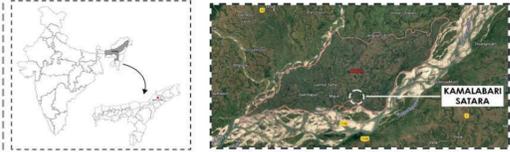


# Resilient Dwellings and Healthy Habitats: Monitoring WASH and Climate Adaptation in the Mishing Settlements of Assam

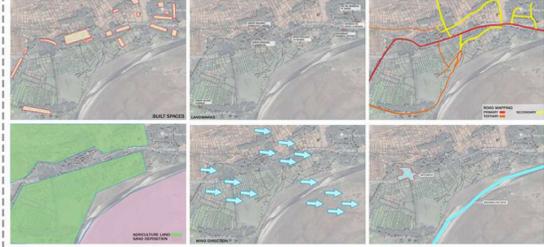
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## About Site & Region



Kamalabari Satra, situated in the heart of Majuli, the world's largest river island, holds immense cultural and spiritual significance for the state of Assam.

## Site Analytical Layerings



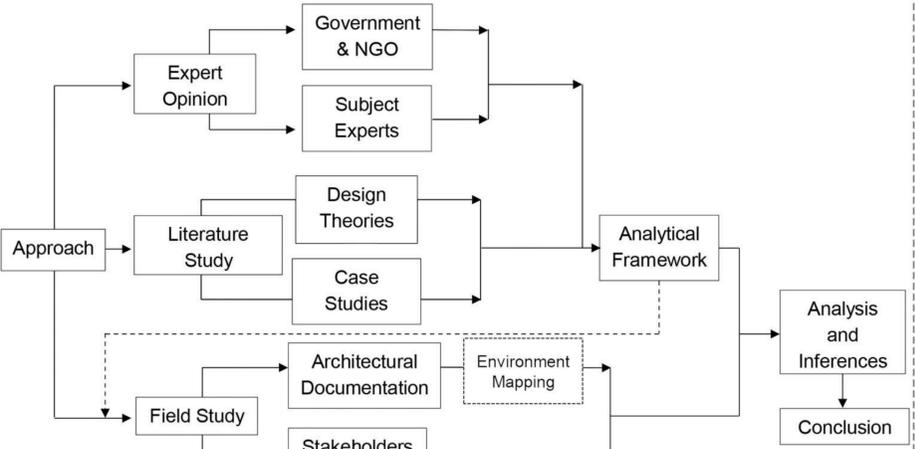
## Aim

This research aims to assess liveability and cultural adaptation in tribal vernacular settlements and government-sponsored housing in Assam within the Mishing community.

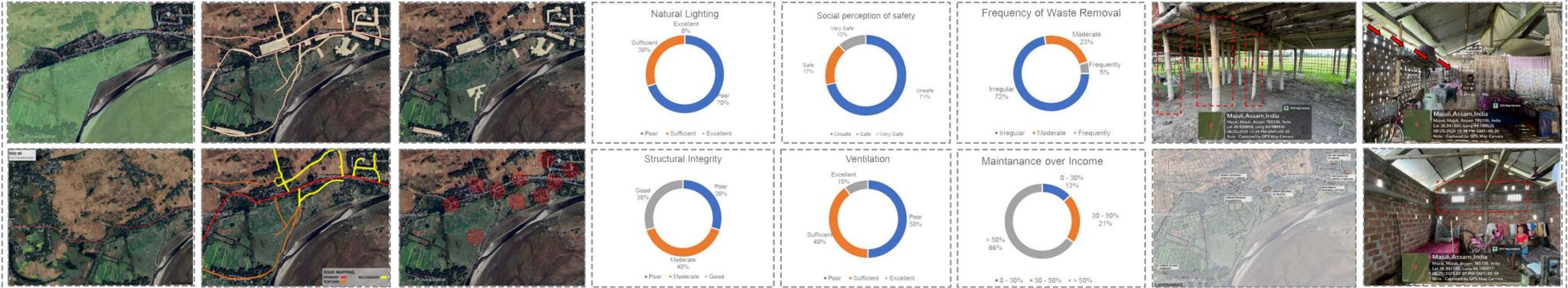
## Objective

- To identify key liveability indicators in both vernacular and government-sponsored housing among the Mishing community, such as spatial comfort, thermal performance, sanitation, and access to basic services.
- To assess the extent of cultural continuity and adaptability in housing forms, layouts, and usage patterns within both housing types.
- To analyse residents' perceptions and satisfaction levels regarding functionality, identity, and emotional attachment in both types of housing.
- To evaluate the adaptability of government-sponsored housing to the lifestyle, customs, and rituals of the Mishing community.

## Research Methodology



## Field Assessment and Site Survey



## On-Field Observations and Measured Values

Site Planning Level						
Sr. No	Parameter	Measuring Standard	Standard Value (Safe/Acceptable)	Dangerous Value (Unsafe/Poor)	Observed/Measured Value	Remarks
1	Total green space to site ratio	% of total site area covered by vegetation (>20-30% recommended by WHO for health benefits)	≥ 30% of site	< 10% (no meaningful green)	80%	Excellent green coverage, FAR exceeds WHO recommendations, supports health and ecology
2	Hard surface to site ratio	% of total site area paved or concreted	≤ 40% of site	> 70% (over-paved, heat island)	30%	Low paving reduces runoff and urban heat island effects, environment-friendly
3	Built-up area to site area ratio	FAR (Floor Area Ratio) or % coverage (building footprint / site area × 100)	≤ 1.2 (low-rise rural/tribal context)	> 2.0 (overcrowding, poor ventilation)	17%	Very low density, ample open space, promotes ventilation and low overcrowding
4	Road area to site area	% of site covered by roads	15-20% (balanced access)	< 5% (poor access) or > 40% (over-dominant)	13%	Slightly below balanced standard, could improve internal accessibility
5	Population density	Persons per hectare (urban standard: 150-400 pph)	150-400 people/ha (rural semi-urban balance)	> 600 people/ha (overcrowded)	6 pph	Extremely low population density, suggests rural or scattered settlement
6	Proximity & ease of access to transport	Distance in meters to nearest bus/taxi stop (≤500 m desirable)	≤ 300m walking distance	> 1 km (poor access)	> 1 km	Very poor access to public transport; increases isolation and limits mobility
7	Proximity to main roads & noise	Distance in meters to main road; noise level in dB (≤55 dB residential)	≥ 100m buffer from highways	< 30m (high noise, dust)	< 30m	Residences too close to main roads, potential exposure to high noise and air pollution
8	Distance to waste collection points	Meters from centroid of residential clusters to waste point (≤100 m optimal)	≤ 50m walking distance	> 200m (leads to littering)	> 200m	Significant distance from homes to waste points, may lead to improper dumping or littering
9	Frequency of waste removal	Number of collections per week	Daily to every 2 days	Weekly or irregular	Irregular	Infrequent collection likely causing waste buildup and hygiene issues
10	Water & waste cycles	Hours/day water supply; % wastewater safely treated	Safe drainage, reuse possible	Stagnant wastewater, open drains	Stagnant wastewater, open drains	Poor drainage and untreated wastewater, raises risk of waterborne and vector diseases
11	Health risks (vector-borne diseases)	Reported cases per year per 1000 people	No visible breeding sites	Stagnant water, open garbage, frequent malaria/dengue	Stagnant water, open garbage, frequent malaria/dengue	High incidence due to environmental conditions, urgent need for improved sanitation

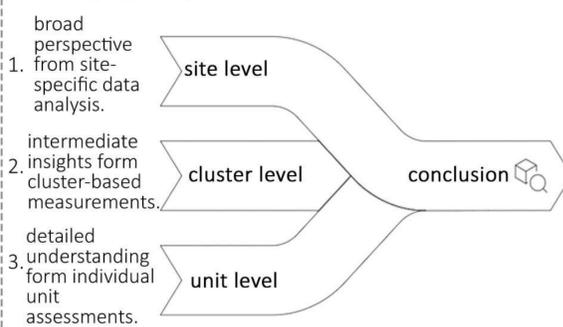
Cluster / Neighbourhood Level						
Sr. No	Parameter	Measuring Standard	Standard Value	Dangerous Value	Observed/Measured Value	Remarks
1	Green space per capita	m <sup>2</sup> green space/person (≥9 m <sup>2</sup> WHO standard)	≥ 9 m <sup>2</sup> /person (WHO standard)	< 3 m <sup>2</sup> /person	≥ 9 m <sup>2</sup> /person	Ample open and agricultural land near settlements
2	Open space to building volume ratio	Ratio of m <sup>2</sup> open space to m <sup>3</sup> building volume	≥ 1:1	< 0.5:1 (too cramped)	≥ 1:1	Adequate spacing between traditional and PMAY-G houses
3	Morphological attributes	Street connectivity index; average block size (m <sup>2</sup> )	80-150m block length, walkable grid	> 300m blocks, poor connectivity	150-300m block length, walkable grid	Organic layout with moderate accessibility
4	Road width vs. building height	Width-to-height ratio (ideal 1:1 to 2:1 for comfort)	1:1.5 to 1:1 (balanced)	< 1:0.5 (narrow road lanes)	1:1.5 to 1:1 (balanced)	Sufficient road width, accessible by foot and small vehicles
5	Social perceptions of safety	% of respondents feeling safe (day/night)	70%+ residents feel safe	< 30% feel safe, high crime	< 30% feel safe, high crime	Nighttime safety perceived low due to poor lighting
6	General sanitation quality	Rating scale (1-5) for cleanliness, drainage	1 toilet/household or 1/5 families shared	Open defecation, non-functional shared toilets	Rating: 1 Open defecation, non-functional shared toilets	Poor drainage and limited sanitation infrastructure
7	Proximity to services/facilities	Distance to nearest health, education, and markets (≤500 m for essentials)	≤ 500m to school, health, shop	> 1 km	> 500 m	Only primary school nearby; healthcare and markets far
8	Frequency of waste removal	Times per week for shared bins	Daily	Weekly or less	Weekly or less	Informal waste disposal; no structured waste system
9	Economic Ability	Median household income vs. neighbourhood service costs	Affordable housing cost ≤ 30% of avg. income	> 50% income on housing	> 50% income on housing	High dependency on agriculture; low disposable income

Unit (Individual House) Level							
Sr. No	Parameter	Measuring Standard	Standard Value	Dangerous Value	Observed/Measured Value		Remarks
					Traditional	Mixed	
1	Structural integrity	Visual inspection, material strength, foundation stability, and resistance to floods/wind loads	Stable structure with no visible cracks, rot, or settlement. Flood-resistant walls above HFL (±1.5m)	Cracks in load-bearing walls, decayed posts, or instability during high floods	Moderate	Good	The structure shows no visible cracks or deterioration, indicating stability and resilience during floods.
2	Natural Lighting	Lux meter readings inside living spaces during daytime	150-300 lux for living areas; 100-150 lux for sleeping areas	Below 100 lux — comes poor visibility, discomfort, and dampness	Poor	Sufficient	Adequate natural light, ensuring visibility and comfort inside living spaces.
3	Ventilation	Air change rate (ACH), window-to-wall ratio (WWR), and number of openings per room	ACH ≥ 5-8/hour; WWR ≥ 20% of floor area	ACH < 3/hour; WWR < 10% — leads to suffocation, indoor humidity	Poor	Sufficient	Proper airflow and window openings are maintained, reducing indoor humidity and ensuring fresh air circulation.
4	Indoor/outdoor thermal control	Temperature/humidity loggers; comparison with outdoor temp	Indoor temp ≤ 3°C higher than outdoor; RH between 40-60%	Indoor temp > 35°C; RH > 70% — heat stress and discomfort	30.5°C	31.5°C	The indoor temperature and humidity are within acceptable limits, minimizing heat stress and discomfort.
5	Adaptability/flexibility	Qualitative observation of reconfigurable or multifunctional spaces	Spaces adaptable for seasonal family needs (e.g., movable partitions, open verandah use)	Fixed layouts that cannot accommodate changing needs or cultural use	Spaces adaptable for seasonal family needs	Spaces adaptable for seasonal family needs	The design allows reconfiguration, accommodating seasonal or changing needs, enhancing functionality.
6	Health risks	Observation/interview on mosquito control, dampness, and smoke	Dry indoor conditions, mosquito nets, smoke-ventilated kitchens	Stagnant water, mold, open waste, unventilated cooking — disease risk	High	High	The conditions are free from mosquito breeding sites and dampness, reducing disease risks.
7	Sanitation Facilities	Availability of toilets, drainage, and water supply; field inspection	Individual functional toilets with water connection, safe drainage	No toilet access, open defecation, clogged or open drains	Poor	Poor	Sanitation infrastructure is adequate, with access to toilets and proper drainage.
8	Privacy	Room arrangement, gender segregation, visibility from public areas	Separate rooms or screened spaces for genders/activities	Shared sleeping areas for all members; no visual barrier from street	Low	Low	Spaces are designed to ensure privacy through room separation and gender segregation.
9	Perceived safety walking	User perception, lighting at night, path condition	Safe, well-lit paths with visibility and stable surface	Poor lighting, unsafe paths, proximity to flood-prone/isolated zones	Unsafe	Safe	Pathways are safe, well-lit, and stable, encouraging walking safety and security.
10	Community Interaction	Observation/interview on communal activities and shared spaces	Frequent interaction spaces (courtyard, chang verandah, common ground)	Social isolation, no common gathering area, fragmented settlement layout	Low	Low	The settlement layout supports community interaction with shared spaces and social gathering areas.

## Conclusion

Typology	Site Level	Measured Observed Values	Cluster Level	Measured Observed Values	Unit Level	Measured Observed Values
Typology 1 (Traditional)	Total green space to site ratio	80%	Green space per capita	≥ 9 m <sup>2</sup> /person	Structural integrity	Moderate
	Hard surface to site ratio	30%	Open space to building volume ratio	≥ 1:1	Natural Lighting	Poor
	Built-up area to site area ratio	17%	Morphological attributes	150-300m block length, walkable grid	Ventilation	Good
	Road area to site area	13%	Road width vs. building height	1:1.5 to 1:1 (balanced)	Indoor/outdoor thermal control	30.5°C
	Population density	6 pph	Social perceptions of safety	< 30% feel safe, high crime	Adaptability/flexibility	Spaces adaptable for seasonal/family needs
	Proximity & ease of access to transport	> 1km	General sanitation quality	Rating: 1 Open defecation, non-functional shared toilets	Health risks	High
	Proximity to main roads & noise	< 30m	Proximity to services/facilities	> 500 m	Sanitation Facilities	Poor
	Distance to waste collection points	> 200m	Frequency of waste removal	Weekly or less	Privacy	Low
	Frequency of waste removal	Irregular	Economic Ability	< 30% income on housing	Perceived safety walking	Unsafe
	Water & waste cycles	Stagnant wastewater, open drains	Community Interaction	Low	Health risks (vector-borne diseases)	Stagnant water, open garbage, frequent malaria/dengue
Total Score		21	17	13	19	18
Typology 2 (PMAY-G)	Total green space to site ratio	80%	Green space per capita	≥ 9 m <sup>2</sup> /person	Structural integrity	Good
	Hard surface to site ratio	30%	Open space to building volume ratio	≥ 1:1	Natural Lighting	Sufficient
	Built-up area to site area ratio	17%	Morphological attributes	150-300m block length, walkable grid	Ventilation	Sufficient
	Road area to site area	13%	Road width vs. building height	1:1.5 to 1:1 (balanced)	Indoor/outdoor thermal control	31.5°C
	Population density	6 pph	Social perceptions of safety	< 30% feel safe, high crime	Adaptability/flexibility	Spaces adaptable for seasonal/family needs
	Proximity & ease of access to transport	> 1km	General sanitation quality	Rating: 1 Open defecation, non-functional shared toilets	Health risks	High
	Proximity to main roads & noise	< 30m	Proximity to services/facilities	> 500 m	Sanitation Facilities	Poor
	Distance to waste collection points	> 200m	Frequency of waste removal	Weekly or less	Privacy	Low
	Frequency of waste removal	Irregular	Economic Ability	< 30% income on housing	Perceived safety walking	Safe
	Water & waste cycles	Stagnant wastewater, open drains	Community Interaction	Low	Health risks (vector-borne diseases)	Stagnant water, open garbage, frequent malaria/dengue
Total Score		31	27	23	26	25
Typology 3 (Mixed)	Total green space to site ratio	80%	Green space per capita	≥ 9 m <sup>2</sup> /person	Structural integrity	Good
	Hard surface to site ratio	30%	Open space to building volume ratio	≥ 1:1	Natural Lighting	Sufficient
	Built-up area to site area ratio	17%	Morphological attributes	150-300m block length, walkable grid	Ventilation	Sufficient
	Road area to site area	13%	Road width vs. building height	1:1.5 to 1:1 (balanced)	Indoor/outdoor thermal control	31°C
	Population density	6 pph	Social perceptions of safety	< 30% feel safe, high crime	Adaptability/flexibility	Spaces adaptable for seasonal/family needs
	Proximity & ease of access to transport	> 1km	General sanitation quality	Rating: 1 Open defecation, non-functional shared toilets	Health risks	High
	Proximity to main roads & noise	< 30m	Proximity to services/facilities	> 500 m	Sanitation Facilities	Poor
	Distance to waste collection points	> 200m	Frequency of waste removal	Weekly or less	Privacy	Low
	Frequency of waste removal	Irregular	Economic Ability	< 30% income on housing	Perceived safety walking	Safe
	Water & waste cycles	Stagnant wastewater, open drains	Community Interaction	Low	Health risks (vector-borne diseases)	Stagnant water, open garbage, frequent malaria/dengue
Total Score		31	27	23	26	25

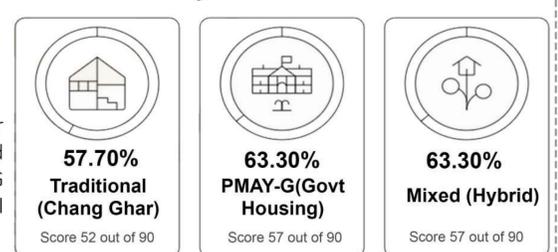
## Converging Perspectives



## Overall Liveability Index

Typology	Score (out of 90)	Percentage	Performance Category
Traditional (Chang Ghar)	52/90	57.70%	Moderate
PMAY-G (Govt Housing)	57/90	63.30%	Moderate-Good
Mixed (Hybrid)	57/90	63.30%	Moderate-Good

## Overall Liveability Index



At the site level, vernacular settlements exhibited better adaptability to flood conditions, ecological integration, and spatial comfort through stilted Chang Ghars, while PMAY-G houses displayed structural stability but lacked environmental responsiveness.

Cluster-level observations showed stronger social cohesion and community interaction in traditional housing clusters, contrasted with reduced engagement and limited green and open spaces in newer layouts.

At the unit level, vernacular dwellings demonstrated efficient ventilation, flexibility, and thermal comfort, but fell short in sanitation and long-term durability. Conversely, PMAY-G units provided improved material permanence but compromised on privacy, cultural alignment, and adaptability to local practices.



"True architecture is a dialogue between human life and the environment that sustains it."  
— Hassan Fathy