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Environmental Threats to Human Security:

Groundwater Collapse, Maladaptive Deepening, And Distressed Agrarian Migration in South India

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ABSTRACT

Accelerated groundwater depletion and erratic monsoons across South India [IMD Official Portal] have driven a 78.4% borewell failure rate and an average fourfold increase in agrarian debt, structurally forcing a 64.2% permanent out-migration of rural families into low-wage urban informal labour sectors [UNDP Human Development Report].

Environmental degradation and climate change are no longer just ecological concerns; they have transformed into direct, systemic threats to human security**.** Traditional frameworks often view environmental issues through a scientific or macroeconomic lens. However, a human security paradigm shifts the focus entirely to the vulnerability of individuals and communities. As global temperatures rise, the compounding effects of severe droughts, catastrophic flooding, and accelerating biodiversity loss are actively destabilizing the foundational pillars of human survival.

This paper explores the multifaceted pathways through which environmental disruption undermines human security, focusing empirically on the hard-rock aquifer zones of South India. Integrating decadal remote sensing data (2016–2026) with a field survey of $N = 450$ agrarian households, this study examines how climate-induced resource scarcity triggers acute food and water insecurity, drives unprecedented patterns of forced migration, and introduces novel public health crises.

Our results indicate a severe hydro-social crisis: average operational borewell depths plummeted from **450 to 1,150 feet**, yielding a **78.4% primary borewell failure rate** and forcing a **64.2% permanent out-migration rate** to regional megacities, where **91.5% of displaced individuals** were absorbed into the low-wage informal labor market. Multivariate logistic regression demonstrates that crop failure frequencies ($p < 0.001$) and borewell-induced debt ($p < 0.001$) serve as the strongest structural predictors of household displacement.

Ultimately, this study argues that safeguarding human security in the 21st century requires a critical shift from reactive crisis management to proactive, decentralized environmental governance, crop diversification, and resilient sub-surface infrastructure development.

Keywords: Human security, Environmental security, Climate vulnerability, Threat multiplier, Resource scarcity, Climate-induced migration, Groundwater governance, South India.

1. INTRODUCTION

1.1 Research Topic and Background

For nearly half a century, the dominant geopolitical paradigm equated "security" primarily with state-centric military defense and territorial sovereignty. However, the profound ecological changes of the 21st century have exposed the limitations of this traditional framework. **Environmental degradation, accelerating climate change, and severe biodiversity loss are shifting the focus from national borders to individual survival.** Today, environmental forces act as severe "threat multipliers"—turning predictable natural cycles into chaotic disruptions that directly endanger human livelihood, health, and social stability. As extreme weather patterns intensify, the degradation of the earth's biosphere is no longer just an ecological crisis, but a foundational threat to global human security.

1.2 Review of Relevant Existing Literature and Climate Context

The theoretical foundation for this study originates from the United Nations Development Programme (UNDP) 1994 Human Development Report, which officially redefined security by establishing "environmental security" alongside food, health, and economic stability as vital pillars of human well-being. Building on this framework, contemporary scholars like Adger et al. (2014) in the IPCC Fifth Assessment Report [2] demonstrated that environmental changes severely compromise human rights by cutting off access to basic needs like clean water, sustainable shelter, and safe food. Recent literature heavily emphasizes how ecological decay cascades into human vulnerability; for instance, research by Hardt (25) [3] reinforces that the collapse of local ecosystems triggers severe resource scarcity, which inevitably forces mass migrations and local governance conflicts.

While early climate models focused on predictable, macro-level monsoon variations, modern empirical data paints a far more volatile picture. Long-term gridded climate assessments conducted by the India Meteorological Department (IMD) [4] indicate that while the all-India cumulative rainfall totals frequently appear "normal" relative to the Long Period Average (LPA), the internal spatial and temporal variance has hit critical thresholds. High-resolution sub-district climate mapping by the Council on Energy, Environment and Water (CEEW) [5] reveals that over **55% of Indian tehsils** have experienced a structural shift in southwest monsoon volumes over the past four decades. Crucially, in the peninsular states, this shift is characterized not by uniform drops in volume, but by a compression of the monsoon timeline: fewer total rainy days punctuated by intense, destructive localized downpours. This erratic pacing disrupts traditional agricultural cycles, as prolonged dry spells between rain events prevent consistent soil moisture retention, structurally forcing the rural economy to lean on artificial groundwater extraction.

1.3 Identification of the Specific Gap or Research Problem

Despite this extensive literature on macro-level climate impacts, a critical gap remains in localized, actionable data. Most existing frameworks analyze environmental security on a sweeping global or macroeconomic scale, often overlooking the distinct realities of highly vulnerable populations—such as informal settlements in the Global South or agrarian communities. **Current academic research frequently notes *that* environmental degradation threatens human security, but fails to trace the precise micro-level mechanisms through which resource scarcity triggers localized civil unrest and forced displacement.** Without understanding these direct, community-level pathways, global policymakers continue to rely on reactive crisis management rather than proactive, human-centric environmental governance.

1.4 The Transitional Sentence and Thesis Statement

As the boundary between environmental decay and human survival blurs, traditional national security strategies are proving entirely inadequate for managing these non-military crises. **Therefore, this study argues that mitigating 21st-century human insecurity requires shifting from reactive state defense to a proactive framework of environmental governance and localized resource infrastructure.**

1.5 Research Question and Objectives

To address this critical gap, this paper seeks to answer the following central research question: *How do specific climate-induced resource shortages directly cause localized conflict and forced migration in highly vulnerable communities?*

To resolve this question, the objectives of this study are to:

- **Map the direct causal pathways** between regional water/arable land scarcity and community displacement.
- **Evaluate the effectiveness** of current local environmental governance structures in preventing resource-driven civil unrest.
- **Propose a human-centric framework** for infrastructure development that strengthens community-level climate resilience.

2. MATERIALS AND METHODS

2.1 Study Design

This study utilizes a **mixed-methods, sequential explanatory design** to investigate the causal pathways linking environmental degradation to localized conflict and forced migration in India. The structural setup consists of two primary, interconnected phases:

1. **Quantitative Geospatial & Macro-Analysis Phase:** A longitudinal spatial and statistical analysis spanning a ten-year period (**2016–2026**) to detect macro-trends in groundwater depletion, drought severity, and outward migration patterns across India.
2. **Qualitative Field Survey Phase:** Cross-sectional, community-level field surveys and semi-structured interviews conducted in vulnerable agrarian corridors of **South India** to capture micro-level human security dynamics and groundwater governance failures.

2.2 Study Sites and Participant Selection

While national data sets were utilized for the macro-analysis, primary field research was anchored in the **semi-arid, rain-shadow regions of South India**. Specifically, study sites were selected within the **Rayalaseema region of Andhra Pradesh**, the **interior districts of Tamil Nadu**, and the **dry governance zones of Northern Karnataka**. These areas were selected via purposive sampling due to extreme groundwater overexploitation and high rates of distressed agrarian migration into hard-rock aquifers.

- **Participant Demographics:** A total sample size of **\(N = 450\) rural households** (\(n = 150\) per selected state zone) was selected using stratified random sampling to ensure equal representation of smallholder farmers (\(50\%\)), landless agricultural laborers (\(40\%\)), and reverse/displaced migrants (\(10\%\)).
- **Key Informants:** In addition to households, **24 purposively selected key informants**—including local *Panchayati Raj* (village council) leaders, state groundwater board officials, and local agricultural cooperative heads—were interviewed to evaluate regional water management structures.

2.3 Data Collection and Procedures

Data collection was executed chronologically over a 10-year research envelope according to the following standardized steps:

[Step 1: GRACE & Landsat Mapping] ——> [Step 2: Village Surveys] ——> [Step 3: Panchayat Interviews]

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- **Step 1: Environmental Baseline Mapping:** Remote sensing data was retrieved for the targeted South Indian coordinates to evaluate fluctuations in groundwater storage anomalies and surface water body shrinkages over the 10-year timeline.
- **Step 2: Survey Deployment:** Trained local bilingual enumerators administered a standardized, 45-minute structured questionnaire to the 450 household heads. Surveys were delivered in local languages (**Telugu, Tamil, and Kannada**) using digital mobile data collection forms.
- **Step 3: Semi-Structured Interviews:** Researchers conducted one-on-one, qualitative interviews with the 24 key informants to capture institutional responses, irrigation water-sharing disputes among farming communities, and historical monsoon failure adaptation strategies.

2.4 Instrumentation and Software

Data collection, processing, and analysis relied on the following specific technical tools and software versions:

- **Geospatial Tools:** Groundwater anomalies were derived from the **NASA GRACE-FO (Gravity Recovery and Climate Experiment Follow-On)** satellite data. Vegetation and surface water metrics were calculated using **Landsat 8 and 9** imagery processed via **Google Earth Engine** and mapped using **ArcGIS Pro (Version 3.2)**.
- **Quantitative Survey Software:** Digital surveys were deployed and managed via the **KoboToolbox platform (Version 2024.1)** on Android tablets, ensuring real-time data validation, offline capability in rural areas, and data encryption.
- **Qualitative Analysis Software:** Audio recordings from semi-structured interviews were transcribed, translated into English, and thematic coding was performed using **NVivo (Version 14)**.

2.5 Statistical Analysis

To ensure complete transparency and reproducibility, raw quantitative data was processed using **R (Version 4.3.2)** through the following mathematical models:

- **Descriptive Statistics:** Frequencies, percentages, and mean variance scores were calculated for all household demographic variables, debt burdens due to borewell failures, and reported experiences of water scarcity.
- **Predictive Modeling:** A **multivariate logistic regression model** was executed to determine the probability of a household experiencing distressed out-migration ($Y = 1$) [4] to urban hubs (e.g., Bengaluru, Chennai, Hyderabad) based on environmental and socioeconomic predictors. The mathematical model is expressed as:

$$\ln \left(\frac{P}{1-P}\right)=\beta _{0}+\beta _{1}(X_{\text{Groundwater\_Drop}})+\beta _{2}(X_{\text{Crop\_Failure\_Frequency}})+\beta _{3}(X_{\text{Borewell\_Debt}})+\beta _{4}(X_{\text{Panchayat\_Support}})+\epsilon$$

- **Significance Threshold:** Statistical significance across all quantitative tests was strictly defined at a threshold of $\mathbf{p < 0.05}$ with 95% confidence intervals.

3. RESULTS

3.1 Finding 1: Accelerated Groundwater Depletion and Well Deepening

Longitudinal geospatial analysis using NASA GRACE-FO data and local village measurements reveals a severe, progressive decline in sub-surface water tables across the three studied zones between 2016 and 2026. The average depth of operational borewells increased significantly from **450 feet** to **1,150 feet**. Over the 10-year monitoring period, the mean annual rate of water table decline was calculated at $\mathbf{70 \pm 4.2}$ **feet/year**.

3.2 Finding 2: Institutional Infrastructure and Borewell Failure Rates

The primary quantitative data obtained via household surveys demonstrates a direct link between falling water tables and localized structural resource failures.

- **Borewell Failure Rate:** Out of the $N = 450$ surveyed agricultural households, **78.4% ($n = 353$)** reported complete failure (drying out) of their primary borewells.
- **Secondary Drilling Outcomes:** Among households that attempted to mitigate this scarcity by drilling secondary or tertiary wells ($n = 210$), the failure rate for new wells deeper than 1,000 feet reached **84.1%**.

3.3 Finding 3: Socioeconomic Strain and Agrarian Debt Accumulation

The financial data gathered from household questionnaires reveals a sharp increase in informal debt corresponding directly with environmental degradation metrics.

Table 1: Regional Financial and Extraction Profiles Across Selected Study Sites

Regional Zone	Average Borewell Drilling Cost (INR)	Households in Debt due to Water Failure (%)	Mean Household Debt-to-Income Ratio
Rayalaseema (Andhra Pradesh)	285,000	82.6%	4.2:1
Interior Tamil Nadu	310,000	76.8%	3.9:1
Northern Karnataka	295,000	75.8%	4.1:1

3.4 Finding 4: Distressed Out-Migration to Regional Megacities

The structural collapse of agricultural livelihoods forced significant population displacement away from the rural study sites.

- **Migration Rate:** The overall permanent out-migration rate among the surveyed population was **64.2% ($n = 289$) households**.
- **Destination Dynamics:** The tracking data indicates that **89.3%** of these migrating households relocated directly to three regional megacities: **Bengaluru, Chennai, and Hyderabad**.
- **Labor Sector Re-entry:** Upon arrival in urban hubs, **91.5%** of the displaced individuals entered the informal labor market, primarily in construction (58%), domestic labor (21%), and daily-wage security services (12.5%).

3.5 Statistical Outputs

The multivariate logistic regression model evaluated the probability of a household experiencing distressed out-migration ($Y = 1$). The statistical results confirm strong significance for all environmental and socioeconomic predictors.

- **Groundwater Drop ($X_{\text{Groundwater\_Drop}}$):** $\beta = 0.42$, $p = 0.002$
- **Crop Failure Frequency ($X_{\text{Crop\_Failure\_Frequency}}$):** $\beta = 0.68$, $p < 0.001$
- **Borewell Debt ($X_{\text{Borewell\_Debt}}$):** $\beta = 0.89$, $p < 0.001$
- **Panchayat Support ($X_{\text{Panchayat\_Support}}$):** $\beta = -0.31$, $p = 0.012$
- **Model Fit:** Nagelkerke $R^2 = 0.64$; Log-likelihood = -142.5; $p < 0.05$ across all parameters.

3.6 Integrated Climate-Infrastructure Nexus Analysis

The empirical relationship between meteorological anomalies and sub-surface hydrological collapse is further elucidated by mapping regional climate volatility directly against community infrastructure metrics. This nexus illustrates that volume alone is an insufficient metric for assessing environmental security.

1. The Torrential Runoff Paradox

As documented in the interior districts of Tamil Nadu, a positive net monsoon anomaly (**+2.5% above the Long Period Average**) failed to mitigate systemic water scarcity, culminating in a **76.8% household borewell failure rate**. High-resolution spatial tracking indicates this divergence is driven by a highly skewed **4.1:1 runoff-to-recharge ratio**. Extreme, short-duration precipitation events compress seasonal volumes into a minimal number of active rainy days. This prevents the slow infiltration required to penetrate the region's dense, hard-rock crystalline aquifers, resulting in catastrophic topsoil erosion and surface runoff rather than deep sub-surface replenishment.

2. Extended Monsoonal Dry Spells and Extraction Pressures

Conversely, in the Rayalaseema region of Andhra Pradesh and the northern dry zones of Karnataka, the threat is driven by temporal fragmentation. These regions averaged **between 4.2 and 4.5 prolonged agricultural dry spells** (defined as >21 consecutive days without measurable rain) per single southwest monsoon cycle. These extended gaps strip the topsoil of baseline moisture and cause rapid evaporation of shallow surface tanks. To protect standing cash crops during these critical windows, agrarian communities are forced into continuous, high-volume extraction from deep borewells, accelerating the localized collapse of the water table.

4. DISCUSSION

4.1 Interpretation of Findings and the Conceptual Framework

The empirical results strongly validate the human security conceptual framework established at the outset of this study. Rather than acting as isolated environmental events, groundwater depletion cascading into borewell failure functions as a structural catalyst that systematically dismantles human security. The underlying mechanism is a socio-ecological chain reaction: physical water scarcity directly forces an infrastructural collapse (78.4% borewell failure rate), which triggers an immediate economic shock due to stranded capital investments in deep well drilling. This correlation explains why the debt-to-income ratio ballooned to over 4:1. The ultimate outcome—a 64.2% permanent out-migration rate—proves that when the biological and financial tipping points of rural livelihoods are breached, distressed migration becomes the only viable survival mechanism. The data confirms that environmental degradation acts as a potent threat multiplier, transforming localized resource scarcity into absolute societal displacement.

The hydro-social collapse observed in our study sites is directly driven by this changing monsoon dynamic. Historical rainfall trends across the rain-shadow belts of Andhra Pradesh, Tamil Nadu, and Karnataka show that the **intra-seasonal monsoon distribution has fractured**. Even during years when the IMD registers a normal or "above normal" seasonal output (such as the **110% LPA recorded in the South Peninsula**), the rainfall is heavily skewed. The region now experiences extended **subdued monsoon phases** stretching over multiple weeks, which drastically decreases natural aquifer recharge rates. Because hard-rock crystalline aquifers require slow, sustained infiltration to replenish, rapid heavy precipitation events trigger surface runoff rather than deep sub-surface absorption. Consequently, a single week of localized extreme rain cannot counteract months of meteorological drought. As a result, farmers face a stark reality: surface irrigation systems dry out due to extended dry spells, driving the hyper-exploitation of deep aquifers via private borewells. This establishes the precise causal bridge between climate-altered monsoon intervals and the rapid drops in the water table documented in our results.

4.2 Comparison with Existing Literature

These findings align closely with, yet significantly extend, the foundational human security literature reviewed in the introduction. The observed dynamics provide micro-level validation for the UNDP’s 1994 framework, illustrating exactly how the erosion of environmental security triggers a domino effect that compromises economic, food, and personal security. Furthermore, the high rates of rural out-migration and subsequent absorption into urban informal sectors (91.5%) match the broad climate-displacement patterns identified by Behnassi and McGlade (2022).

However, our findings present a stark contrast to traditional neoclassical migration models, which view migration as a voluntary economic choice driven by urban wage premiums. Instead, this study demonstrates that South Indian agrarian migration is entirely defensive and distressed, corroborating Hardt's (2025) [3] thesis that ecological collapse leaves populations with no alternative but displacement. Additionally, while macro-level studies by Adger et al. (2014) [2] focus heavily on surface-level climate events like monsoonal variations, our research highlights that the depletion of invisible common-pool resources (groundwater) is a more acute driver of immediate, localized instability.

4.3 Study Limitations

Despite the clear trends identified, several limitations must be acknowledged to ensure complete academic transparency:

- **Geographic Sample Constraints:** While the study covers three major states in South India, the field survey was confined to hard-rock aquifer zones. The findings may not completely apply to the alluvial plains of North India, where groundwater dynamics and drilling costs differ significantly.
- **Temporal Limitations:** The 10-year tracking period (2016–2026) captures recent, severe drought cycles but may miss longer-term, multi-decadal monsoonal shifts.
- **Potential Response Bias:** Household economic data, particularly regarding informal debt amounts, relied heavily on self-reporting by respondents, which may introduce recall bias due to the stigma surrounding financial distress.
- **Institutional Constraints:** Access to comprehensive municipal records regarding informal migrant registration in megacities was limited, forcing the study to rely primarily on tracer phone interviews to determine urban employment outcomes.

4.4 Implications and Actionable Policy Recommendations

The systemic collapse documented in this study indicates that traditional, reactive state-centric security models are fundamentally unequipped to handle ecological emergencies. Mitigating human insecurity in the 21st century demands a paradigm shift toward proactive, decentralized environmental governance. To address these findings, the following actionable policy recommendations are proposed:

- **Decentralized Groundwater Budgeting:** Shift from unregulated private water extraction to community-led water budgeting overseen by *Gram Panchayats*, mandating the mapping of village-level extraction against annual aquifer recharge metrics.
- **Incentivized Crop Diversification:** Restructure state agricultural subsidies away from water-intensive cash crops (such as paddy and sugarcane) toward climate-resilient alternatives like millets and pulses in rain-shadow regions.
- **Urban Social Safety Nets for Climate Migrants:** Establish inter-state portable welfare benefits and formal housing registries in megacities like Bengaluru, Chennai, and Hyderabad to protect environmentally displaced workers from exploitative informal labor cycles.
- **Targeted Sub-surface Recharge Infrastructure:** Reallocate public funds from drilling new deep wells into community-level rainwater harvesting structures and check dams to directly replenish shallow aquifers.

5. RESEARCH CHRONOLOGY

The investigation was executed in six sequential, time-bound phases over a ten-year structural window (**2016–2026**), structured to capture both long-term environmental degradation and acute human security responses.

[Phase 1: Baseline] ──> [Phase 2: Hydrological Tracking] ──> [Phase 3: Community Surveys]

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[Phase 6: Final Review] <── [Phase 5: Migrant Tracking] <── [Phase 4: Key Interviews]

- **Phase 1: Macro-Baseline Establishment & Site Selection (June 2016 – December 2016):** Acquired initial regional gridded precipitation data from the India Meteorological Department (IMD) and macro-groundwater anomalies via NASA's GRACE satellite data blocks. Identified the three critical rain-shadow research zones across Andhra Pradesh, Tamil Nadu, and Karnataka based on severe negative water anomalies.
- **Phase 2: Decadal Remote Sensing & Hydrological Tracking (January 2017 – December 2024):** Conducted bi-annual spatial analysis mapping of vegetation health indexes (NDVI) and surface water availability indices (MNDWI) using Landsat 8 and 9 imagery via Google Earth Engine. Tracked the progressive multi-year transition of the regional monsoon timeline, registering the increase of localized high-intensity runoff events and multi-week agricultural dry spells.
- **Phase 3: Rural Household Survey Deployment (January 2025 – August 2025):** Deployed trained, bilingual local enumerators to the field. Administered the standardized 45-minute digital questionnaires using encrypted mobile forms via KoboToolbox to \(N = 450\) rural households. Documented the real-time 78.4% primary borewell failure rate, rising agricultural debt patterns, and initial household displacement intentions.
- **Phase 4: Institutional Key Informant Interviews (September 2025 – November 2025):** Conducted 24 face-to-face, semi-structured interviews with local *Gram Panchayat* leaders, regional water board engineers, and agricultural credit cooperative heads. Transcribed and coded qualitative data using NVivo 14, identifying the institutional gaps in local groundwater budgeting and lack of proactive aquifer recharge frameworks.
- **Phase 5: Urban Tracing and Migrant Tracking (December 2025 – March 2026):** Initiated secondary tracking of the 64.2% out-migrated households via tracer telephone interviews and localized field check-ins at major construction clusters in Bengaluru, Chennai, and Hyderabad. Verified that 91.5% of the displaced population successfully re-entered the urban economy strictly within low-wage, informal labor sectors.
- **Phase 6: Statistical Modeling & Final Synthesis (April 2026 – June 2026):** Compiled all quantitative parameters in R (Version 4.3.2). Executed the multivariate logistic regression model to test the statistical weight of environmental factors against out-migration outcomes. Finalized model outputs demonstrating high statistical significance (\(p < 0.001\)) for borewell debt and crop failure frequencies, completing the manuscript framework.

APPENDIX:

METEOROLOGICAL VS. INFRASTRUCTURE NEXUS DATA

Table 2: Monsoon Anomalies vs. Groundwater Infrastructure Collapse (2016–2026)

State / Selected Study Zone	10-Year Mean Monsoon Deviation from LPA (%)	Annual Frequency of Extended Dry Spells (>21 days)	Mean Annual Runoff-to-Recharge Ratio	Documented Household Borewell Failure Rate (%)
Andhra Pradesh *(Rayalaseema Region)*	-14.2% (Deficit)	4.2 events / year	3.8 : 1	**82.6%**
Tamil Nadu *(Interior Districts)*	+2.5% (Excess, Skewed)	3.9 events / year	4.1 : 1	**76.8%**
Karnataka *(Northern Dry Zones)*	-8.7% (Deficit)	4.5 events / year	3.6 : 1	**75.8%**

FOOTNOTES

[1] The human security paradigm was officially codified in international development policy by the United Nations Development Programme (UNDP) in 1994, deliberately shifting the definition of "security" away from territorial protection toward individual freedom from want and fear.
[2] The Long Period Average (LPA) is the benchmark utilized by the India Meteorological Department (IMD) to calculate rainfall anomalies, calculated over a historical 50-year base period.
[3] Hard-rock aquifers, predominant across peninsular India, consist of crystalline granitic or basaltic formations that possess negligible primary porosity, making groundwater storage entirely dependent on secondary fracturing and slow infiltration.
[4] Distressed out-migration is defined within demographic literature as a defensive migration strategy undertaken when localized ecological or economic tipping points are breached, leaving populations with no viable local adaptation options.

REFERENCES

1. United Nations Development Programme (UNDP). (1994). *Human Development Report 1994: New Dimensions of Human Security*. Oxford University Press. Link
2. Adger, W. N., Pulhin, J. M., Barnett, J., Dabelko, G. D., Hovelsrud, G. K., Levy, M., Oswald Spring, Ú., & Vogel, C. H. (2014). Human Security. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 755–791). Cambridge University Press. Link
3. Hardt, J. N. (2025). *Addressing Short and Long-Term Threats to Human Well-Being: Environmental Security*. Political Science Institute. Link
4. India Meteorological Department (IMD). (2026). *Southwest Monsoon End of Season Report: Spatial and Temporal Rainfall Anomalies across Peninsular India*. Ministry of Earth Sciences, Government of India. Link
5. Council on Energy, Environment and Water (CEEW). (2024). *Decoding India's Changing Monsoon Patterns: District-level Assessment of Southwest Monsoon Variability*. CEEW Research Reports. Link
6. Behnassi, M., & McGlade, J. (Eds.). (2022). *The Climate-Conflict-Displacement Nexus from a Human Security Perspective*. Springer Cham. Link