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From risk reduction action plans to heat-resilient livelihoods: An integrated community-led adaptation model from coastal Bangladesh

Abstract

Extreme heat in coastal Bangladesh is rarely an isolated hazard. In low-lying saline environments, heat interacts with drought, freshwater scarcity, cyclones, tidal surges, waterlogging, lightning and climate-sensitive livelihoods, creating compound risks for health, mobility, income and household recovery. This article examines a community-led resilience model implemented through the Inclusive Community Resilience to Disaster and Climate Vulnerabilities (ICRDCV) programme in Assasuni Upazila, Satkhira. Using a practice-based descriptive case-study design, the paper synthesizes project baseline information, Risk Reduction Action Plans (RRAPs), routine monitoring records, progress reports and implementation evidence available through 15 August 2026. The programme covers 68 communities in 27 wards across three unions and combines community risk planning, local disaster-management institutions, last-mile early warning, community-prioritized risk-reduction works, heat-health communication, climate-resilient water and sanitation, tree planting, livelihood diversification and local-government financing. Descriptive results show 31 functioning disaster-management committees, RRAP coverage in all 68 communities, 14 completed local risk-reduction/adaptation works, 54 permanent early-warning and lightning-safety boards, 3,330 climate-resilient trees, support to 720 livelihood households, 70 programme-wide household rainwater-harvesting systems, a 20,000-litre community rainwater-harvesting system, and incorporation of disaster risk reduction/climate change adaptation allocations into all three target Union Parishad budgets. The analysis argues that the programme's principal innovation is not a stand-alone heatwave intervention but a compound-risk resilience pathway in which community agency identifies priorities, layered interventions reduce exposure and sensitivity, and local institutions create a route from community demand to public financing. The case suggests that heat resilience in vulnerable coastal settings is strengthened when safe water, livelihood security, social inclusion, ecosystem measures, preparedness and local governance are designed as mutually reinforcing components. Because the evidence comes from programme monitoring rather than an experimental evaluation, causal claims are not made; instead, the article identifies a replicable implementation architecture and priorities for more rigorous future evaluation.

Keywords: heat resilience community-based adaptation, disaster risk reduction, water security, climate-resilient livelihoods, local governance, Bangladesh, Satkhira

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Key messages

a) Heat resilience in coastal Bangladesh should be treated as a compound-risk problem linking heat, salinity, water insecurity, livelihoods and disaster exposure.

b) RRAP-led planning creates a practical bridge from locally identified risks to project-financed actions and higher-value government investment.

c) Heat-health messaging is more actionable when paired with reliable safe-water access, shade/nature-based measures and weather-sensitive work practices.

d) Livelihood diversification, productive assets and government technical services can reduce household sensitivity to climate shocks while strengthening women's economic resilience.

e) Institutionalization through Disaster Management Committees and Union Parishad DRR/CCA budgeting is central to sustaining local adaptation beyond project cycles.

Introduction

Heat risk is increasing in importance across South Asia, but its consequences are mediated by local living conditions, work patterns, access to water, social vulnerability and the capacity of institutions to anticipate and respond. Heat extremes are associated with a wide range of health risks and can substantially affect outdoor workers and households with limited access to cooling, shade and safe hydration.[1] In coastal settings, these risks are intensified when freshwater is scarce or saline, livelihoods depend on agriculture, fisheries, aquaculture and day labour, and communities are also exposed to cyclones, storm surges, waterlogging and erosion.

Southwestern coastal Bangladesh illustrates this interaction particularly clearly. Research from Satkhira and adjoining coastal areas has documented severe drinking-water stress linked to salinity, drought and climate variability, as well as strong community reliance on locally adapted water-management practices such as rainwater harvesting.[2,3] Other work has emphasized that effective adaptation in the southwest is context-specific, multi-level and closely connected to local knowledge, early warning, livelihood decisions

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and institutional support.[4] Community resilience research in coastal Bangladesh likewise shows that preparedness, livelihood capacities and connections to external institutions matter together rather than as isolated inputs.[5]

Yet many programmes and policies still treat heat, water, disaster preparedness, livelihoods and local governance as separate sectors. This fragmentation can weaken adaptation. For example, advice to increase fluid intake during extreme heat has limited value where safe drinking water is distant, saline or unaffordable. A road or embankment improvement may be counted as infrastructure, but its resilience value lies in whether it enables safer evacuation and access to services. Training may increase knowledge, but without productive assets, extension support or markets it may not translate into livelihood resilience. Similarly, community participation can remain symbolic unless local priorities influence resource allocation and public decision-making.

This article examines the Inclusive Community Resilience to Disaster and Climate Vulnerabilities (ICRDCV) programme in Assasuni Upazila of Satkhira District as a practice-based case of integrated local adaptation. The programme is supported by Muslim Aid UK Bangladesh Field Office and has been implemented by ESDO since November 2024 while maintaining continuity with community structures and livelihood groups formed during an earlier stage. The current programme operates in 68 communities across 27 disaster-prone wards in Assasuni Sadar, Sreeula and Protapnagor unions. Its operating premise is that communities identify and rank risks and solutions through Risk Reduction Action Plans (RRAPs); feasible actions are implemented directly, while larger needs are elevated to disaster-management and local-government systems.[6]

The paper asks three questions. First, how does an RRAP-led programme combine heat-health protection with broader multi-hazard resilience in a saline coastal environment? Second, what implementation evidence indicates that water security, livelihood support, early warning, nature-based measures and local institutions are functioning as a connected resilience system? Third, what elements of the model appear most suitable for replication, and what evidence gaps must be addressed before stronger causal conclusions can be drawn? The article contributes a programme-derived conceptual framework—the compound-risk community resilience pathway—to show how community agency, layered local action and institutionalization can interact to strengthen adaptive capacity.

Analytical framing: Heat as a compound coastal risk

The public-health literature increasingly treats heat as an exposure that is shaped by physiological vulnerability, occupation, housing, access to water, timing of activity and social protection. Ebi et al.,[1] show that hotter weather and heat extremes raise morbidity and mortality risks and that adaptation requires measures extending beyond individual behaviour. This is especially relevant for people engaged in outdoor and physically demanding work. In practical terms, risk reduction may involve access to drinking water, shade, rest, communication, altered work schedules and attention to vulnerable groups. The 2025 WHO–WMO technical guidance likewise recommends occupational heat action programmes tailored to local conditions, job demands and worker vulnerability.[7]

In coastal Bangladesh, heat interacts with chronic water insecurity. Studies in southwestern districts have shown that salinity intrusion and drought reduce the availability of safe water and affect health, agriculture, fisheries and household well-being.[2,3,8] These studies also demonstrate that communities do not simply experience vulnerability passively; they develop coping and adaptation strategies, including rainwater harvesting and other locally available water solutions. The implication for heat resilience is important: safe-water infrastructure is not only a WASH intervention but also part of the enabling environment for heat-health protection.

A second strand of literature emphasizes community resilience and locally grounded adaptation. Ahmed et al.,[5] argue that cyclone resilience in coastal Bangladesh depends on interacting capacities, including livelihoods, warning systems, social organization and external institutional connections. Ashrafuzzaman,[4] similarly documents adaptation in the southwestern coastal region as a multi-level process involving local practices and wider institutional support. These findings caution against evaluating resilience solely through the number of physical assets delivered.

A third consideration is inclusion and agency. Recent research on community-based water management in southwest coastal Bangladesh finds that participation alone does not guarantee empowerment; effective decision-making roles, access to resources, institutional support and context-specific barriers matter.[9] This insight is relevant to RRAPs and Disaster Management Committees: the analytical question is not simply whether community structures exist, but whether they help identify priorities, mobilize services, manage assets and connect community needs to public financing.

Drawing these strands together, this paper treats resilience as a pathway rather than a single outcome. Community agency shapes priorities; interventions seek to reduce exposure and sensitivity; livelihood and service access strengthen adaptive capacity; and institutionalization can improve continuity beyond the project period. Heat resilience is therefore interpreted as an emergent property of the wider local system, not as a stand-alone awareness activity (Figure 1).

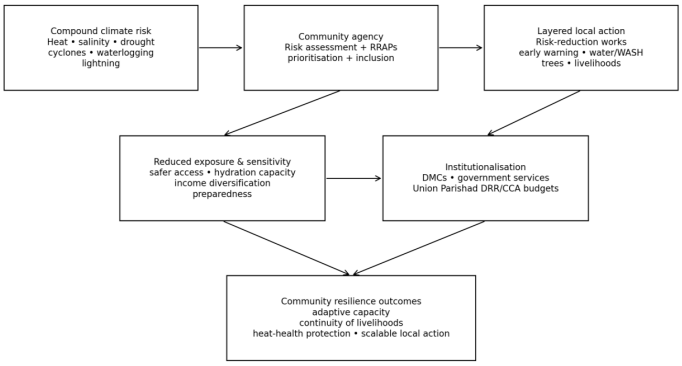


Figure 1 Compound-risk community resilience pathway used to interpret the ICRDCV case.

Methods

Study design and setting

The article uses a practice-based descriptive case-study design based on secondary analysis of routine programme evidence. The study setting is Assasuni Upazila, Satkhira District, in the southwestern coastal zone of Bangladesh. The programme covers 68 communities in 27 wards across Assasuni Sadar, Sreeula and Protapnagor unions. The area is characterized by interacting exposure to cyclones, tidal surges, salinity intrusion, river erosion, waterlogging, drought, extreme heat and lightning. Livelihoods commonly include day labour, agriculture, fisheries, shrimp farming and other forms of outdoor work.

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Data sources

The analysis draws on project documentation available through 15 August 2026, including the February 2024 baseline study, project proposals, completion and quarterly progress reports, target-versus-achievement tracking, gender-responsive and inclusive RRAPs, committee and activity monitoring records, early-warning and heat-health communication materials, WASH and water-system records, livelihood support records, beneficiary case documentation and implementation photographs. The synthesis used the latest verified cumulative or current figure reported in the programme evidence and distinguished programme-wide totals from outputs specifically delivered during ESDO implementation where the source did so.[6]

Analytical procedure

Evidence was organized into five analytical domains derived from the programme logic and the literature: (1) community agency and local governance; (2) risk reduction, early warning and preparedness; (3) heat-health, water security and nature-based adaptation; (4) climate-resilient livelihoods and inclusion; and (5) institutionalization and public financing. Quantitative monitoring indicators were used descriptively. Narrative programme records were used to interpret how activities were intended to function together. No inferential statistics were undertaken, and the analysis does not attribute observed changes exclusively to the programme.

Research integrity and limitations of the evidence base

The manuscript analyses routine programme monitoring rather than data collected through a research protocol designed for causal evaluation. Activity participant counts may contain repeat participation across different events. Several infrastructure indicators are cumulative across programme stages, while the source separately identifies the subset delivered under ESDO implementation. Direct measures of heat exposure, heat-related illness, temperature reduction from tree planting, household income trajectories and counterfactual outcomes were not available. Accordingly, the article reports implementation evidence and plausible resilience pathways rather than causal impact estimates (Table 1).

Table 1 Intervention architecture and hypothesized resilience functions

Programme component	Operational mechanism	Primary resilience function	Illustrative evidence
RRAP-led planning	Community hazard analysis, vulnerability identification and prioritization	Builds local agency and aligns action with locally perceived risk	68 communities covered; 11 new RRAPs developed by ESDO and 57 earlier plans reviewed/carried forward
Local risk-reduction works	Cash-for-Work and small-scale adaptation/mitigation works	Reduces exposure and improves evacuation/access	14 completed community-prioritized interventions
Early warning and preparedness	DMC logistics, permanent boards, dissemination sessions, drills and volunteer groups	Improves anticipatory action and last-mile communication	54 boards; 95 dissemination sessions; 7 documented drills
Heat, water and WASH	Heat messaging, safe-water systems, rainwater harvesting, RO treatment, toilets and safer work practices	Enables hydration, reduces water insecurity and supports health protection	70 programme-wide household RWHS; 20,000-L community RWHS; 2 new + 1 repaired treatment facilities
Nature-based measures	Climate-resilient tree planting and environmental awareness	Supports shade, erosion control and longer-term ecosystem resilience	3,330 trees planted
Livelihood resilience	Training + productive inputs + government extension + market linkage + follow-up	Diversifies income and reduces sensitivity to climate shocks	720 households in 29 groups; at least BDT 10,000-equivalent productive inputs per household
Institutionalization	DMC coordination, line-department engagement and Union Parishad budgeting	Links local demand to public systems and financing	DRR/CCA allocations incorporated into all 3 target Union Parishad budgets

Results

Community agency and an RRAP-first planning architecture

The programme's organizing mechanism is the RRAP. All 68 communities are covered by RRAP-based planning. ESDO directly developed 11 new RRAPs and reviewed or operationalized 57 earlier plans, preserving continuity while updating local priorities. RRAPs identify hazards, vulnerable groups, risk locations, seasonal patterns and priority actions. This process creates an explicit record linking a proposed intervention to a locally identified risk rather than starting with a fixed menu of project activities.

The RRAP process is embedded within a broader local governance architecture. Thirty-one Disaster Management Committees remain functional and engaged: 27 Ward Disaster Management Committees, three Union Disaster Management Committees and one Upazila Disaster Management Committee. Twenty-seven women/youth volunteer groups support preparedness and last-mile communication, while 21 Cyclone Shelter Management Committees have received capacity-building support. At least 185 committee-level quarterly coordination or review meeting events were documented through 31 July 2026.

This institutional density matters because it enables a two-track financing model. Priorities that can be accommodated within project resources are implemented directly. Larger needs—such as major embankment works, canal re-excavation or other high-value infrastructure—are documented and referred through Union and Upazila disaster-management and government channels. The model

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therefore treats local planning as a gateway to multiple sources of action rather than as a one-off participatory exercise.

Risk reduction, last-mile warning and preparedness

Fourteen community-prioritized risk-reduction or adaptation interventions were completed. These include road and road-cum-embankment repair, cyclone-shelter access or field raising, tree planting and related locally identified works. The protective function is central: repaired routes can enable faster movement towards cyclone shelters, reduce hazards created by damaged access during flooding, and in some locations reduce the entry of tidal or flood water into settlements. Cash-for-Work is used as a delivery modality, combining temporary income support with locally valued protective infrastructure.

Preparedness measures reinforce these physical works. All 27 ward committees have early-warning logistics accumulated through programme support, including hand mikes or megaphones, torches and signal flags. Fifty-four permanent information boards are installed across the 27 wards: 27 focused on early-warning messages and 27 on lightning safety. Ninety-five structured early-warning dissemination sessions were documented, while seven simulation or mock drills reached 5,206 participant contacts. A 30 HP mobile generator is maintained for emergency power to cyclone shelters, control rooms, water-treatment plants and other critical services.

The programme also uses folk and mass communication. Twenty-three major mass-awareness sessions on coping, adaptation and special care for vulnerable people reached 11,020 participant contacts. Seven drills and first-aid or school-based knowledge activities create additional preparedness channels, with 1,916 documented first-aid knowledge contacts, including 1,775 student contacts. These counts indicate reach, not unique individuals, but they demonstrate a deliberate strategy of repeating key messages through multiple platforms.

Heat-health resilience through water security, communication and nature-based action

The ICRDCV evidence presents heat as one element of a compound hazard environment rather than as an isolated seasonal event. Programme records identify prolonged heat conditions and recurring lightning as concerns for health, mobility and occupational safety. This is especially relevant for people engaged in day labour, agriculture, fisheries and shrimp farming, and for women, children, older persons, pregnant women and persons with disabilities who may face additional barriers to safe water, mobility and emergency assistance.

Heat-health communication is integrated into committee, community, ward and livelihood-group meetings. Communication materials promote regular safe-water intake, rest in shaded or cooler places, avoidance of unnecessary exposure during severe heat, light and loose clothing, attention to people with underlying health conditions, recognition of heat-related illness and timely referral. Mass-awareness scripts use drama, folk song, pot song, miking and demonstration to convey these messages alongside cyclone, lightning, hygiene and tree-planting content. This repeated communication architecture is important in settings where formal training alone would miss part of the population.

The programme's strongest contribution to practical heat resilience may be the link between behaviour advice and water access. Across the three-stage programme, 70 household rainwater-harvesting systems are in place, of which 40 were installed under ESDO implementation. A 20,000-litre community rainwater-harvesting system has been completed and handed over. Two new community water-treatment/RO plants were installed and one previously non-functional facility was repaired and returned to service; three damaged deep tube wells were also repaired. These assets sit alongside 90 programme-wide climate-resilient household toilets, one renovated market WASH facility and two upgraded gender- and disability-inclusive school WASH facilities.

Nature-based action provides an additional resilience layer. As of 15 August 2026, 3,330 climate-resilient trees had been planted. The programme associates these trees with shade, environmental protection, erosion control and longer-term adaptation. The monitoring data do not include local temperature measurements, so a quantitative cooling effect cannot be claimed. Nevertheless, tree planting is operationally linked with heat awareness, public-space protection and wider ecosystem stewardship.

The programme also applies heat-risk management to its own operations. During extreme heat, field activities and construction or Cash-for-Work schedules have been shifted to safer times, while shade, drinking water and oral rehydration solution have been provided to workers. Later heatwaves and lightning events similarly triggered schedule adjustments and reinforcement of preparedness messaging. This is a practical example of adaptation being embedded in implementation procedures rather than communicated only to beneficiaries.

Climate-resilient livelihoods and women's economic resilience

A continuing cohort of 720 livelihood households is supported through 29 beneficiary or farmer groups. Each household has received relevant livelihood training and at least BDT 10,000-equivalent productive input support over the programme, representing at least BDT 7.2 million in productive start-up assets or inputs across the cohort. Options include homestead gardening, freshwater fish culture, Bagda and Golda shrimp, poultry or duck rearing and goat rearing, selected according to local conditions and household capacity.

The livelihood model extends beyond training. Agriculture, Fisheries and Livestock officers act as technical resource persons and provide extension, vaccination and troubleshooting support. Beneficiaries receive follow-up visits and participate in quarterly group learning meetings where production progress, constraints and technical responses are discussed. Market linkage is treated as part of resilience rather than as a separate post-project activity.

This layered livelihood package is relevant to heat and climate risk for two reasons. First, diversification can reduce household dependence on one climate-sensitive income source. Second, productive assets and technical support may reduce the need for distress borrowing aftershocks. Programme case documentation describes households using income from aquaculture, gardening and livestock to reinvest, save, maintain children's education or reduce dependence on day labour. These cases are illustrative and cannot establish average programme effects, but they provide plausible mechanisms connecting productive assets, agency and recovery capacity.

Inclusion, reach and local public financing

The latest verified active reach reported by the programme is 8,211 direct and 7,062 indirect beneficiaries. Women account for 5,800

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direct beneficiaries, or 70.6% of the direct reach, and 179 persons with disabilities are included. Programme targeting also prioritizes women-headed households, older people, children, ethnic minorities, widows or divorced women, ultra-poor households, day labourers, small farmers, fishers, informal workers and households living near rivers, embankments or chronically waterlogged areas.

Institutional uptake is visible in local budgeting. Project staff participated in annual budget meetings of all three-target Union Parishads, and DRR/CCA allocations were incorporated into each budget. Government Agriculture, Fisheries, Livestock, Health and Disaster Management actors also participate as trainers, technical service providers and planning partners. This creates a pathway through which community-identified priorities can continue to receive attention even when they exceed the project's own financial envelope (Table 2).

Table 2 Selected quantitative implementation evidence through 15 August 2026

Indicator	Latest verified result
Geographic coverage	68 communities; 27 wards; 3 unions
Current verified reach	8,211 direct beneficiaries; 7,062 indirect beneficiaries
Female participation in direct reach	5,800 (70.6%)
Persons with disabilities in direct reach	179
Local disaster governance	31 DMCs; 27 women/youth volunteer groups
RRAP coverage	68 communities; 11 new RRAPs developed by ESDO; 57 earlier plans reviewed/carried forward
Risk-reduction/adaptation works	14 completed
Early-warning/lightning boards	54 permanent boards
Early-warning dissemination	95 structured sessions
Mass awareness	23 sessions; 11,020 participant contacts
Simulation/mock drills	7 drills; 5,206 participant contacts
Climate-resilient trees	3,330
Livelihood resilience	720 households; 29 groups; ≥ BDT 10,000-equivalent productive input support per household
Climate-resilient household toilets	90 programme-wide; 40 delivered under ESDO implementation
Household rainwater harvesting	70 programme-wide; 40 delivered under ESDO implementation
Water-treatment assets	2 installed + 1 repaired/returned to service
Community rainwater harvesting	1 system completed and handed over; 20,000-litre capacity
Local budget integration	DRR/CCA allocations incorporated into all 3 target Union Parishad budgets

Discussion

Heat resilience as a system property, not a single activity

The central analytical insight from the ICRDCV case is that heat resilience emerges from the interaction of multiple local systems. Heat-health messages are important, but they become materially more actionable when safe water is available, work can be rescheduled, shade is accessible, vulnerable people are known to local committees, and households have more resilient livelihood options. This interpretation is consistent with the broader heat-health literature, which emphasizes the interaction of exposure, susceptibility and adaptive capacity.[1]

In Assasuni, the water dimension is particularly important. Previous research in southwestern coastal Bangladesh has shown that salinity, drought and freshwater scarcity are persistent risks requiring both household and institutional adaptation.[2,3,8] ICRDCV operationalizes this insight by linking heat messaging to rainwater harvesting, water treatment, rehabilitation of failed water assets and community management. The practical lesson is straightforward: a heat action message that says "drink safe water" must be paired with an adaptation strategy that makes safe water physically and financially reachable.

From participation to actionable community agency

A second contribution is the RRAP-first architecture. Participatory planning is often criticized when communities are consulted but priorities do not influence resource allocation. The ICRDCV approach attempts to avoid this by establishing two routes after prioritization: feasible works can be financed by the programme, while larger items are elevated to government systems. This makes the RRAP a decision instrument rather than only a diagnostic document.

The importance of this distinction is supported by research on community institutions in southwest coastal Bangladesh. Lima et al.,[9] show that participation becomes more meaningful when it influences decisions, resources and institutional processes. In the ICRDCV case, evidence of 31 functioning DMCs, repeated coordination meetings, volunteer groups and Union Parishad budget integration suggests movement toward that more substantive form of participation. Future research should nevertheless examine who speaks, whose priorities are selected, how women and marginalized groups influence decisions, and whether budget allocations translate into completed public investments.

Layered adaptation and the value of combining "soft" and "hard" measures

The programme combines physical works with communication, institutions, training and service linkages. This is important because resilience rarely results from infrastructure alone. A repaired access road contributes to resilience when warning arrives in time, households know what to do, vulnerable people receive support and a functional shelter is accessible. A water plant contributes when it is maintained, affordable and connected to community management. Livelihood inputs contribute when skills, extension, markets and reinvestment are present.

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This layered approach reflects findings from community resilience research in Bangladesh, where social connections, livelihoods, preparedness and external institutional support interact.[5] It also aligns with context-specific adaptation evidence from the southwest, which points to the importance of combining local knowledge with multi-level support.[4] For implementers, the implication is that project design and monitoring should assess the chain of functions connecting assets to protective outcomes, not simply count outputs.

Livelihood resilience as part of heat and health adaptation

The linkage between livelihoods and heat resilience deserves greater attention. Households dependent on outdoor work may face a difficult trade-off between income and avoiding dangerous heat. Diversified livelihoods, productive assets and savings can potentially increase flexibility, allowing households to adjust work patterns or absorb short-term climate shocks without immediate distress. ICRDCV's livelihood model—training, productive capital, technical support, group learning and market linkage—addresses several of these constraints simultaneously.

However, the current evidence is stronger on programme delivery than on measured economic outcomes. The programme documents promising household cases, but average changes in income, assets, debt, savings, dietary diversity or time allocation were not available in a form suitable for causal analysis. A future longitudinal design could test whether diversified livelihood households experience lower income volatility during heatwaves, salinity shocks or cyclone recovery periods than comparable households.

Institutionalization and the route beyond project financing

The incorporation of DRR/CCA allocations into all three target Union Parishad budgets is one of the most policy-relevant findings. Many local adaptation programmes face a sustainability gap when external grants end. By connecting RRAP priorities with formal local-government budgeting and technical line departments, the programme creates a potential transition from project delivery toward locally financed adaptation.

This mechanism should not be overstated: an allocation in a budget does not automatically guarantee expenditure, implementation quality or sustained funding. Nevertheless, it establishes an institutional route that is absent in purely project-based models. Replication efforts should therefore track not only whether priorities are referred to government but also whether they are funded, completed and maintained.

Implications for policy, practice and scaling

The ICRDCV experience suggests that replication should focus less on copying a fixed package of infrastructure and more on reproducing the decision process that links locally perceived risk with layered action and public systems. Six implications follow:

1. **Institutionalize RRAP-led planning:** Use community risk assessment and RRAP review as a recurring local-government process before cyclone, monsoon and heat seasons, with explicit tracking of which priorities are project-financed, publicly financed or pending.
2. **Build heat action into multi-hazard systems:** Integrate heat-health communication, lightning safety, cyclone preparedness and WASH rather than creating parallel committees and campaigns for each hazard.
3. **Treat safe water as heat infrastructure:** Prioritise rainwater harvesting, rehabilitation of viable failed water assets, community water treatment, affordability and operation/maintenance alongside heat-health messaging.
4. **Protect outdoor workers operationally:** Use safer work-hour scheduling, shade, drinking water, ORS, supervision and weather-triggered adjustments in Cash-for-Work, construction, agriculture and other outdoor activities.
5. **Link livelihoods with technical services and markets:** Avoid input-only livelihood support. Combine productive assets with government extension, animal health services, aquaculture/agriculture advice, peer learning, market linkage and savings/reinvestment support.
6. **Measure institutional uptake and outcomes:** Track public budget expenditure, functionality of DMCs and water systems, heat-related health indicators, water quality, livelihood volatility, women's decision-making and cost-effectiveness over time.

Limitations and research priorities

This paper has several limitations. First, it is based on routine programme monitoring and internal implementation documentation rather than a pre-specified research protocol. Second, there is no control or comparison group and no consistent pre-post outcome dataset for heat-related morbidity, household income, water quality or adaptive capacity. Third, activity participant counts may include repeat participation, so they should not be interpreted as unique beneficiaries. Fourth, some infrastructure indicators are cumulative across programme stages; although the source identifies ESDO-specific delivery for several indicators, attribution across stages requires care. Fifth, the analysis cannot quantify whether tree planting reduced local temperatures or whether heat messaging changed behaviour at population scale.

These limitations point to a clear research agenda. A future evaluation could combine household panel surveys, qualitative interviews, wearable or environmental heat-exposure measurement, water-quality testing, facility functionality audits, cost-effectiveness analysis and administrative data on Union Parishad budget execution. Outcome domains should include heat-related symptoms, hydration practices, work-hour adaptation, women's decision-making, livelihood volatility, debt and savings, time required to obtain safe water, and functionality of local disaster-management institutions. Such a design would allow the promising implementation architecture documented here to be tested more rigorously.

Conclusion

The ICRDCV experience in Assasuni shows how a community-led multi-hazard programme can make heat resilience more concrete by embedding it within water security, livelihood support, preparedness, nature-based action and local governance. The programme's distinctive feature is its RRAP-first pathway: communities identify and rank risks; feasible priorities are converted into local action; higher-value needs are connected to government structures and budgets; and the same local institutions support warning, service linkage, inclusion and asset management. The descriptive evidence—68 RRAP-covered communities, 31 disaster-management committees, 14 local risk-reduction works, 3,330 trees, 720 livelihood households, 70 programme-wide household rainwater-harvesting systems and DRR/CCA allocations in all three target Union Parishad budgets—shows substantial implementation depth. It does not, by itself, prove causal impact. The stronger contribution is conceptual and operational:

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in saline, climate-exposed coastal settings, heat resilience is most credible when it is designed as a system of mutually reinforcing capacities rather than a stand-alone awareness intervention. Scaling this model should retain community prioritization and institutional linkage while strengthening measurement of health, economic, environmental and governance outcomes.

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Conflict of interest

The authors declare that there is no conflict of interest.

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