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Inventorisation, Status and Community-Based Management of Wetlands in the Eastern Mawryngkneng Community and Rural Development Block, Meghalaya, Northeast India

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Abstract: Small inland wetlands in the hill states of Northeast India remain largely undocumented because they fall below the minimum mapping unit of national wetland inventories and below the notification thresholds of the Wetlands (Conservation and Management) Rules, 2017. In 2025 the Government of Meghalaya reported to the High Court of Meghalaya that, of 225 water bodies inspected across the state, none qualified as a Ramsar site. Such an assessment, however, says nothing about the ecological and cultural significance of these systems for the communities that depend on them. This study presents a village-level inventory of wetlands in the eastern part of the Mawryngkneng Community and Rural Development (C&RD) Block, East Khasi Hills district, Meghalaya. One hundred wetlands were geotagged and classified, a structured household survey (n = 100) was administered across the villages of the study area, faunal and wetland-associated plant use was documented through free listing, and land use–land cover (LULC) change between 2020 and 2024 was analysed using Sentinel-2 derived 10 m land cover data. Springs (42 records) and streams (41 records) dominated the inventory, and 82% of the wetlands were perennial. Water (37%) and fish (34%) were the most valued resources, and fishing, agriculture and domestic water supply were the principal reported uses. Twenty-nine per cent of respondents reported the local disappearance of aquatic species, 45% had personally witnessed wetland destruction, and 32% perceived a decline in water levels, yet 48% reported no threat to their wetlands, indicating a shifting baseline in local perception. Built-up area within the block expanded from approximately 7.5% to 10.7% of the block area between 2020 and 2024, largely at the expense of rangeland. Ninety per cent of respondents supported wetland protection and 66% held that responsibility should rest with the community, but 74% had never participated in any conservation activity and 71% were unaware of any wetland programme or scheme. A SWOT analysis indicates that strong customary institutions, high biocultural dependence and expressed willingness to act constitute the principal opportunity for conservation, while the absence of formal recognition, monitoring and enforcement constitutes the principal risk. We argue for a decentralised, village-register-based approach to wetland recognition in Meghalaya, anchored in the customary authority of the Dorbar Shnong and supported by GIS documentation.

Keywords: Wetland inventory; community perception; Khasi Hills; springs; land use–land cover change; SWOT analysis; traditional ecological knowledge; Meghalaya.

I. INTRODUCTION

The Ramsar Convention on Wetlands (1971) defines wetlands as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres. This deliberately expansive definition captures a functional continuum rather than a discrete habitat class, and it is precisely this breadth that makes wetlands difficult to inventory in mountainous terrain, where individual water bodies are small, dispersed and hydrologically coupled to their catchments.

Wetlands have been described as the "kidneys of the landscape" for their role in water purification, nutrient retention and hydrological regulation, and as "biological supermarkets" for the food webs they support (Mitsch and Gosselink, 2015). The Millennium Ecosystem Assessment (2005) established that wetlands deliver provisioning, regulating, cultural and supporting services disproportionate to their areal extent. Globally, however, wetland loss has been severe: long-term reconstructions suggest that between 54% and 87% of natural wetland area has been lost since 1700, with losses accelerating through the twentieth century (Davidson, 2014). In India, wetlands cover approximately 4.7% of the land area and are subject to sustained pressure from encroachment, siltation, pollution and hydrological alteration (Bassi et al., 2014).

Meghalaya occupies an unusual position in this landscape of concern. The state contains no notified Ramsar site. In February 2025 the High Court of Meghalaya registered a suo motu public interest litigation to verify this position, following a direction of the Supreme Court of India that High Courts oversee the identification and ground-truthing of wetlands within their jurisdictions. The report subsequently placed before the Court by the Chief Conservator of Forests recorded 225 water bodies across the state - comprising 66 lakes and ponds, one oxbow or cut-off meander, six riverine wetlands, 18 waterlogged bodies, 100 rivers and streams, nine reservoirs and barrages, and 25 tanks and ponds - and concluded that none met the criteria for designation as a Ramsar site; the petition was accordingly disposed of in April 2025 (SCC Online, 2025).

The legal conclusion is defensible in its own terms. Ramsar designation requires wetlands of a minimum extent, depth or distinctive character, and the Wetlands (Conservation and Management) Rules, 2017 similarly operate on wetlands identified through national inventories whose minimum mapping unit (2.25 ha for the National Wetland Atlas) excludes the great majority of hill wetlands. What the conclusion does not address is the question of local significance. A spring that supplies drinking water to forty households, a stream reach that supports the only fishery in a village, or a paddy-field wetland that sustains amphibian breeding are, by any functional measure, wetlands; they are simply not wetlands of international importance. The regulatory framework has, in effect, rendered them invisible.

This invisibility is consequential in the Khasi Hills, where the majority of land is held under customary tenure and managed through village-level institutions - principally the Dorbar Shnong - rather than through state forest or revenue departments (Tiwari et al., 2010). Conservation outcomes therefore depend heavily on community knowledge, community consent and community capacity. Yet the ethnobotanical and ethnozoological knowledge embedded in Khasi villages, documented for wild edible plants by Kayang (2007) and for forest management practice by Tiwari et al. (2010), has not been systematically linked to wetland documentation. Comparable work in the Eastern Himalaya has shown that spring discharge is declining across the region and that reviving springs requires precisely this combination of hydrogeological mapping and community stewardship (Tambe et al., 2012; NITI Aayog, 2018).

Against this background, the present study was undertaken in the eastern part of the Mawryngkneng C&RD Block of East Khasi Hills district. The objectives were: (i) to identify and map the wetlands of the study area; (ii) to evaluate the human activities affecting them; (iii) to explore community perception, dependence and conservation effort in relation to wetland management; and (iv) to propose strategies for sustainable wetland conservation appropriate to the customary governance context of the region.

II. MATERIALS AND METHODS

A. *Study area*

The Mawryngkneng C&RD Block lies in the East Khasi Hills district of Meghalaya, approximately 36 km by road from Shillong, and extends between about 25°29′ and 25°41′ N latitude and 91°49′ and 92°12′ E longitude. The block covers roughly 285.5 km², almost entirely rural, and comprised 64 villages with a population of 67,291 at the 2011 Census. The population is overwhelmingly Khasi, and land is held predominantly under clan and community tenure administered through the Khasi Hills Autonomous District Council and the village Dorbar Shnong.

The terrain is an undulating mid-altitude plateau dissected by a dense dendritic drainage network of first- to third-order streams (Fig. 2). The climate is subtropical monsoonal, with the southwest monsoon setting in during the second week of June and extending to mid-October. The present study was confined to the eastern portion of the block, covering [twenty-one] villages, including Mawryngkneng, Ksehpyndeng, Thangshalai, Mawthlieh, Pomlahier, Iapshyndiat, Nongplit, Niur, Puriang, Puriang Sung, Khonshnong, Mawiong-Sung, Kur, Mawpyrshong, Mawber, War-Matlah, Umsawlum, Thadan, Sohryngkham, Mawlyndep and Pommura (Fig. 1). [Confirm the exact number of villages surveyed and the field survey period, e.g. "between March and May 2025".]

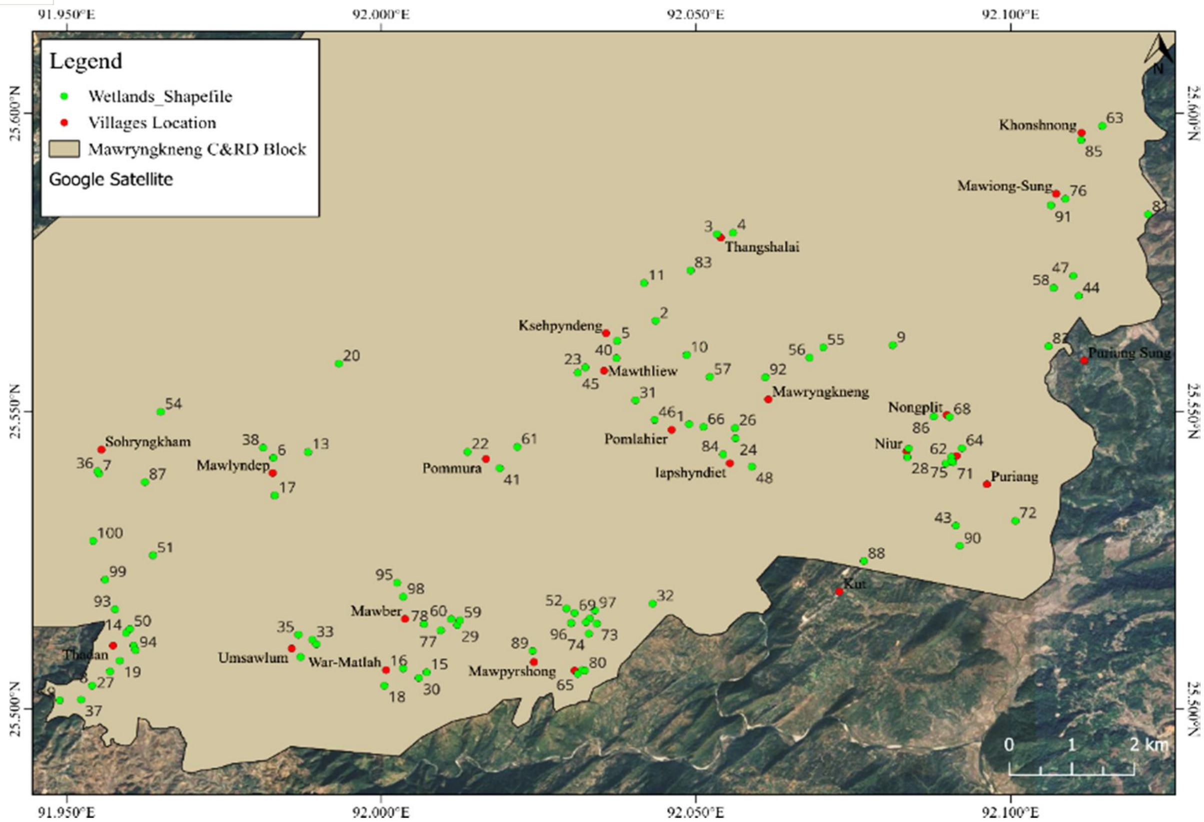

Fig. 1. Location and distribution of the 100 inventoried wetlands (green) and surveyed village settlements (red) in the eastern Mawryngkneng C&RD Block, East Khasi Hills district, Meghalaya. Basemap: Google Satellite.

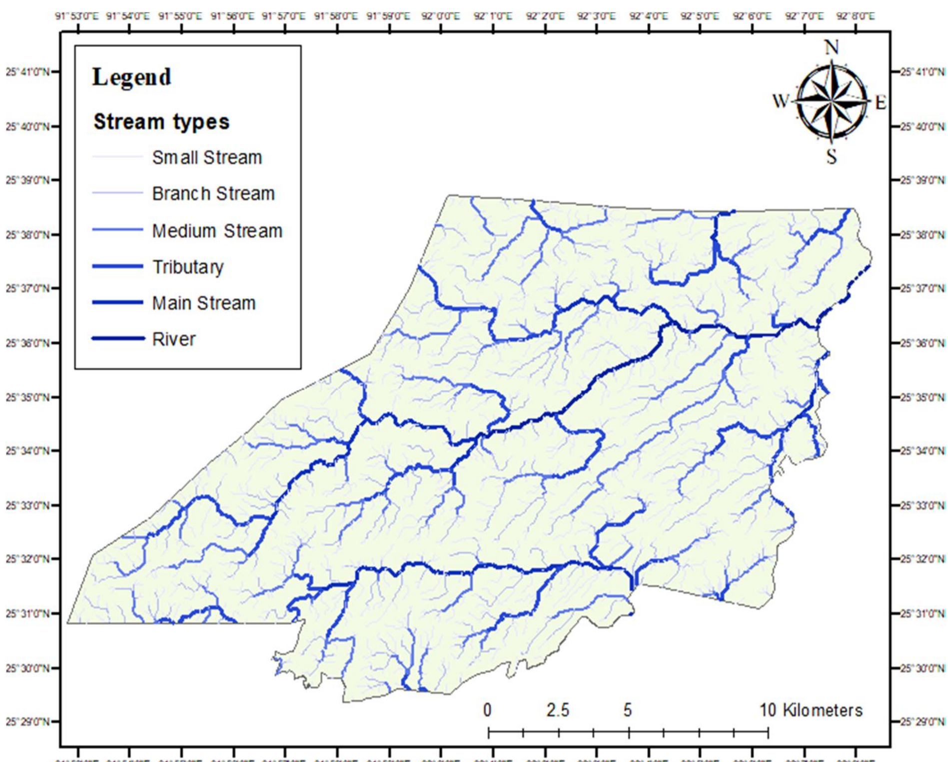

Fig. 2. Stream network of the Mawryngkneng C&RD Block, classified by stream order, showing the dendritic drainage pattern that structures the distribution of springs and streamlets in the study area.

B. Wetland inventory and mapping

Wetlands were identified through reconnaissance surveys conducted village by village, guided by key informants nominated by the Dorbar Shnong of each village. Every wetland encountered was geotagged with a handheld GPS receiver, photographed, and characterised in situ for type, approximate extent, hydroperiod (perennial or seasonal), surrounding land use and reported use. A total of 100 wetland sites were recorded.

Sites were classified into a locally adapted typology - spring, stream, streamlet, river, pond, man-made pond, swamp, paddy-field wetland, lake and peatland - derived from the hierarchical scheme of Cowardin et al. (1979) and its Indian adaptation by Gopal and Sah (1995). Because several sites exhibit more than one wetland character (for example, a spring emerging into a stream reach, or a pond fed by a streamlet), the typological records (n = 113) exceed the number of geotagged sites (n = 100). Coordinates were imported into QGIS 3.x, overlaid on a Google Satellite basemap, and compiled as a point shapefile (Fig. 1). The drainage network (Fig. 2) was extracted from an SRTM digital elevation model and ordered following the Strahler scheme.

C. Household survey

A structured and semi-structured questionnaire was administered to 100 respondents across the study villages. Respondents were selected to include, in each village, at least one member of the Dorbar Shnong, elders with long residence, and adults directly dependent on wetlands for fishing, irrigation or domestic water. The instrument covered five domains: (i) household dependence on wetlands and the resource considered most valuable; (ii) perceived change in water level and water quality over the respondent's lifetime; (iii) observed loss of aquatic species; (iv) perceived threats and witnessed instances of wetland destruction; and (v) attitudes towards protection, views on who should hold responsibility, past participation in conservation activity, and awareness of any wetland scheme or project. Prior informed consent was obtained orally from every respondent and from the village Dorbar before work commenced in each village.

D. Faunal and floristic documentation

Faunal diversity was documented by free listing: respondents were asked to name the animals they associate with, or observe at, the wetlands of their village. Local Khasi names were recorded verbatim and the frequency with which each taxon was named across the 100 respondents was tabulated as an index of salience. This approach yields a perception-weighted inventory rather than an ecological census, and the resulting frequencies should be read as measures of cultural salience and encounter rate rather than of abundance. Wetland-associated wild edible plants named by respondents were cross-checked against the ethnobotanical inventory of Kayang (2007) for scientific name, family and mode of utilisation.

E. Land use–land cover change analysis

Land use–land cover for the whole Mawryngkneng C&RD Block was extracted for 2020 and 2024 from the Sentinel-2 derived 10 m Annual Land Use Land Cover product generated by Impact Observatory and distributed through the Esri Living Atlas (Karra et al., 2021). The product classifies imagery into nine classes - water, trees, flooded vegetation, crops, built area, bare ground, rangeland, snow/ice and clouds - using a deep-learning classifier trained on billions of human-labelled pixels, and has a reported average overall accuracy exceeding 75% (Venter et al., 2022). Layers were clipped to the block boundary in ArcGIS and class areas were computed by zonal statistics (Fig. 5, Table 4).

F. SWOT analysis

Findings from the inventory, the household survey and the LULC analysis were synthesised into a SWOT (Strengths, Weaknesses, Opportunities, Threats) framework (Table 5). Internal factors (strengths and weaknesses) were drawn from the ecological and institutional attributes of the wetlands and their custodian communities; external factors (opportunities and threats) were drawn from policy instruments, land-use trajectories and climatic variability.

G. Data Analysis

Questionnaire responses were coded and analysed with descriptive statistics. Because several questions permitted multiple responses, category totals for those items exceed 100; single-response items sum to n = 100. Results are reported as counts, which for n = 100 are numerically identical to percentages. All charts were prepared from the coded response matrix.

III. RESULTS

A. *Wetland typology, distribution and hydroperiod*

The 100 wetlands inventoried in the eastern Mawryngkneng Block are distributed along the drainage lines and settlement fringes of the study area (Fig. 1), and the inventory is dominated by two lotic and semi-lotic classes. Springs accounted for 42 records and streams for 41, together representing 73% of all typological records (Fig. 3a; Table 1). Ponds (12 records) formed the principal lentic class, followed by river reaches (7). Paddy-field wetlands (3), streamlets (2), man-made ponds (2) and swamps (2) were recorded in small numbers, and a single lake and a single peatland were documented.

Eighty-two per cent of the wetlands were perennial and 18% seasonal (Fig. 3b). The perennial dominance reflects the spring-fed character of the system: springs in the Khasi Hills are sustained by fractured-rock aquifers recharged during the monsoon and discharging through the dry season. The seasonal fraction is concentrated in the paddy-field wetlands, the swamps and the smaller ponds, which are precisely the classes most sensitive to shifts in monsoon timing.

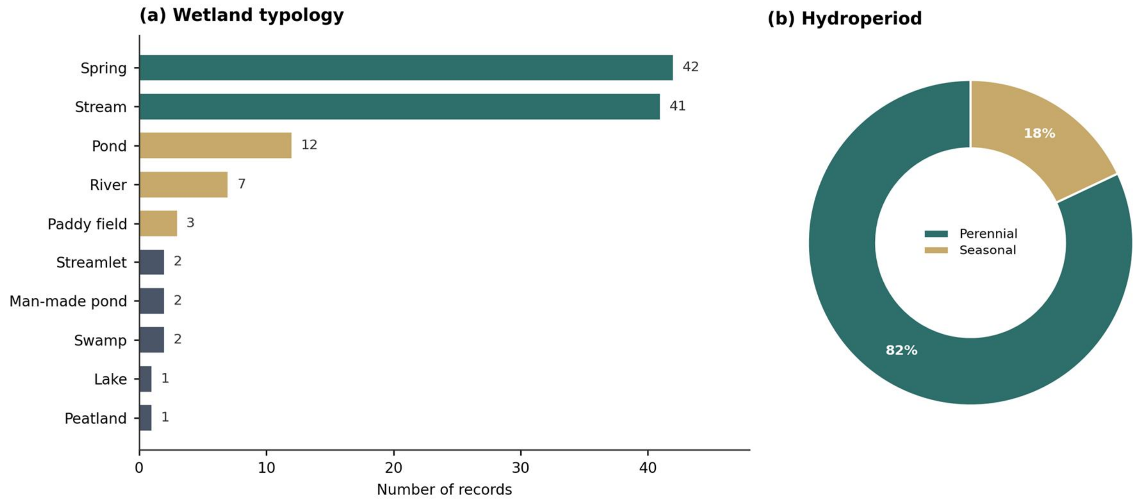

Fig. 3. (a) Typological composition of the wetland inventory (113 typological records across 100 geotagged sites; several sites exhibit more than one wetland character). (b) Hydroperiod of the inventoried wetlands.

Table 1. Wetland typology and hydroperiod in the eastern Mawryngkneng C&RD Block.

Wetland type	Records	Share of records (%)	Dominant hydroperiod
Spring	42	37.2	Perennial
Stream	41	36.3	Perennial
Pond	12	10.6	Perennial / seasonal
River	7	6.2	Perennial
Paddy-field wetland	3	2.7	Seasonal
Streamlet	2	1.8	Seasonal
Man-made pond	2	1.8	Perennial
Swamp	2	1.8	Seasonal
Lake	1	0.9	Perennial
Peatland	1	0.9	Perennial
Total	113	100.0	82% perennial

B. Household Dependence and Valued Resources

Wetland use in the study area is diversified rather than specialised. Fishing (20 responses), agriculture (19) and drinking and washing (19) were reported in almost equal measure as the primary use of local wetlands, with community uses such as ritual bathing and festival gatherings (5) and other uses (5) accounting for the remainder; 39 respondents did not specify a single primary use, which itself suggests that wetlands are experienced as a general-purpose resource rather than a dedicated one (Fig. 4a).

Asked to name the single most valuable resource their wetlands provide, respondents identified water (37) and fish (34) far above all other categories. Biodiversity as such was named by 10 respondents, other natural resources by 5, and cultural or spiritual value by 1, while 23 gave no clear answer (Fig. 4b). The near-parity of water and fish is notable: it indicates that the wetlands of the study area are valued simultaneously as infrastructure and as habitat, and that any degradation of water quality is likely to be registered by households through the fishery before it is registered through the water supply.

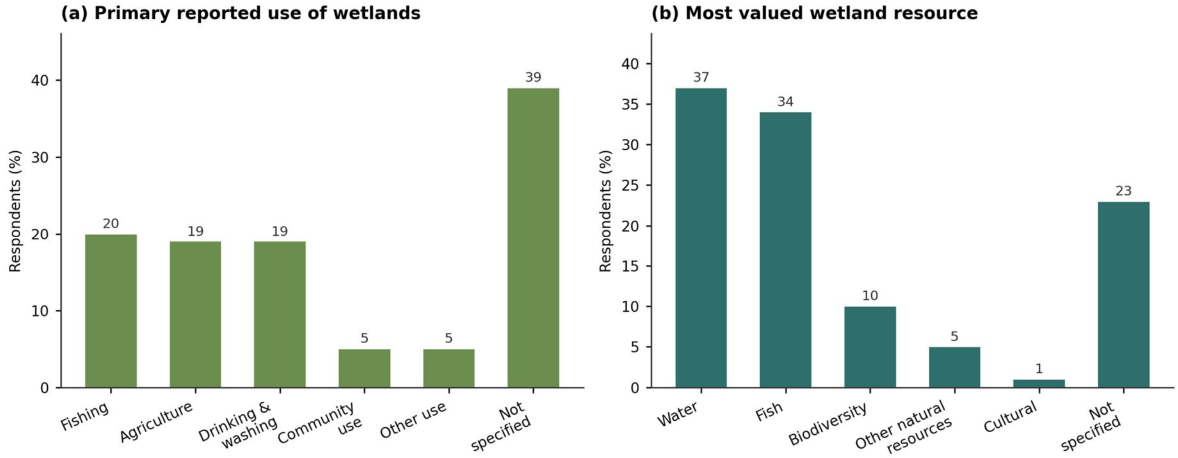

Fig. 4. Household dependence on wetlands (n = 100 respondents). (a) Primary reported use. (b) Resource identified as most valuable. Both items permitted a degree of multiple response; category totals therefore exceed 100.

C. Faunal Diversity

Free listing yielded 34 faunal taxa across five groups (Table 2). Fishes were the most salient group, led by the snakehead (Dohthli; named by 32 respondents), catla (22), rohu (19) and the locally named Shalynnai barb (17). Among birds, the bulbul (23) and the spotted dove, Langdkhur (21), dominated recall. Amphibians were represented chiefly by frogs (18) and toads (12), and mammals by the squirrel (17), wild rat (11) and fox (8). Reptiles, principally snakes (12) and water snakes (5), and aquatic insects including crabs, crickets and water striders completed the inventory.

The composition of this list is diagnostic. The presence of catla, rohu and grass carp - none of them native to hill streams - alongside indigenous taxa such as the copper mahseer (Kha Saw), Kuria labeo (Kha Ski) and Khasi garra points to an ongoing overlay of stocked pond aquaculture on a native lotic fauna. That the Khasi garra was named by a single respondent, while stocked carps were named by 19 to 22, is consistent with a gradual displacement of native fish from the sphere of everyday encounter.

Table 2. Faunal diversity of the wetlands of the eastern Mawryngkneng C&RD Block, documented by free listing. Frequency denotes the number of respondents (out of 100) naming each taxon.

Group	Taxon	Freq.	Group	Taxon	Freq.
Amphibians	Frog	18	Insects	Crab	6
	Toad	12		Cricket	7
	Tadpole	4		Centipede	1
Birds	Crow	2		Water strider	3
	Spotted dove (Langdkhur)	21	Mammals	Deer	5
	Bulbul	23		Fox	8

	Common cuckoo	3		Monkey	1
	Common myna	1		Rabbit	1
	Eagle	3		Squirrel	17
	Wild chicken	5		Stag	5
	Lesser cuckoo	3		Wild cat	2
	Minivet	4		Wild rat	11
	Owl	1	Fishes	Catla	22
	Saro	1		Rohu	19
	Shoiñ	2		Snakehead (Dohthli)	32
	Sparrow	6		Grass carp	5
	Drongo	7		Shalynnai barb (Shalynnai)	17
Reptiles	Snake	12		Fighting catfish	5
	Water snake	5		Copper mahseer (Kha Saw)	6
	Red-necked snake	3		Kuria labeo (Kha Ski)	6
	Bsein Thlei	8		Khasi garra	1

D. Wetland-associated wild edible plants

Seventeen wild edible plant species associated with wetland margins, seepage zones and stream banks were named by respondents and confirmed against Kayang (2007) (Table 3). Polygonaceae (four species) and Asteraceae and Rosaceae (three species each) were the best-represented families. Leaves used as a cooked or raw vegetable was the dominant mode of utilisation, recorded for ten species; four species were used for their fruit and one, Smilax perfoliata (Shiah krot), is fermented, extracted and sun-dried for storage and off-season use - a processing practice that materially extends the provisioning window of the wetland.

Two species are worth noting. Houttuynia cordata (Jamyrdoh), eaten raw as a whole plant, is a wetland-obligate herb widely used across Northeast India and a reliable indicator of moist, undisturbed seepage habitat. Centella asiatica (Kynbat moina), likewise, is restricted to damp ground. Their continued availability is therefore a direct function of wetland margin integrity, and their loss would be an early signal of degradation that would very likely be noticed by households before any change in the wetland itself became apparent.

Table 3. Wetland-associated wild edible plants of the eastern Mawryngkneng C&RD Block. Scientific names, families and modes of utilisation follow Kayang (2007).

Local (Khasi) name	Scientific name	Family	Mode of utilisation
Jajew	*Begonia josephi Br.*	Begoniaceae	Leaves cooked as vegetable
Jalynniar	*Sonchus asper Linn.*	Asteraceae	Leaves used as vegetable
Jalynnoh	*Polygonum orientale Linn.*	Polygonaceae	Leaves used as vegetable
Jamyrdoh	*Houttuynia cordata Thunb.*	Saururaceae	Whole plant eaten raw
Jarain	*Fagopyrum dibotrys D. Don*	Polygonaceae	Tender shoots cooked and eaten
Ja-ut	*Polygonum nepalense Meissn.*	Polygonaceae	Leaves used as vegetable
Jhur sniang	*Rumex nepalensis Spr.*	Polygonaceae	Tender shoots used as vegetable
Khmut sim	*Ixeris gracilis DC.*	Asteraceae	Leaves used as vegetable

Kynbat moina / Khlieng-syiar	*Centella asiatica Linn.*	Apiaceae	Roots and leaves eaten raw or cooked
Long tang	*Oxyspora paniculata DC.*	Melastomataceae	Stem and leaves eaten as vegetable
Shiah krot	*Smilax perfoliata Lour.*	Smilacaceae	Shoots fermented, extracted, sun-dried for off-season use
Soh dkhiew	*Oxalis corniculata Linn.*	Oxalidaceae	Plant used as vegetable
Soh khasi	*Solanum ferox Linn.*	Solanaceae	Fruits used as food; seeds for local drink
Soh khawiong	*Rubus niveus Thunb.*	Rosaceae	Fruits edible
Soh lamjew	*Sonchus oleraceus Linn.*	Asteraceae	Fruits eaten raw
Soh nepbah	*Rubus rugosus Sm.*	Rosaceae	Fruits edible
Soh shiah	*Rubus ellipticus Sm.*	Rosaceae	Fruits edible

E. Land use–land cover change, 2020–2024

Land cover in the Mawryngkneng Block is dominated by tree cover and rangeland, which together accounted for about 89% of the block area in 2020 and about 87% in 2024 (Fig. 5, Table 4). The most consequential change over the four-year interval was the expansion of built-up area, which rose from roughly 7.5% to 10.7% of the block - an increase of approximately 9 km², or 42% in relative terms. This expansion is concentrated along the western and central road corridors, precisely where settlement density and wetland density coincide (compare Fig. 1 and Fig. 5).Rangeland contracted correspondingly, from about 35.5% to 31.5%, and cropland declined from about 3.4% to 2.7%. Tree cover registered a marginal increase, from about 53.6% to 55.1%, which is consistent with regrowth on abandoned shifting-cultivation plots and with the classifier's tendency to absorb dense scrub into the tree class. Water and flooded vegetation together occupy less than 0.1% of the block in both years - a figure that is not evidence of the absence of wetlands but of the fundamental limitation of a 10 m raster in a landscape where most wetlands are springs, seeps and stream reaches narrower than a single pixel. This mismatch is itself one of the principal findings of this study.

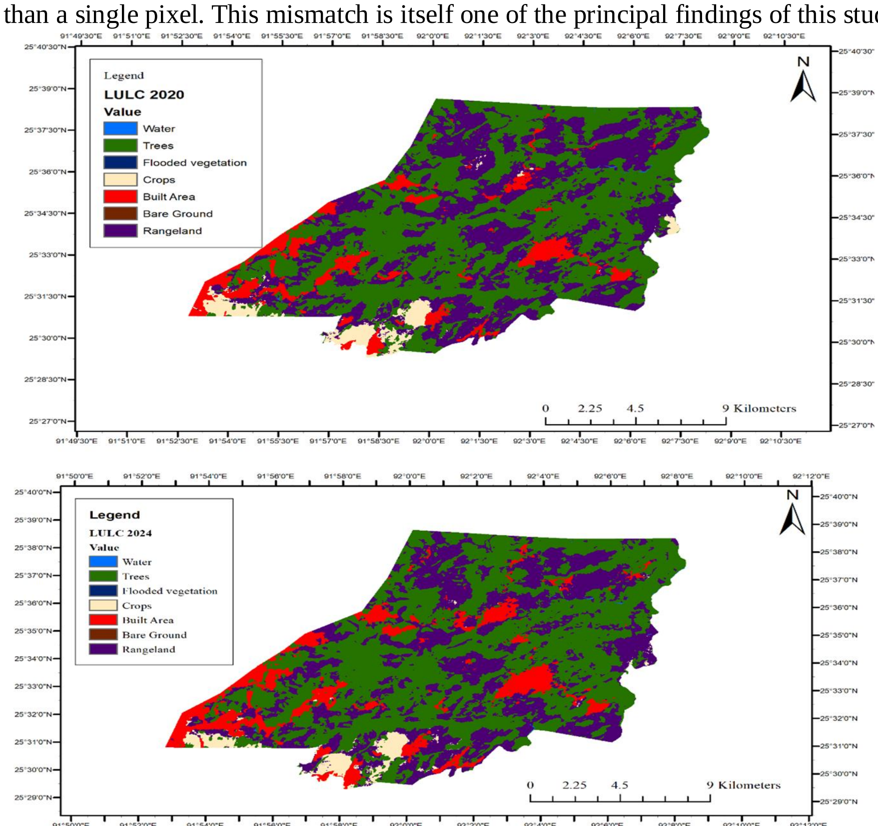

Fig. 5. Land use–land cover of the Mawryngkneng C&RD Block in 2020 (upper) and 2024 (lower), derived from the Sentinel-2 10 m Annual Land Use Land Cover product (Karra et al., 2021). Note the expansion of built area (red) along the western and central corridors.

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Table 4. Land use–land cover composition of the Mawryngkneng C&RD Block, 2020 and 2024. Areas are computed on a block area of 285.5 km². Values are indicative and should be replaced with exact zonal statistics from the source rasters.

Class	2020 (km²)	2020 (%)	2024 (km²)	2024 (%)	Change (km²)
Trees	152.95	53.57	157.17	55.05	+4.22
Rangeland	101.23	35.45	89.97	31.51	−11.26
Built area	21.46	7.51	30.53	10.69	+9.07
Crops	9.82	3.44	7.78	2.72	−2.04
Water	0.06	0.02	0.07	0.02	+0.01
Bare ground	0.01	<0.01	<0.01	<0.01	≈0
Flooded vegetation	0.00	0.00	0.00	0.00	0

F. Perceived hydrological change, degradation and threats

Respondents were divided on the direction of hydrological change (Fig. 6a). Forty-three reported that water levels had remained stable, but 32 reported a decrease and a further 28 described levels as seasonal or highly variable; only six reported an increase. Taken together, 60 respondents therefore described a hydrological regime that is either declining or becoming less predictable.

Forty-five respondents had personally witnessed the destruction of a wetland, against 49 who had not (Fig. 6b), and 29 reported that species formerly present had disappeared (Fig. 6d), with elders naming the fish Kha Dohthang, the fox and the deer among the losses. When asked to identify threats, however, 48 respondents named none (Fig. 6c). Among those who did, construction and land-use change (14), hydrological change (12) and pollution and waste (11) were most frequently cited, followed by climatic and natural causes (8), biodiversity loss (8) and human-use pressure (6).

The tension between these figures is the most significant perceptual finding of the study. Nearly half the sample had watched a wetland be destroyed, and nearly a third had watched species vanish, yet nearly half reported no threat at all. This is the signature of shifting baseline syndrome (Pauly, 1995): degradation that occurs gradually, and that is not attributed to any identifiable agent, is progressively normalised and ceases to be perceived as threat.

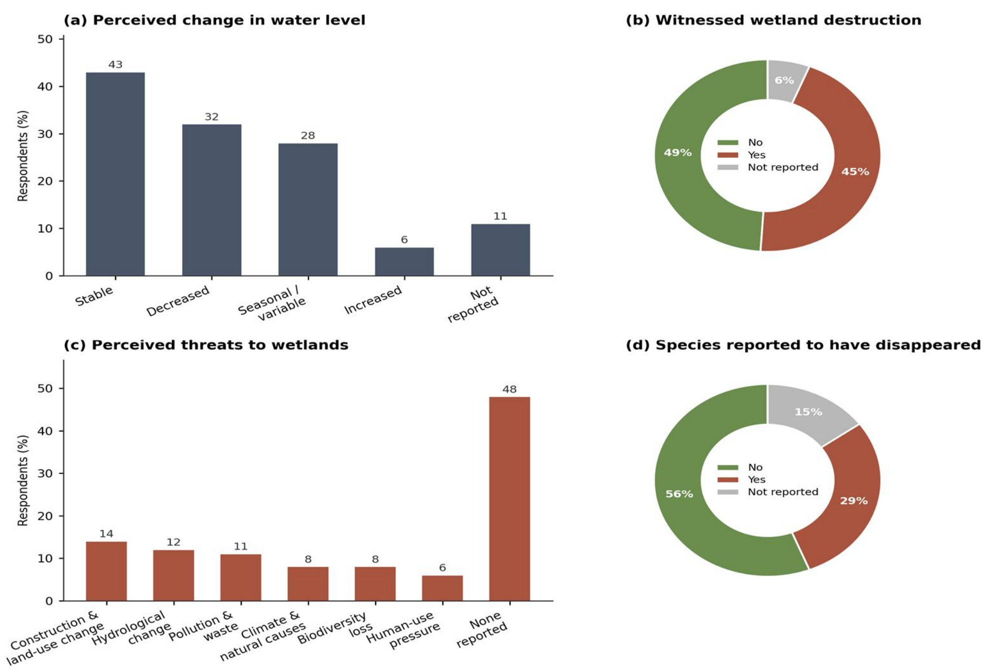

Fig. 6. Community perception of wetland change and threat (n = 100). (a) Perceived change in water level. (b) Whether the respondent had witnessed wetland destruction. (c) Threats identified by respondents (multiple response). (d) Whether species formerly present were reported to have disappeared.

G. Conservation attitudes, responsibility and participation

Support for wetland protection was near-universal: 90 respondents held that the wetlands of their village should be protected (Fig. 7a). Two-thirds (66) held that responsibility for protection should rest with the community itself, against 15 who assigned it to government, 12 to private owners and 6 to a mixed arrangement (Fig. 7d). This is a strong and internally consistent endorsement of decentralised custodianship, and it aligns closely with the customary land-management authority exercised by the Dorbar Shnong.

Against this, the record of realised action is thin. Seventy-four respondents had never participated in any wetland conservation activity, and only 20 had (Fig. 7b); 71 were unaware of any wetland project or scheme operating in or near their village, and only 26 had heard of one (Fig. 7c). The gap between a 90% endorsement of protection and a 20% participation rate is therefore not a gap in willingness but a gap in opportunity, organisation and information.

When asked what protective action should be taken, respondents proposed cleaning drives (33) and physical infrastructure such as fencing, embankments and check dams (25) most often, followed by community mobilisation (16), monitoring (8), policy and rule-making (4) and government action (3) (Fig. 7e). The preference for cleaning and construction over monitoring and rule-making is instructive: it reflects a repertoire of familiar, visible, short-horizon interventions and a corresponding absence of exposure to the institutional instruments - registers, boundary demarcation, seasonal monitoring - through which wetlands are actually protected in the long term.

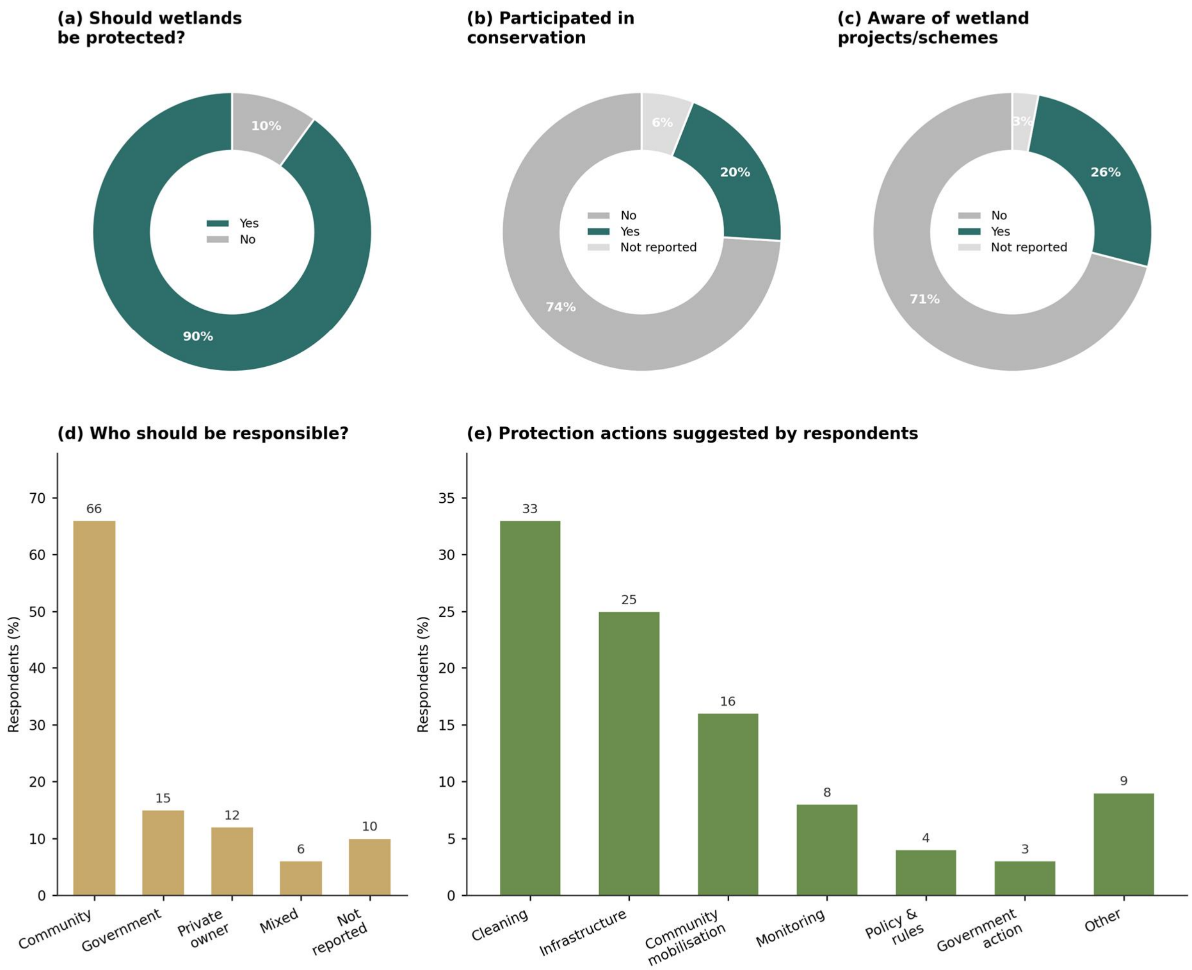

Fig. 7. Conservation attitudes, governance preferences and participation (n = 100). (a) Whether wetlands should be protected. (b) Prior participation in conservation activity. (c) Awareness of wetland projects or schemes. (d) Actor considered responsible for protection. (e) Protective actions proposed by respondents (multiple response).

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H. SWOT synthesis

Table 5 synthesises the ecological, social and institutional findings into a SWOT framework. The essential structure that emerges is one in which the strengths and opportunities are overwhelmingly social - biodiversity that remains locally valued, sustained livelihood dependence, intact cultural association, high stated willingness to act - while the weaknesses and threats are overwhelmingly institutional and physical: no management plan, no monitoring, no enforcement, and a land-use trajectory moving in the wrong direction.

Table 5. SWOT analysis of the wetlands of the eastern Mawryngkneng C&RD Block.

Strengths	Weaknesses	Opportunities	Threats
Rich local biodiversity (e.g. snakehead, Shalynnai barb, spotted dove, bulbul).	Seasonal drying observed in several wetlands, limiting year-round ecosystem function.	Strong latent demand for community-led conservation (90% support protection).	Encroachment by agriculture, settlement and grazing increasing in several areas.
Continued livelihood reliance for fishing, agriculture, livestock watering and drinking water across all villages.	No formal management plan or monitoring system in any surveyed village.	Scope for low-impact eco-tourism in scenic wetlands (e.g. Ksehpyndeng, Thangshalai).	Increased turbidity and runoff from adjacent land-use activity affecting water quality.
Strong cultural and spiritual association (e.g. christening rituals at the wetlands of Wah Jordan).	Weak awareness of conservation instruments; 71% unaware of any wetland scheme.	Integration with the Wetlands (Conservation and Management) Rules, 2017 and state wetland authority processes.	Climatic variability worsening seasonal water availability.
Detailed local knowledge of wetland NTFPs and wetland value.	Limited participation in conservation activity (74% have never participated).	Schools and youth groups available as vehicles for awareness campaigns.	Loss of valued wetland species and traditional aquatic plants reported by elders.
-	Biodiversity loss (e.g. Kha Dohthang, fox, deer) unrecognised by nearly half the sample.	GIS mapping and village registers can support official recognition and action.	No enforcement mechanism; overlapping jurisdiction between council, state and village.

IV. DISCUSSION

A. The problem of the invisible wetland

The central result of this study is a mismatch of scale. One hundred functioning wetlands exist in the eastern portion of a single C&RD Block; the statewide inventory placed before the High Court of Meghalaya in 2025 recorded 225 water bodies for the whole of Meghalaya. The discrepancy is not a failure of the state inventory on its own terms - that inventory was assembled to answer a specific question about Ramsar eligibility - but it demonstrates that the instruments through which Indian wetlands are recognised are calibrated to a class of wetland that the Khasi Hills do not contain. A minimum mapping unit of 2.25 ha excludes almost every spring and streamlet recorded here. The 10 m Sentinel-2 land cover product classified less than 0.1% of the block as water or flooded vegetation, while the ground inventory found wetlands in every surveyed village.

This has a direct policy consequence. Under the Wetlands (Conservation and Management) Rules, 2017, protection follows notification, and notification follows identification. Wetlands that no inventory sees cannot be notified, and wetlands that are not notified cannot be protected. Meghalaya's wetlands are therefore not unprotected because they are unimportant; they are unprotected because they are small. Comparable arguments have been advanced for small water bodies across the Himalayan states, where spring systems supply the majority of rural drinking water yet appear in no wetland register (NITI Aayog, 2018).

B. Springs, hydroperiod and the coming water problem

That springs and streams constitute 73% of the inventory places the wetlands of Mawryngkneng squarely within the hydrogeological regime described for the Eastern Himalaya, in which discharge depends on the recharge of fractured shallow aquifers during a monsoon of narrowing duration and rising intensity (Tambe et al., 2012). The 82% perennial fraction recorded here should not be read as evidence of security. Sixty per cent of respondents described water levels as decreasing or as increasingly variable, and the seasonal fraction of the inventory is concentrated in precisely those classes - swamps, paddy wetlands, small ponds - whose persistence depends on the tail of the monsoon.

The LULC trajectory compounds this. A 42% relative expansion of built-up area in four years, concentrated along the road corridors where wetland density is highest, increases impervious surface in the recharge zone, accelerates runoff, and reduces the infiltration on which spring discharge depends. The concurrent contraction of rangeland - the class most likely to be functioning as recharge area on these slopes - is the mechanism by which built-up expansion translates into hydrological loss. Spring-shed management, in which recharge zones are mapped, demarcated and protected upslope of the discharge point, is the established response (NITI Aayog, 2018), and it is workable here precisely because the land in question is under village control.

C. The perception gap and the participation gap

Two gaps run through the survey data. The first is perceptual. Forty-five per cent of respondents had witnessed wetland destruction and 29% had seen species disappear, yet 48% identified no threat. Gradual, diffuse and unattributable degradation is not registered as threat; it is registered as the way things are. Pauly (1995) named this shifting baseline syndrome in fisheries, and the fish data here illustrate it exactly: stocked carps, present in the landscape for perhaps two generations, were named by 19 to 22 respondents each, while the native Khasi garra was named by one. The baseline against which respondents judge their wetlands is already a degraded baseline.

The second gap is behavioural. Ninety per cent supported protection; 20% had ever acted. This is not apathy. Seventy-one per cent had never heard of a wetland scheme, and the actions respondents proposed - cleaning drives, fencing, check dams - are the actions available to a community that has never been offered an institutional alternative. The finding that 66% assign responsibility to the community rather than to government is therefore the most actionable result in this paper: the willingness and the customary authority both exist, and what is absent is the intermediate institutional layer that would convert them into monitoring, demarcation and rule-making. Ostrom's (1990) design principles for durable common-pool resource institutions - clearly defined boundaries, congruence between rules and local conditions, collective-choice arrangements, monitoring, graduated sanctions and recognised rights to organise - describe with some precision what is missing here, and equally what the Dorbar Shnong is already structurally capable of supplying.

D. Biocultural Dependence as a Conservation Asset

The ethnobotanical and ethnozoological records assembled here are not incidental to conservation; they are the mechanism by which it might be achieved. Seventeen wild edible plant species, several of them wetland-obligate, are harvested from wetland margins. Thirty-four faunal taxa are recognised, named and encountered. This depth of biocultural association means that wetland condition is continuously, if informally, monitored by the households that use it - an existing monitoring capacity that requires only to be formalised. The single respondent who named cultural value as the most important resource understates the case considerably: rituals at Wah Jordan, the fermentation and storage of Smilax perfoliata shoots, and the Khasi nomenclature for fish and birds all constitute cultural infrastructure attached to these wetlands.

E. Management Recommendations

Based on these findings we propose five measures, ordered by the immediacy with which they could be implemented:

1) Village wetland registers. Each Dorbar Shnong should maintain a register of the wetlands within its jurisdiction, recording location, type, hydroperiod, use and custodian. The GIS layer produced by this study (Fig. 1) provides a ready base. Registers create the legal and administrative object that the Wetlands Rules, 2017 require and that state inventories currently lack.

2) Spring-shed demarcation. For the 42 springs recorded, recharge zones should be delineated upslope and placed under a village-agreed restriction on construction and quarrying. This is the single intervention with the highest expected return on dry-season water security.

3) Community monitoring protocol. A simple seasonal protocol - water level at a fixed staff gauge, presence or absence of five indicator taxa (Houttuynia cordata, Centella asiatica, Khasi garra, frog, water strider), and a photographic record from a fixed point - can be operated by school students and reported to the Dorbar. Monitoring is the design principle most conspicuously absent at present.
4) Awareness through schools and youth groups. Given that 71% of respondents were unaware of any wetland scheme, awareness is not a supplementary activity but the binding constraint. Schools and youth organisations were independently identified by respondents as the appropriate vehicle.
5) Formal recognition and convergence. The village registers should be transmitted to the Meghalaya State Wetland Authority and the Khasi Hills Autonomous District Council, with a view to recognition under the Wetlands Rules, 2017 and convergence with watershed and MGNREGA works already operating in the block.

V. CONCLUSION

The wetlands of the eastern Mawryngkneng C&RD Block support biodiversity, fisheries, agriculture and domestic water supply for every village in which they occur, and they do so without any formal recognition, management plan or monitoring system. One hundred wetlands were geotagged and classified in an area for which the state inventory records essentially none, and the community that depends on them holds detailed knowledge of their flora, fauna and hydrology, endorses their protection almost unanimously, and considers itself - rather than the state - the appropriate custodian.

What is missing is neither knowledge nor will. It is the institutional apparatus of recognition: registers, boundaries, monitoring, and a rule-making forum. The combination of GIS documentation with the existing customary authority of the Dorbar Shnong offers a route to that apparatus that is both administratively cheap and socially legitimate. This study contributes the documentation; the argument it makes is that village-level wetland inventories of this kind, replicated across the C&RD blocks of Meghalaya, would give the state a wetland map that corresponds to the wetlands that actually exist. Future work should extend the inventory to the western half of the block, add physicochemical characterisation of water and sediment, and establish the seasonal monitoring baseline against which future change can be measured.

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REFERENCES

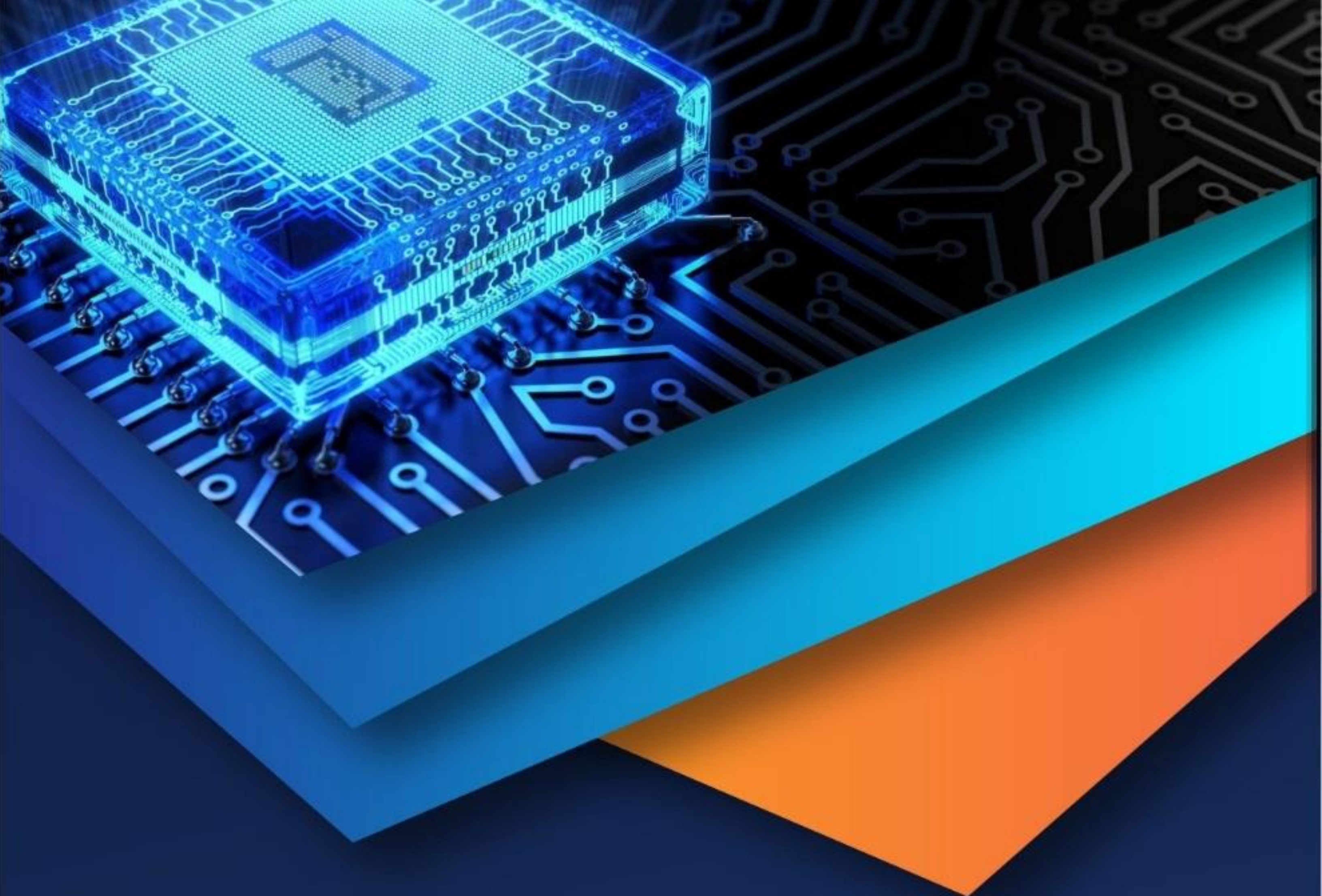
[1] Bassi, N., Kumar, M. D., Sharma, A., & Pardha-Saradhi, P. (2014). Status of wetlands in India: A review of extent, ecosystem benefits, threats and management strategies. Journal of Environmental Management, 135, 1–13.
[2] Cowardin, L. M., Carter, V., Golet, F. C., & LaRoe, E. T. (1979). Classification of wetlands and deepwater habitats of the United States (FWS/OBS-79/31). U.S. Fish and Wildlife Service, Washington, D.C.
[3] Davidson, N. C. (2014). How much wetland has the world lost? Long-term and recent trends in global wetland area. Marine and Freshwater Research, 65(10), 934–941.
[4] Gopal, B., & Sah, M. (1995). Inventory and classification of wetlands in India. Vegetatio, 118(1–2), 39–48.
[5] Karra, K., Kontgis, C., Statman-Weil, Z., Mazzariello, J. C., Mathis, M., & Brumby, S. P. (2021). Global land use/land cover with Sentinel-2 and deep learning. In IGARSS 2021 – IEEE International Geoscience and Remote Sensing Symposium (pp. 4704–4707). IEEE.
[6] Kayang, H. (2007). Tribal knowledge on wild edible plants of Meghalaya, Northeast India. Indian Journal of Traditional Knowledge, 6(1), 177–181.
[7] Millennium Ecosystem Assessment. (2005). Ecosystems and human well-being: Wetlands and water synthesis. World Resources Institute, Washington, D.C.
[8] Ministry of Environment, Forest and Climate Change. (2017). Wetlands (Conservation and Management) Rules, 2017. Gazette of India, Government of India, New Delhi.
[9] Mitsch, W. J., & Gosselink, J. G. (2015). Wetlands (5th ed.). John Wiley & Sons, Hoboken, New Jersey.
[10] NITI Aayog. (2018). Report of the Working Group I on inventory and revival of springs in the Himalayas for water security. Government of India, New Delhi.
[11] Ostrom, E. (1990). Governing the commons: The evolution of institutions for collective action. Cambridge University Press, Cambridge.
[12] Pauly, D. (1995). Anecdotes and the shifting baseline syndrome in fisheries. Trends in Ecology & Evolution, 10(10), 430.
[13] Ramachandra, T. V., Bhat, S. P., Sudarshan, B., & Vinay, S. (2021). Ecosystem services of wetlands. Journal of Wetlands Environmental Management. [Verify volume, issue and page range.]
[14] Ramsar Convention Secretariat. (2016). An introduction to the Ramsar Convention on Wetlands (7th ed.). Ramsar Convention Secretariat, Gland, Switzerland.
[15] SCC Online. (2025, May 1). Meghalaya HC closes suo motu PIL to protect wetlands, considering none of the sites qualified as Ramsar site. SCC Online Blog. https://www.scconline.com/blog/post/2025/05/01/
[16] Singh, A. L., & Khundrakpam, M. L. (2011). Phumdi proliferation: A case study of Loktak Lake, Manipur. Water and Environment Journal, 25(1), 99–105.

[17] Space Applications Centre. (2011). National Wetland Atlas. Indian Space Research Organisation, Ahmedabad.

[18] Tambe, S., Kharel, G., Arrawatia, M. L., Kulkarni, H., Mahamuni, K., & Ganeriwala, A. K. (2012). Reviving dying springs: Climate change adaptation experiments from the Sikkim Himalaya. Mountain Research and Development, 32(1), 62–72.

[19] Tiwari, B. K., Tynsong, H., & Lynser, M. B. (2010). Forest management practices of the tribal people of Meghalaya, North-East India. Journal of Tropical Forest Science, 22(3), 329–342.

[20] Venter, Z. S., Barton, D. N., Chakraborty, T., Simensen, T., & Singh, G. (2022). Global 10 m land use land cover datasets: A comparison of Dynamic World, World Cover and Esri Land Cover. Remote Sensing, 14(16), 4101.



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