

Spatial Heterogeneities and Differential Impacts of Climate-Induced Hydromet Hazards on gender-based violence across women's lifecycle in India: An Agroecological Approach

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Abstract

Climate change, a global challenge, is often studied from a homogeneous perspective, though its implications vary based on the type of hazards and disproportionately affect women across the lifecycle. This study assesses the impact of hydrometeorological hazards on gender-based violence in India, focusing on three life trajectories: marriage, partner relationships, and motherhood and identifies spatial hotspots. Regression and geospatial analyses were conducted using data from the Council on Energy, Environment, and Water (CEEW) on climate exposure scores (1970–2019), encompassing floods, cyclones, and droughts (2010–2019), alongside women's well-being data from the Demographic and Health Survey (DHS) (2015–2021). Drought, a slow-onset hazard, was associated with a 3% increase in child marriage, a 26% rise in intimate partner violence (IPV), a 36% increase in dropout from antenatal care, and a 6% rise in miscarriages or stillbirths. In contrast, cyclones, as sudden-onset hazards, resulted in more severe outcomes, including a 10% increase in child marriage, a 27% rise in IPV and miscarriages or stillbirths, and a 59% increase in dropout from antenatal care, likely due to damage to property and livelihoods. These findings highlight the differential effects of droughts, floods, and cyclones on women's lives, emphasising the need for targeted interventions from gendered perspectives.

Keywords: Climate change, Hydromet Hazards, Gender-based violence, Lifecycle

Extended Abstract:

Background and Objectives

Climate change is impacting various aspects of life through the occurrence of sudden extreme weather events and slow-onset events ([Rockström et al., 2023](#)). These events have adverse impacts directly or indirectly on sustainable development goals in general and population health in particular ([Rana et al., 2023](#)), with different intensities, recognising the need for a heterogeneous lens to study their impacts. According to the sixth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC), there are multiple impacts of climate change ranging from mortality, morbidity, malnutrition, an increase in susceptibility to other health problems, including mental health problems, and impairment in cognitive and work performance, with resulting economic impacts due to disruptions of food, health and livelihood systems ([Lee et al., 2023](#)). However, women are disproportionately affected by natural disasters and climate change as it is a multifaceted phenomenon deeply influenced by the complex interplay of socioeconomic factors, cultural norms, and gender dynamics shaping women's experiences and vulnerabilities ([World Bank Group, 2011](#)). These disparities enhance women's climate-induced risks, amplifying their exposure to gender-based violence (GBV) across different stages of their lives.

The [ICRW & UNFPA India \(2004\)](#), [World Bank Group \(n.d.\)](#) and [OECD \(2023\)](#) highlight that gender-based violence may occur throughout a woman's lifecycle, which manifests in the form

of sex-selective abortions, female infanticides, girl child marriage, sexual abuse, domestic violence, differential access to care, nutrition, health, economic abuse etc. Around 303,000 women die due to preventable causes associated with pregnancy and childbirth; 18 per cent of early adolescent girls experience sexual abuse; 12 million girls witness girl child marriage; women are more likely affected by infectious diseases and witness many health problems in their post-reproduction years, globally (WHO, 2019). Climate change is said to be a “threat multiplier” (UN Women, 2022), it intensifies the already existing challenges in women’s lives through an interplay of socioeconomic, political and legal barriers like limited access to financial resources, burden of unpaid work, discriminatory laws, lack of voice in decision making, limited land ownership and lack of technology and capacity building resources and existing patriarchal system (Gunawardena, 2020).

This study aims to understand the impact of climate change on women’s lives in terms of gender-based violence. The objective of this study is two-fold; firstly, it attempts to identify the spatial hotspots across agroecological zones where climate change is coexisting with gender-based violence. Secondly, it analyses the differential impacts of climate-induced hydromet hazards on gender-based violence. Aligning with the World Bank, ICRW & UNFPA India and OECD frameworks, this study focuses on gender-based violence across three stages of women’s lives, that is, marriage, partner-relationship and motherhood. The unique contribution of this study lies in two aspects: one, it traces the impact of climate change on different aspects of violence in women’s lifecycle, and other, it provides a heterogenous lens in understanding the impact of each of the climate-induced hazards. None of the previous studies, to our knowledge, have linked climate change and violence against women from this perspective.

Methods

This study is based on two secondary sources of data: district-level data from the Council on Energy, Environment and Water (CEEW) for climatic indicators and individual-level data from the National Family Health Survey (NFHS), which is equivalent to Demographic and Health Surveys (DHS), for women’s wellbeing indicators.

Climate vulnerability was assessed through two indicators: (1) exposure scores (based on analysis of frequency and intensity of hydromet hazards for the period 1970-2019), and (2) whether a district is exposed to drought, flood, and/or cyclone for the year 2010-19. The implication of climate vulnerability on women was assessed through four indicators: (1) girl child marriage, (2) experiencing Intimate Partner Violence (IPV), (3) miscarriage/stillbirth, and (4) drop-out from the minimum recommended Antenatal Care (ANC). The first indicator represents violence against women at the marriage-related stage of women’s lives; the second one shows in terms of relationship with the partner, and the last two are in terms of motherhood.

The empirical analysis is conducted in two stages. Firstly, a geospatial analysis is undertaken to identify the hotspots where climate change coexists with gender-based violence indicators. Secondly, a pooled regression is carried out where to ensure consistency between the NFHS data and the CEEW data, the two most recent rounds of NFHS, conducted in 2015-16 and 2019-21, were combined to generate the database for 2015-21. The NFHS provides experiences on selected indicators for five years before the survey. By combining the data of women from these two NFHS rounds, data could be obtained for a ten-year period, 2010-21, which is equivalent to hydromet hazards data of CEEW. The objective is to examine the impact of droughts, floods, and cyclones between 2010 and 2019 on the well-being of women surveyed from 2015 to 2021. This study conceptually recognised that exposure to drought, flood or cyclone has a differential impact on women.

Results

Findings reveals that in terms of girl child marriage, Deccan Plateau hot semi-arid ecoregion (AEZ-6), Deccan Plateau and Eastern Ghats hot semi-arid ecoregion (AEZ-7) and Eastern Plain hot subhumid ecoregion (AEZ-13) are major hotspots where there is high prevalence of girl child marriage as well as high exposure score for extreme hydromet hazards. These hotspots cover the states of Andhra Pradesh, Bihar, and parts of Maharashtra (Fig 1). Also, some parts in southern West Bengal, Madhya Pradesh, Uttar Pradesh and Telangana are also vulnerable to the coexistence of girl-child marriage and high exposure scores for extreme hydromet hazards. The hotspots of coexistence of high intimate partner violence and high exposure scores of extreme hydromet hazards are particularly clustered in the southern part of the country, including the states of Karnataka, Andhra Pradesh, Tamil Nadu and parts of Maharashtra (Fig 2).

Table 1 shows the differential impacts of hydromet hazards on violence against women across different stages of women's lives. The odds of girl-child marriage are three per cent higher among women if exposed to drought. In regions affected by drought, families may face economic hardships due to crop failures and loss of livelihoods. Moreover, women shoulder an increased workload during these periods, working longer hours and taking on additional tasks. This added burden often forces girls to drop out of school to help with household responsibilities (Sahu, 2018; Zimmermann, 2011; Calow et al., 2006). In such circumstances, families may resort to marrying off their daughters at a younger age to reduce the financial burden and ensure their well-being.

Fig 1: Map depicting the geospatial analysis of exposure to extreme hydromet hazards and girl-child marriage

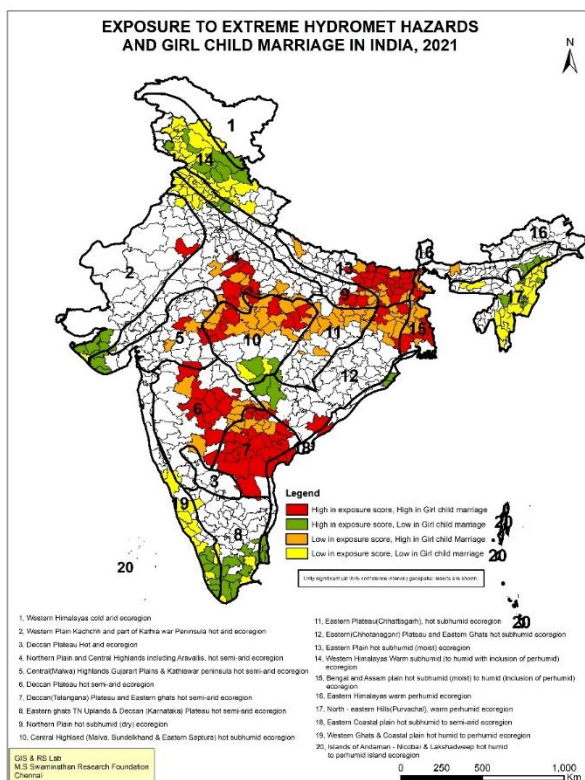


Fig 2: Map depicting the geospatial analysis of exposure to extreme hydromet hazards and prevalence of intimate partner violence (IPV)

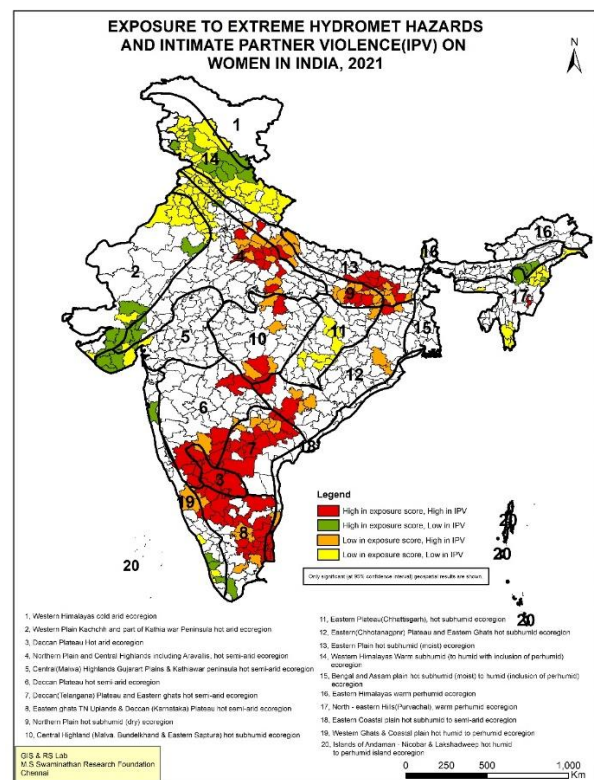


Table 1: Impact of exposure to extreme hydro-met hazards on women-related indicators in India

	Drought	Flood	Cyclone
Girl Child Marriage	+3%	NS	+10%
Intimate Partner Violence	+26%	+7%	+27%
Miscarriage/Still Birth	+6%	NS	+27%
Dropout from minimum recommended Antenatal Care ^{2,3}	+36%	+6%	+59%

Note: This table is derived from adjusted multivariate pooled logistic regression analysis, and percentages describe the likelihood of decrease(-)/ increase(+) of an indicator if exposed to extreme hydro-met events, computed using odds ratio

The above results are significant at a 95% confidence interval, and NS=Not significant

Adjusted for place of residence, social group, wealth status, household with sanitation facility, household with clean water, household with clean fuel, mass media exposure, women's education, number of household members, time

Also, women exposed to drought are found to have 26 per cent higher odds of experiencing intimate partner violence compared to those not exposed to drought. The increase in IPV is possibly due to drought-induced stress and economic strains, resource scarcity, and heightened emotions in times of crisis, resulting in conflicts within households and exacerbating women's vulnerability. Further, our analysis found that exposure to drought-prone regions is likely to increase dropout from the minimum recommended Antenatal Care (ANC) by 36% and miscarriage or stillbirth by about six per cent. During emergencies, the provision of prenatal care and delivery becomes challenging as the health system is overstretched, risking pregnancy complications and childbirth in unsafe conditions, increasing maternal and infant morbidity and mortality (Nour, 2011).

Further, there is a significant increase (+7%) in the likelihood of intimate partner violence against women in flood-exposed areas and 27 per cent likelihood of increase in cyclone-exposed areas. Rai et al., 2021 confirm that women residing in districts affected by cyclones face higher odds of experiencing emotional, physical, and sexual violence compared to those not exposed to cyclones. Disruptions to livelihoods, increased competition for dwindling resources, and heightened insecurities may intensify tensions within households, leading to a surge in incidents of domestic abuse. Floods and cyclones may disrupt or damage healthcare services and infrastructure; consequently, there is a significant increase (+6%) in the likelihood of women dropping out from minimum recommended ANC services when exposed to floods and a significant 59 per cent higher likelihood if exposed to cyclones. In addition, miscarriage or stillbirth is more likely to occur by 27 per cent if exposed to cyclones.

Conclusion

Our findings confirm a major impact of hydromet hazards on girl-child marriages, disruption in access to maternal health care services, increased adverse pregnancy outcomes and most daunting is the significant increase in intimate partner violence (IPV). In addition, this study reveals that certain regions in India exhibit poor status of women due to a range of demographic, social, cultural, economic, or policy-related factors. Importantly, the high exposure scores to hydrometeorological hazards in these areas suggest that climate change may intensify the existing vulnerabilities. The intersection of these socio-economic disadvantages with increasing climate risks underscores the urgency of developing and implementing climate-sensitive strategies with gender-specific considerations in policy responses. Formulating such plans will be crucial for mitigating the adverse effects of climate change and improving resilience in the most vulnerable regions.

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