



Impact of Climate Disasters on Rural Out-Migration in Purba Medinipur

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Abstract: *Climate induced environmental shocks increasingly undermine rural livelihood stability along with household demographic mobility across vulnerable agrarian territories. Purba Medinipur situated within the littoral zone of West Bengal confronts heightened exposure toward tropical cyclonic systems along with storm surges together with catastrophic inundations alongside saline water ingress followed by riverine bank degradation and substantial agrarian output degradation. Such environmental vulnerabilities directly transform regional migration dynamics through the obliteration of productive household capital alongside the contraction of farm based employment opportunities together with escalating domestic debt burdens and the systemic erosion of local subsistence viability among rural domestic units. This investigation interrogates the precise linkages connecting ecological catastrophes with rural population outflows throughout Purba Medinipur directing dedicated empirical attention toward the specific socio economic channels through which environmental crises catalyze transient alongside seasonal together with protracted spatial displacements. Methodologically the inquiry synthesizes secondary empirical repositories procured from the Census of India along with peer reviewed scholarly treatises together with official post disaster damage evaluations and contemporary field investigations centered upon coastal Purba Medinipur. The analytical synthesis reveals that environmental shocks never function as singular isolated determinants of human mobility rather they operate synergistically across pre existing deprivation alongside chronic agrarian reliance together with precarious labor arrangements alongside pervasive landlessness and structural deficits in occupational diversification. Severe cyclonic episodes exemplified through Cyclone Amphan alongside Cyclone Yaas illustrate how recurrent ecological disturbances systematically dismantle agricultural assets along with residential infrastructure and localized labor absorption thereby institutionalizing migratory mobility as a primary household risk mitigation mechanism. This treatise maintains that climate adaptive agrarian infrastructure alongside economic diversification together with anticipatory disaster readiness and comprehensive institutional safety nets remain indispensable imperatives to curtail involuntary distress migration while preserving spatial movement as an autonomous voluntary livelihood choice.*

Keywords: *Climate Disasters, Rural Out-Migration, Climate Migration, Cyclones, Purba Medinipur, Livelihood Vulnerability, Migration Adaptation.*

Introduction: Spatial relocation has historically served as a vital livelihood mechanism among rural households throughout India. Individuals relocate on an impermanent or enduring basis in pursuit of remunerative employment alongside enhanced earnings together with scholastic advancement and elevated living standards. Nevertheless ecological strain increasingly represents a critical determinant steering

domestic relocation choices. Climate induced hazards transform migration patterns directly through the physical displacement of households and indirectly through widespread damage to agriculture alongside livestock assets together with residential dwellings as well as communal infrastructure and localized employment avenues. The relationship connecting environmental shifts with population movement remains fundamentally multifaceted while being actively mediated through household economic reserves alongside sectoral livelihood dependencies and accessible alternative employment opportunities.

Purba Medinipur occupies an exceptionally critical position within this context because its coastal and riverine zones remain exposed to recurring multiple hazards. The district experiences severe cyclonic occurrences alongside extensive inundations together with storm surges and saline water infiltration while substantial segments of its rural populace depend directly or indirectly upon agricultural production alongside fisheries and related climate sensitive pursuits. Scholarship evaluating inundation risks throughout Purba Medinipur categorizes the territory as acutely susceptible owing to the systemic convergence between physical hazard exposure and structural demographic vulnerability (Gayen et al., 2022).

The destructive consequences of recent atmospheric disturbances provide compelling empirical confirmation. Cyclone Amphan during 2020 along with Cyclone Yaas during 2021 triggered widespread inundation alongside catastrophic devastation across agricultural acreage and vegetative cover throughout Purba Medinipur. An analytical investigation of Cyclone Yaas revealed that approximately 239.69 square kilometers representing roughly 5% of the total territorial expanse suffered flood immersion with agrarian lands constituting approximately 95% of the submerged terrain (Khatun et al., 2022). In identical fashion contemporary inquiries into agricultural destruction documented severe impacts generated by Cyclone Fani alongside Cyclone Amphan as well as Cyclone Yaas with Cyclone Amphan producing exceptionally devastating agricultural destruction throughout the littoral blocks of the district.

Objectives of the Study:-The investigation pursues the following foundational objectives.

- The primary objective seeks to examine the prominent climate related hazards confronting rural territories of Purba Medinipur.
- The secondary objective aims to analyze the empirical relationship connecting environmental disasters with rural outward migration flows.
- The tertiary objective focuses on identifying the livelihood mechanisms through which ecological crises steer domestic migration choices.
- The final objective examines the socio economic consequences of climate induced displacement across rural households.

Methodology: The investigation adopts a descriptive alongside analytical research design grounded primarily upon secondary empirical records. Relevant information has been compiled from the Census of India along with administrative state reports together with published scholarly treatises and contemporary inquiries examining cyclonic occurrences alongside inundation trends together with agricultural vulnerability and livelihood conditions across Purba Medinipur as well as coastal West Bengal.

The analytical inquiry utilizes a conceptual framework wherein environmental disasters shape population movement through intermediate livelihood ramifications. These intermediate channels encompass harvest devastation alongside livestock mortality together with the destruction of dwellings and productive capital assets alongside diminished agricultural hiring together with mounting debt burdens alongside saline water contamination and deteriorating livelihood security. Consequently spatial mobility represents not merely an unmediated reaction toward climatic disruptions but operates as the structural outcome of the ongoing interaction between environmental pressures and socio economic vulnerability.

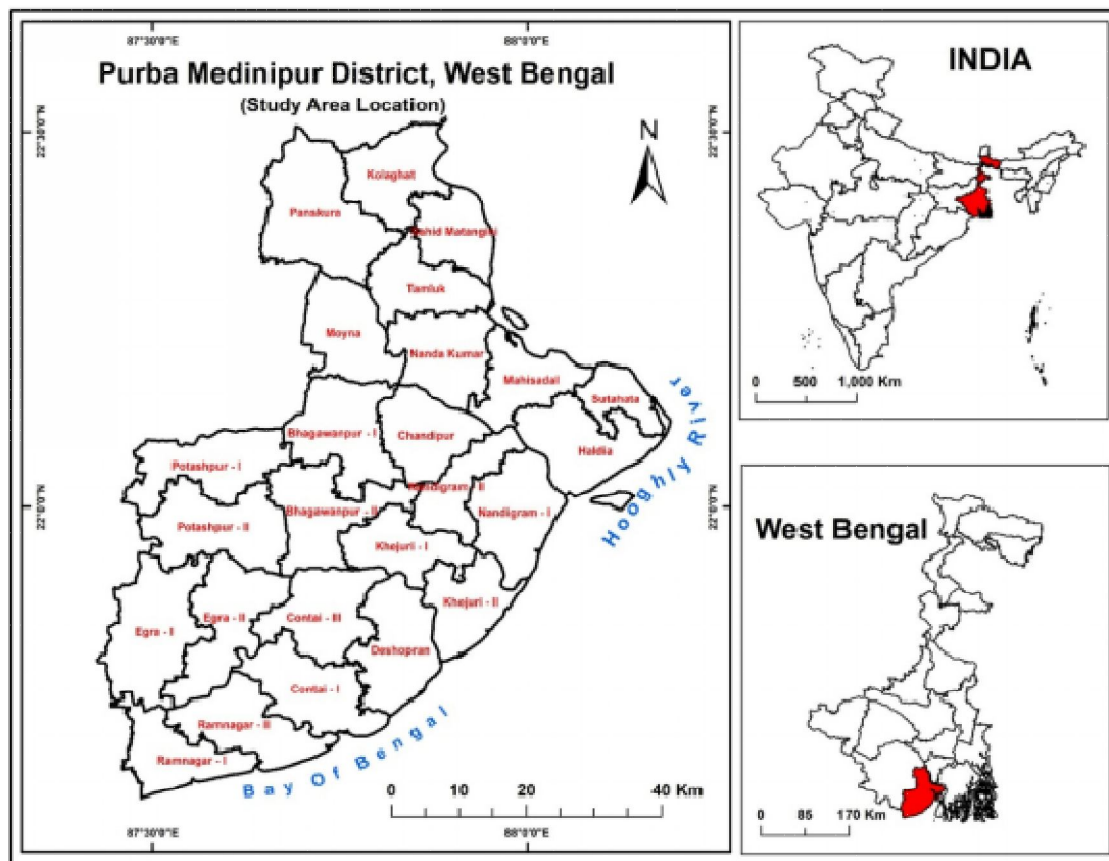


Fig 1: Study Area location map

Results and Discussion

Climate Disaster Vulnerability of Purba Medinipur: The geographical configuration of Purba Medinipur renders its agrarian population exceptionally vulnerable to environmental disruptions. Littoral and depression zones face persistent exposure to cyclonic gales alongside storm surges together with tidal inundations and saline water infiltration. Empirical flood risk scholarship establishes that both inundation recurrence alongside the socioeconomic susceptibility of rural settlements govern spatial disparities in disaster exposure across the administrative territory (Gayen et al., 2022).

Cyclonic systems hold critical significance because their operational ramifications transcend immediate infrastructural devastation. Violent gales and coastal surges frequently dismantle residential structures alongside transit routes together with containment embankments alongside cultivated parcels together with piscicultural gear and domestic livestock. Subsequent chronic waterlogging alongside residual soil salinity continuously suppress agrarian yields long after the atmospheric disturbance has dissipated.

The destructive trajectory of Cyclone Amphan exemplifies this interconnected systemic fallout. Empirical assessments evaluating Cyclone Amphan across West Bengal identified pervasive submersion alongside catastrophic destruction of crop acreage and vegetative cover encompassing tracts across Purba Medinipur (Chakraborty et al., 2021). Furthermore recent field analyses focused specifically upon the littoral blocks of Purba Medinipur established severe storm induced agronomic devastation generated by Cyclone Fani alongside Cyclone Amphan together with Cyclone Yaas confirming the destabilizing role of recurrent environmental shocks across rural sustenance systems.

Climate Disasters and Rural Out-Migration: Environmental catastrophes catalyze spatial relocation primarily by undermining the economic solvency of agrarian domestic units. A family unit reliant upon

agricultural cultivation frequently endures immediate harvest eradication following a cyclonic or inundation shock. Whenever productive capital assets including livestock herds alongside maritime equipment or agricultural machinery suffer concurrent destruction economic reconstitution becomes increasingly intractable. When localized rural labor markets contract domestic members increasingly pursue employment alternatives beyond the perimeter of the village or home district.

The domestic mobility determination can be conceptualized through the following progressive continuum



Population mobility may initially manifest as a temporary or seasonal coping mechanism. A male household constituent frequently relocates to an urban core or an adjacent administrative district to engage in construction alongside freight transport together with manufacturing alongside culinary hospitality or diverse alternative informal labor sectors. Whenever repeated environmental calamities impede domestic recovery temporary spatial movement progressively transitions into more frequent or extended displacement cycles.

Empirical evidence from rural India corroborates the extensive nexus connecting detrimental meteorological conditions with migratory behavior. Scholarship by Gray and Mueller (2012) established that environmental disturbances exert substantial pressure upon mobility determinations although this behavioral response fluctuates substantially across differing household attributes alongside localized survival systems. In a comparable manner Dallmann and Millock (2017) demonstrated that meteorological disruptions actively reshape demographic mobility configurations throughout developing country environments.

A notably salient Indian investigation by Bohra-Mishra et al. (2020) confirmed that adverse meteorological disturbances across rural India significantly accelerate rural to urban population transfers particularly toward destination corridors situated beyond the home state of the migrant. Their analytical findings establish that climatic parameters steer both the fundamental determination to relocate alongside the geographic selection of the receiving destination chosen by outbound individuals.

Cyclones, Agricultural Loss and Migration Pressure: Agrarian production establishes a foundational nexus connecting environmental crises with demographic outflows throughout Purba Medinipur. Rural domestic units reliant upon agrarian cultivation remain susceptible not merely to the instantaneous decimation of standing harvests but likewise to protracted environmental deterioration across pedological properties and hydrological reserves.

The systemic fallout triggered by Cyclone Yaas substantiates this functional relationship. Khatun et al. (2022) revealed that approximately 239.69 square kilometers across Purba Medinipur suffered extensive inundation subsequent to Cyclone Yaas wherein agricultural parcels comprised the overwhelming proportion of the submerged expanse. Such extensive agronomic degradation erodes aggregate domestic earnings alongside localized labor absorption while drastically escalating the financial investments requisite for subsequent agricultural rehabilitation.

Contemporary investigations focused upon the coastal tracts of Purba Medinipur similarly demonstrate the cumulative repercussions generated by recurrent cyclonic events upon agrarian productivity. A 2026 inquiry interrogating the impacts of Cyclone Fani alongside Cyclone Amphan together with Cyclone Yaas documented extensive agronomic destruction particularly originating from Cyclone Amphan while classifying cyclonic submersion as a catastrophic hazard confronting cultivated acreages across coastal

administrative blocks. These empirical observations indicate that chronic environmental disturbances steadily diminish the operational viability of agrarian family units to depend solely upon indigenous cultivation practices.

Among marginal and smallholder agricultural producers the socioeconomic ramifications prove exceptionally acute. Pervasive harvest devastation frequently compels domestic units to contract institutional or informal loans to satisfy immediate sustenance requirements alongside subsequent farming resumption expenses. When successive environmental disasters unfold prior to the complete settlement of accumulated debts geographic mobility emerges as an indispensable mechanism to secure supplementary external income streams.

Salinity, Livelihood Transformation and Migration: Saline water intrusion constitutes a less conspicuous yet profoundly persistent consequence of coastal environmental shocks. Storm surges alongside severe inundations routinely inject saline water into arable fields together with freshwater reservoirs which severely diminishes agricultural productivity while destabilizing livestock sustenance alongside inland fisheries.

Recent field investigations conducted across Ramnagar I and Ramnagar II blocks within Purba Medinipur documented substantial transformations across agricultural plots alongside freshwater bodies and rural habitation zones directly associated with flood inundation together with escalating soil salinity. That empirical inquiry likewise identified severe post disaster employment deficits among surveyed rural residents. Such extensive disruption to rural survival systems substantially heightens the economic appeal of alternative employment avenues located beyond the boundaries of the impacted territory.

This empirical pattern demonstrates that climate driven population mobility does not inevitably stem from an isolated catastrophic occurrence. Rather recurrent lower intensity environmental disturbances combined with progressive ecological degradation frequently compound over time. A family unit that weathers an initial cyclonic event without resorting to geographic relocation may ultimately determine to dispatch one or more working members elsewhere after confronting successive crop failures alongside persistent unyielding unemployment and escalating debt burdens.

Migration as a Household Adaptation Strategy: Outward demographic relocation must not be uniformly characterized as involuntary physical displacement. Across diverse rural domestic units spatial mobility serves as a calculated adaptive mechanism. A family frequently preserves its ancestral dwelling alongside its agricultural acreage while delegating a single member to another geographic destination to secure gainful employment. Financial remittances generated through such mobility subsequently reinforce domestic nutritional consumption alongside educational continuity together with essential medical care alongside structural dwelling restoration and post calamity agricultural rehabilitation.

The conceptual differentiation separating distress migration from adaptive migration assumes critical importance in this context. Distress migration manifests when domestic units relocate primarily because they possess insufficient capital reserves to sustain economic solvency following an environmental catastrophe. Conversely adaptive mobility reflects premeditated temporary relocation designed to diversify domestic income portfolios while diminishing acute dependency upon climate vulnerable subsistence activities.

The Groundswell analytical framework formulated by the World Bank similarly conceptualizes internal climate induced population shifts as a dynamic driven by contracting agricultural productivity alongside acute hydrological stress and related environmental transformations while underscoring that mobility trajectories remain heavily conditioned by prevailing development baselines alongside domestic adaptation capabilities (World Bank, 2021).

Within the specific geographic context of Purba Medinipur migration delivers a complex mixture of prospective advantages and structural vulnerabilities. Inflowing remittances can substantially fortify

household resilience yet the prolonged absence of prime working age constituents often elevates uncompensated domestic labor for women while depleting the localized pool of available agricultural labor alongside domestic caregiving support.

Household and Social Consequences: Climate catalyzed outward migration triggers profound restructuring across rural domestic systems. Following the outbound relocation of adult members women frequently absorb primary responsibility across agrarian management along with domestic financial administration together with child rearing and elderly support. Dependent children may endure diminished parental oversight while elderly family constituents become increasingly reliant upon remaining relatives.

Concurrently migratory earnings supply vital economic stability. Domestic units receiving predictable remittance flows exhibit greater financial capacity to reconstruct damaged dwellings alongside procuring modern agrarian inputs together with funding formal educational requirements and meeting critical healthcare expenditures.

As a direct consequence the demographic ramifications of climate induced population movement remain fundamentally contradictory. Spatial mobility can augment aggregate domestic earnings while simultaneously depleting the physical presence of productive working age adults. It facilitates livelihood diversification yet amplifies localized caregiving obligations. The ultimate developmental outcome remains governed by the temporal duration of migration alongside destination characteristics together with employment safety conditions alongside disaster recurrence intervals and the consistent reliability of incoming remittance flows.

Table 1: Major Climate Disasters and Potential Migration Effects in Purba Medinipur

Climate-related hazard/event	Quantitative evidence	Major livelihood impact	Potential migration response
Cyclone Amphan, 2020	43,408 ha of agricultural land inundated; 32,550 ha of crop area affected in Purba Medinipur	Extensive crop loss, waterlogging and disruption of agricultural livelihoods	Temporary/seasonal labour migration
Cyclone Yaas, 2021	239.69 km ² (5%) of the district affected by flooding; about 95% of flooded area was agricultural land/ cropland	Crop damage, prolonged inundation and loss of agricultural income	Short-term and livelihood-related migration
Storm surge and coastal flooding	Yaas flooding affected areas up to 18 m elevation, with greatest inundation below 5 m	Inundation of low-lying agricultural land and damage to rural assets	Temporary migration and occupational diversification
Agricultural damage from repeated cyclones	Recent assessment estimates severe damage to about 542 km ² (40%) of cropland from Amphan and about 78 km ² (5.77%) from Yaas	Declining agricultural productivity and increased livelihood insecurity	Seasonal/longer-term out-migration
Soil salinity and saline-water	Particularly significant in low-lying coastal areas following cyclone-	Reduced agricultural productivity and changes	Occupational migration and

intrusion	induced flooding	in farming practices	diversification into non-farm work
Repeated climate disasters	Multiple major cyclones, including Fani (2019), Amphan (2020) and Yaas (2021), affected the coastal region	Recurrent asset loss, income instability and recovery costs	Greater possibility of prolonged or repeated out-migration
Coastal erosion	Localised loss of agricultural and residential land in vulnerable coastal areas	Loss of productive assets and displacement pressure	Relocation or longer-term migration

Sources: Das et al. (2022); Khatun et al. (2022); recent assessment of agricultural cyclone damage in coastal Purba Medinipur. The migration responses represent analytical interpretations rather than direct enumerations of migratory individuals.

The quantitative empirical documentation establishes the immense magnitude of climate driven livelihood disruption throughout Purba Medinipur. During the passage of Cyclone Amphan approximately 43,408 hectares of agrarian acreage experienced severe flooding while estimated standing crop inundation reached 32,550 hectares across the district.

The destructive consequence of Cyclone Yaas proved similarly extensive given that approximately 239.69 square kilometers representing 5% of the total geographical expanse of the district suffered submersion and roughly 95% of the inundated territory comprised cultivated farmland.

Contemporary satellite based assessments establish that Cyclone Amphan inflicted severe devastation across roughly 542 square kilometers representing 40% of the aggregate cropland area whereas Cyclone Yaas severely compromised approximately 78 square kilometers representing 5.77% of cultivated fields.

Such recurrent agronomic destruction progressively suppresses domestic earnings while intensifying dependence upon external credit channels and undermining the structural capacity of agrarian households to maintain cultivation as their primary economic foundation. Consequently population mobility emerges as an indispensable coping and income diversification mechanism especially among marginal domestic units constrained by acute landlessness alongside irregular employment and negligible financial reserves.

Table 2: Impact of Climate Disasters on Rural Out-Migration in Purba Medinipur

Climate Disaster / Environmental Stress	Quantitative / Documented Evidence	Major Livelihood Impact	Migration Mechanism	Likely Migration Pattern
Cyclone Amphan (2020)	About 43,408 ha of agricultural land inundated; approximately 32,550 ha of crop area affected in Purba Medinipur	Crop loss, waterlogging, damage to agricultural assets and reduction in farm income	Loss of agricultural income → employment insecurity → search for alternative work	Temporary and seasonal out-migration
Cyclone Yaas (2021)	About 239.69 km² (5%) of the district	Extensive crop damage,	Agricultural loss → income reduction →	Temporary, seasonal and

	affected by flooding; approximately 95% of flooded area was agricultural	prolonged inundation and loss of agricultural employment	dependence on non-farm employment	livelihood-related migration
Repeated Cyclones (Fani, Amphan and Yaas)	Multiple major cyclonic events affected coastal areas within a relatively short period	Repeated crop and asset losses; increased recovery costs and livelihood instability	Recurrent shocks → reduced capacity for local livelihood recovery → diversification through migration	Repeated or prolonged out-migration
Storm Surge and Coastal Flooding	Low-lying coastal areas are particularly exposed; Yaas flooding was concentrated in areas of lower elevation	Damage to crops, houses, livestock, roads and productive assets	Asset destruction → reduced household economic capacity → search for employment elsewhere	Temporary migration and household-level labour migration
Saline-Water Intrusion	Particularly important in vulnerable coastal and low-lying areas following cyclone-induced flooding	Soil degradation, reduced agricultural productivity and changes in farming practices	Declining farm productivity → reduced local employment → occupational diversification	Seasonal and longer-term out-migration
Agricultural Land and Crop Loss	Recent assessments indicate substantial cropland damage following major cyclones, particularly Amphan	Reduced agricultural production and household income	Crop failure → indebtedness and livelihood insecurity → migration for income	Seasonal and longer-term migration
Livestock and Productive-Asset Loss	Cyclones and flooding can damage livestock, fishing equipment, machinery and other productive assets	Loss of household productive capacity and increased recovery expenditure	Asset loss → reduced earning capacity → dependence on external employment	Temporary and circular migration
Coastal Erosion	Localised loss of agricultural and residential land in vulnerable coastal areas	Loss of land, housing and productive assets	Loss of productive space → displacement and search for alternative livelihoods	Relocation and longer-term migration
Post-Disaster Employment Decline	Disaster-related agricultural and rural livelihood disruption reported in vulnerable coastal blocks	Fewer agricultural and local wage-employment opportunities	Local employment shortage → demand for employment outside the village/district	Seasonal and temporary labour migration
Household Indebtedness	May increase following repeated crop loss,	Reduced household	Debt repayment pressure → migration to generate	Temporary, seasonal or

	asset damage and reconstruction costs	financial security	additional income	prolonged migration
Overall Climate-Livelihood Stress	Interaction of cyclones, flooding, salinity, erosion and agricultural vulnerability	Declining livelihood security and reduced capacity to depend exclusively on agriculture	Environmental shock + socioeconomic vulnerability → migration decision	Temporary, seasonal and longer-term out-migration

Source: Compiled from the studies and secondary sources cited in the article, including Das et al. (2022), Gayen et al. (2022), Khatun et al. (2022), Bohra-Mishra et al. (2020), and Jana and Jana (2026).

Conclusion: Environmental catastrophes constitute an increasingly decisive element shaping the demographic mobility landscape across agrarian Purba Medinipur. Recurring cyclonic disturbances alongside pervasive inundations together with storm surges alongside marine salinity infiltration and corresponding agricultural devastation progressively erode the livelihood security of rural domestic units while catalyzing transient alongside seasonal or extended outward relocation flows.

This dynamic nexus remains neither deterministic nor homogeneous across the population. Ecological disruptions operate synergistically with underlying poverty levels alongside operational farm sizes together with agricultural reliance alongside non farm labor accessibility together with outstanding debt obligations and access to institutional relief mechanisms. Domestic units commanding superior financial reserves frequently leverage spatial mobility as a calculated risk diversification maneuver whereas impoverished households resort to relocation primarily because localized subsistence opportunities have become temporarily or permanently unviable.

The empirical ramifications of Cyclone Amphan alongside Cyclone Yaas underscore the critical necessity of contextualizing demographic movement within the broader paradigm of disaster exposure and agrarian economic restructuring. Contemporary findings from Purba Medinipur establish extensive agronomic and survival shocks originating from storm induced submersion and saline intrusion. Such systemic stresses cultivate intense migratory compulsions when family units repeatedly confront the annihilation of productive capital assets combined with the collapse of localized employment alternatives.

Consequently mitigating environmentally triggered distress mobility does not require the absolute suppression of human movement. Instead institutional policy frameworks should aspire to guarantee that spatial reallocation functions as an autonomous and economically rewarding livelihood pathway. Reinforcing cyclone shelter facilities alongside flood barrier embankments together with advancing climate resilient agricultural practices alongside widening crop and livestock insurance penetration together with stimulating rural employment creation alongside incentivizing salinity tolerant cultivars together with promoting economic diversification and guaranteeing expeditious post disaster compensatory disbursements can substantially diminish the pressures driving distress relocation. Concurrently migrating individuals alongside their resident dependents must secure dependable social safety nets and unhindered access to portable welfare entitlements.

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Citation: Das Mahapatra. S. K., (2026) “Impact of Climate Disasters on Rural Out-Migration in Purba Medinipur”, *Bharati International Journal of Multidisciplinary Research & Development (BIJMRD)*, Vol-4, Issue-07, July-2026.