.57 women in kovilur (source:author)

Fig.58 Fetching water from the vaniyaru river (source:author)

8. COMPARITIVE ANALYSIS

- Geology, Climate, and Hydrology

TABLE 4 COMPARISON OF NATURAL ENTITIES

1	Mountain	SHERVARAYAN	KALVARAYAN	JARUGUMALAI
2	Village name	Koviloor , Yercaud	Sembur, Karumandurai	Melur , Karumandurai
3	Location	11.872505, 78.308027	11.710491, 78.641423	11.612508, 78.197442
4	Elevation	796m	1058m	883m
5	Geography	next to the vaniyaru river, in the terrain	on the hill, settlement is in the flat land	on the hill, settlement is in the flat land
6	Geology	charnockite and gneissic rocks	quartzites, granites, and pegmatites	Charnockitic granite
7	Climate	sub-tropical climate	temperate climate	Tropical savanna, wet
8	Tempreture	Typically warm to hot summers, with mild to cool winters. Average annual temperatures range from 18°C to 24°C	Characterized by moderate temperatures. Average annual temperatures typically range from 0°C to 20°C	Warm temperatures year-round, with average temperatures ranging from 20°C to 30°C
9	hydrology	The Vellar River originates in the Servarayan Hills and flows into the Bay of Bengal. The Tirumanimuthar River, a tributary of the Cauvery River, originates in the Manjavadi area	The Manimukta nadi originates in the Kalvarayan Hills and drains the southern part of the district.	spring exists

- Ekistics analysis

There is a need for a science dealing with human settlements, because otherwise we cannot view these settlements in a reasonable way. In shaping his settlements, man has always acted in obedience to five principles [22]

The information regarding "Man" in the Ekistics Grid has been referenced from [23], while the Ekistics Grid framework itself is derived from Citation [24]. These citations provide the foundational basis for understanding and contextualizing the human element within the broader Ekistics framework.

TABLE 5 COMPARISON OF EKISTICS GRID ANALYSIS

Aspect	Kovilur	Sembur	Melur
NATURE	Closely interconnected with nature	Closely interconnected with nature	Closely interconnected with nature

MAN	Parents don't care for their ward's education	Parents care least about their wards education	Parental care is average on their wards towards their education
	Superstitious believes Prevailing to a greater extend.	Superstitious believes-The limited practice of these believes.	Superstitious believes-The limited practice of these believes.
	Gender Bias-Prevalent to a greater extent.	Gender Bias-Not prevalent.	Gender Bias- prevalent to a lesser extent.
SHELLS	The placement of houses depends not just on proximity to neighbors but also on ensuring that trees and natural features are preserved, creating a union between the built environment and nature.	Houses are arranged in a row housing format, sharing common walls. This layout reflects a sense of community and efficient land use, with houses facing each other across the street.	Due to the hilly terrain, there's no clear street pattern, and access between houses is informal. People often navigate through gaps between the houses to visit neighbors, creating a more organic and non-linear settlement pattern.
NETWROK	The pathways between houses are informal, adapting to the natural landscape. This organic approach fosters a blend of privacy and community, as neighbors are still relatively close .	Clear, linear streets provide structure to the village, offering a defined pedestrian flow, contrasting sharply with the more organic movement patterns in Melur.	The lack of defined pedestrian paths makes movement across the village less structured, which reflects the need to adapt to the irregular terrain.
SOCIETY	Houses are placed irregularly, often wherever space between trees allows, which leads to a more organic and adaptive layout.	The shared walls between houses and the street-oriented design encourages social interaction among neighbors.	Homes are spaced to maximize privacy, often oriented away from other houses, using the slope and natural landscape to achieve separation.

- Human influences

TABLE 6 COMPARISON TABLE OF HUMAN ASPECTS

Aspect	Kovilur	Sembur	MELUR
primary occupation	agriculture	agriculture	agriculture
dress	plain white cloth	Kambali	inskirt only
caste	malayalis, scheduled tribes	malayalis, scheduled tribes	malayalis, scheduled tribes
livelihood	construction works, daily wages	jaggery making, daily wages	varied occupation in CBD
marriage	paerporutham	based on the elders wish	-
custom	people are cold to the outsiders	people are welcoming	-
technology	-	jaggery maker	aer kalapai, brick manufacturing
ecducation	tribal welfare school, primary	anganadi	higher sec school
religion	Hindu	Hindu	Hindu
temple	Amman, Vaanishwaran	Amman	Murugan
temple location	inside the hamlet, shiva temple outskirts	inside the hamlet	outside the hamlet

- Construction techniques

a) Terrain and Street Patterns:

Melur: The settlement is developed along the contours of a slope, with houses built wherever flat land is available.

Sembur: Built on flat terrain, Sembur allows for a more organized settlement with a clearly defined street pattern.

Kovilur: The settlement here is more organically developed, similar to Melur, but with a particular emphasis on natural features.

Fig.59 comparission of settlement pattern (source:author)

b) Building Materials:

Melur Houses here are primarily constructed using locally sourced bricks, with nearby brick kilns facilitating brick production. Sembur uses mud as the primary construction material is notable, leveraging its thermal properties. Stones are used to elevate the plinth, and clay tiles form the roof. In Kovilur, Stone is the main material, which reflects the abundant availability of stone in the area. The use of stone provides durability and insulation, particularly in maintaining a stable interior climate

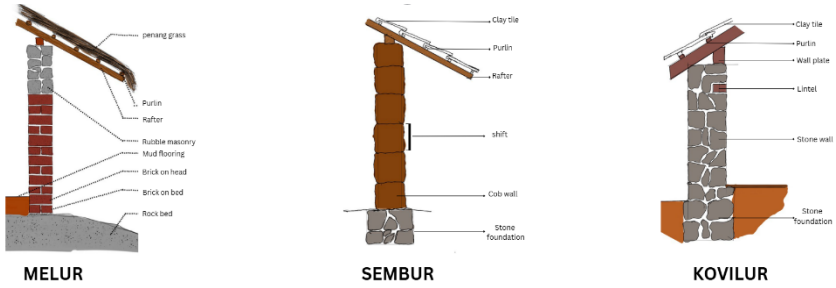

Fig.60 comparission of wall sections (source:author)

c) Climate Adaptation:

In Melur The climate is moderate and warm, thanks to its moderate elevation and proximity to the city. The temperature variation between day and night is managed by using thermal mass materials like bricks, which help stabilize the interior temperature. Situated at higher elevation, Sembur enjoys cooler temperatures, making it necessary to use insulating materials like mud walls and clay tiles to retain warmth during colder months. The thermal properties of mud make it ideal for places with cooler temperatures during the night and warm days. In kovilur, the climate is milder, positioned at a slightly lower elevation, Stone construction here provides thermal stability, ensuring comfort in both summer and winter months.

d) Drainage and Water Management

In Melur,a stone-lined drainage system directs water into the ground, preventing soil erosion and contamination. This encourages natural water filtration and replenishes groundwater

levels. In Sembur, On flat terrain water management is done by directing wastewater toward plants via raised platforms and small slopes. This system channels water for irrigation and contributes to water recycling.. Kovilur is similar to Sembur, the community uses raised platforms for bathing, allowing water to flow towards nearby plants. This method also ensures water recycling, promoting sustainable water use.

9. KEY CHLLENGES AND ISSUES

Establishing standards requires not only a better understanding of the necessary perceptions and their physical counterparts, but also a consideration of the social, political and economic aspects of living space design. [25]

Some of the problems of conserving the vernacular are encountered in countries where

the concept is unfamiliar, where resources are limited, and where aspirations are to the 'modern lifestyle'. [26]

Many disciplines dropped the use of "vernacular" in the 21st century because of the term's connotations of primitivism, classism, and marginalization arising from 19th-century colonialism, the term has risen in usage among folklorists and ethnologists in the early 21st century. [27]

10. RESULT AND RECOMMENDATION

To integrate the benefits of vernacular housing into Tamil Nadu's current housing policies, it is essential to focus on knowledge sharing and credibility. Knowledge sharing can be promoted through workshops, community-based training, and digital platforms to bridge the gap between traditional techniques and modern practices, ensuring their relevance to sustainable housing. Credibility can be built by showcasing successful case studies and vernacular housing projects, which will help gain trust from policymakers and the public, encouraging the adoption of these sustainable practices in mainstream housing.

1. Revise housing development schemes under TNHB and TNSUDP to incorporate vernacular design principles, such as climate-responsive materials and natural ventilation systems. Consequence of Combining Indigenous Techniques with a Flexible Design to Reduce Energy Consumption [28].

2. Policy Change: Amend the Tamil Nadu State Urban Development Policy (TNSUDP) to include sustainable building materials that are locally sourced and have low environmental impact. Traditional practices and indigenous knowledge of various tribal communities are rather intricately interwoven with the tenets of SD ,Their practices benefit humanity in all sectors of living such as water, agriculture, food and health, biodiversity and infrastructure.[29]

3. Policy Change: Modify urban and rural planning policies to involve community participation in housing design, taking inspiration from the communal nature of vernacular housing.

4. Revise urban and rural climate action plans to include vernacular housing solutions for climate adaptation.

11. LIMITATION

This research focuses on three hill regions in Salem—Jarugumalai, Aranoothumalai, and the Kalvarayan Hills—selected due to time constraints and accessibility challenges. The villages studied are situated in remote interior areas, with limited or no internet connectivity. Consequently, on-site visits were the primary method of data collection, as most residents lack access to mobile phones or telecommunication facilities, making remote contact nearly impossible. These limitations influenced the scope of the research, restricting the ability to include a broader range of settlements in the study. Additionally, the study was conducted within a six-month time frame, balancing other academic commitments, which limited the depth and scope of the research.

12. CONCLUSION

Keeping in mind the difficult conditions prevalent here, the traditional houses are built with features to combat the various natural calamities, without loss of life and property [30]. Remarkably, even within a single village, construction practices, materials, and spatial organization of homes vary based on factors such as proximity to water bodies, elevation, soil type, and available natural resources. These variations demonstrate the adaptability and ingenuity of indigenous communities in crafting solutions that are inherently sustainable and climate-responsive. Globalization significantly impacted India in 1991, with the introduction of economic liberalization reforms. The opening up of markets to foreign investment and the reduction of trade barriers spurred rapid economic growth and infrastructure development.[31] A one-size-fits-all concrete approach is not suitable for the diverse needs of rural and tribal communities. Also, any change in the settlement pattern will create a wide spread transformation in various dimensions of rural households. for this reason, the design for villagers requires comprehensive planning on regional knowledge. [32]. Despite contributing to India's emergence as one of the fastest-growing economies globally, the environmental and cultural repercussions of these changes cannot be overlooked. The transformation in architecture, driven by globalization, highlights a pressing need to balance modernization with sustainability. It is crucial to document, preserve, and integrate traditional techniques into modern architectural practices to ensure their continuity. Vernacular buildings not only offer lessons in sustainable construction but also respect both the environment and cultural heritage. By combining these traditional practices with contemporary methods, we can create more resilient, culturally meaningful, and environmentally sustainable housing solutions for the future.

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