# The Feminization of Agriculture in Rural India

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# Introduction

The agricultural sector in India has historically relied heavily on women's labor yet has long been impacted by patriarchal structures that prioritize male land ownership, restrict access to formal credit, and overlook women. The Hindu Succession (Amendment) Act (HSAA) of 2005 sought to provide legal parity and recognition for women's stakes in property however its impact has been uneven across states. This context is increasingly critical as intensifying climate stress drives male out-migration from rural areas in search of alternative livelihoods. Consequently, women remain on the farms with greater managerial and physical labor roles.

Crucially, the feminization of agriculture is not inherently an empowering transformation; rather, it often represents labor substitution. True agency emerges only when this shift is supported by a confluence of enabling pillars. Our central thesis posits that this transition from substitution to agency requires the consolidation of at least three key institutional and economic supports: access to regular remittances controlled by the woman, formal land, lease, or joint title registration in her name, access to formal credit instruments such as the Kisan Credit Card or through robust Self-Help Groups (SHGs), reliable access to irrigation infrastructure, and comprehensive services including extension information via ICTs, Farmer Producer Organization (FPO) support, and childcare services such as Anganwadi or crèches.

Within this framework, the paper highlights the gendered dimensions of climate vulnerability in India's agrarian economy, examining how structural inequities, institutional design, and environmental pressures intersect to shape the evolving roles and agency of women in rural agriculture.

# Methodology

This study adopts a multidimensional approach that combines climatic assessment, socio-economic analysis, and gendered labor evaluation. The empirical basis rests on secondary data drawn from national surveys, administrative records, and institutional datasets. The central aim is to examine how climate-induced male outmigration in Bihar and Eastern Uttar Pradesh reshapes the feminization of agriculture and the conditions under which it leads to empowerment rather than substitution. The analysis proceeds in three steps.

1. First, climatic variability and stress are assessed using gridded data from the India Meteorological Department (IMD) covering 2005–2024. Temperature anomalies, rainfall variation, and flood incidence are analyzed to establish the relationship between climate shocks and male outmigration, supported by evidence from Census migration tables and PLFS employment data.
2. Second, socio-economic transformations are examined through government and institutional sources including the Periodic Labor Force Survey (2017–2024), Agricultural Census (2005–2021), and Time Use Surveys (2019, 2022). These datasets capture shifts in female agricultural labor participation, operational control of land, and time burdens across districts with differing migration intensities and irrigation reliability.
3. Third, structural and institutional enablers are analyzed using administrative and programmatic reports from NRLM/JEEViKA, PMFBY, PM-KISAN, and PMKSY. These records are used to evaluate the influence of remittance flows, land titling, credit access, and irrigation systems on women's decision-making power and economic agency.

Through this triangulation of climatic data, socio-economic indicators, and institutional evidence, the study identifies the structural conditions such as tenure, credit, irrigation, and remittance control under which the feminization of agriculture transitions from a form of labor substitution to a process of genuine empowerment in Bihar and Eastern Uttar Pradesh.

# Literature Review

India's agrarian economy is highly dependent and sensitive to climatic shifts like erratic rainfall and extreme heat. With approximately 80% of rural women in India engaged in agriculture, farming and food security concerns are central to discussions related to gender parity. Adaptation strategies must therefore address the structural barriers that increase the vulnerability of the most affected individuals and move beyond simple employment creation.

The Feminist Political Ecology (FPE) approach is commonly used to examine this problem, concentrating on the interrelated nature of gender, environment, and power. Adaptive capacity i.e. the ability to adapt to climate change is structurally mediated by factors including unequal power relations, command over key assets, and access to decision-making. One of the central constraints that have been noted in the literature is the "agency and decision-making deficit." Rural women are usually denied access to formal education and information, which limits knowledge accumulation and leads to biased decision-making at the household and community levels, where men usually have a monopoly. Vulnerability is therefore not natural but is structurally produced by this unequal resource distribution and political exclusion.

(i) The Barrier of Land Tenure

Despite women producing an estimated 60–80%of all food, fewer than 10 percent of female farmers are landowners. This failure to secure land tenure has cascading economic consequences.

Land is required as collateral for accessing formal financial services. Consequently, women without land titles face exclusionary treatment from banks, which categorize them as higher-risk borrowers. This systematically excludes them from government support, formal credit systems and insurance to mitigate losses from climate impacts like droughts. This forces women to rely on informal lending sources which perpetuate a cycle of debt.

(ii) Climate Implications on Labor and Health

Climate change intensifies women's labor burden both domestically and agriculturally. When heatwaves and droughts strike, the crop yields decline. This compels women to work in the field till extended hours (often from early morning until late evening in harsh conditions). Simultaneously, water scarcity forces women to undertake more frequent and longer journeys to distant sources. Breakdown of the agrarian system under climatic stress leads to extreme health and nutrition hazards. Cultural tradition makes women eat "last and least" within resource-poor households. Crop losses and decreased food availability substantially elevate their risk of nutritional deficiencies, most significantly affecting reproductive-age women, leading to adverse neonatal outcomes. Higher exposure to heat extremes increases the risk of negative reproductive outcomes such as preterm birth and preeclampsia. Additionally, women's domestic work brings them nearer to standing water and sites where mosquitoes breed, making them more susceptible to vector-borne illnesses (VBDs), with pregnant women having a three-times higher risk of severe malaria.

(iii) Policy Analysis

A systematic review of India's climate governance reveals a significant gap between policy goals and ground reality. While most policies acknowledge gender as a mediator of vulnerability, the implementation is uneven. Effective climate policy must move beyond focusing solely on the differences between men and women to engaging deeply with the intersections of sex, caste, class, and resource access to address the compounded discrimination faced by the most marginalized. To achieve structural empowerment, policy interventions must prioritize strengthening women's land tenure and ownership rights. Providing women with equal access to agricultural resources could increase farm productivity. The goal should be to transform women from passive beneficiaries into empowered agents of social change by supporting their collective organization and strengthening their decision-making capabilities within communities and institutions. This also requires multisectoral coordination, integrating health as a key factor with development policy and significant public investment in water infrastructure to reduce health risks and labor burden.

# Section I: Climate Stress, Male Migration and Increasing Feminization of Agriculture in Bihar and Uttar Pradesh

Climate variability and rural livelihood transformations in northern India have significantly reshaped gendered labor dynamics. This section examines how climate stress and male outmigration in Bihar and Uttar Pradesh are intensifying the feminization of agriculture, altering household structures and agrarian relations.

**Climate stress in Uttar Pradesh**

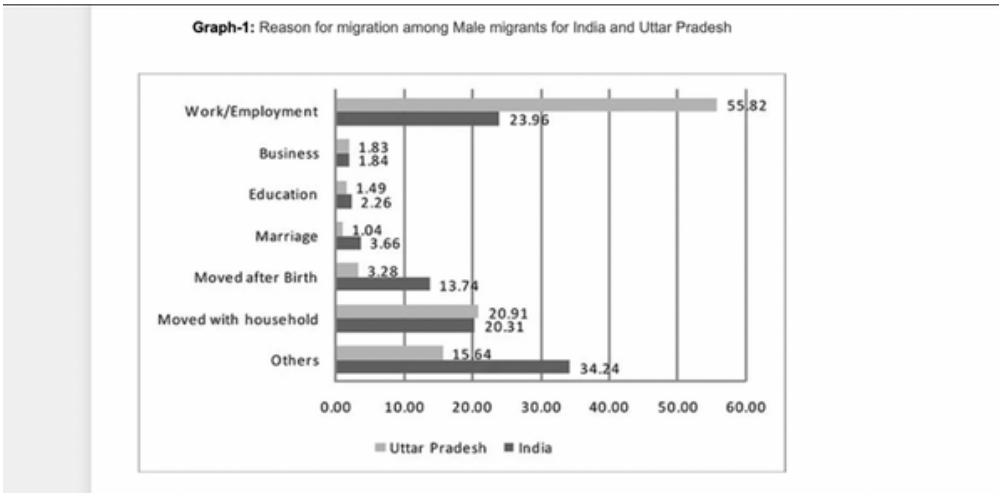
In Uttar Pradesh, annual rainfall is projected to increase by 15% to 20% by the 2050's relative to the baseline and the increase in maximum temperature is also predicted to increase to 2.1 degree Celsius during that period as compared to the earlier 1.8 degree Celsius. Districts such as that of Bundelkhand, Vindhya Regions, Kaushambi etc. show high vulnerability to climate change.

The primary causes of such climate changes include emissions from that of stubble burning and methane. Even the extreme sensitivity to heat, rainfall etc. lead to much of climate changes

Stubble burning, the process of burning residue of crops in the field after harvesting, generates substantial greenhouse emissions and intensifies air pollution, especially when practiced during the winter season. According to an interdisciplinary research carried out by Indian Agricultural Research Institute (IARI), the time between September to October 2025 showed 734 incidents of stubble burning in UP.

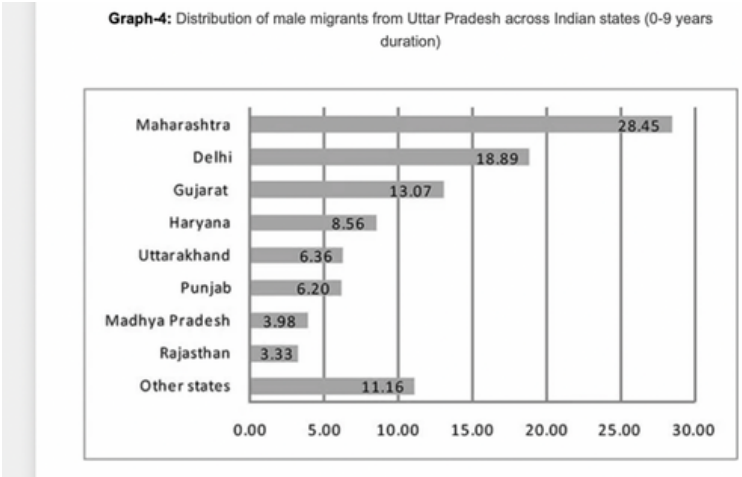
Given the state's large population, agricultural productivity must continually increase to match the growing food demand, even when the climate conditions deteriorate. The state's climate is highly sensitive to heat, with the temperature always varying from 0 to 46 degree Celsius. During high temperatures, hot winds (loo) and dust storms further damage the agricultural produce, compounding the vulnerability of agricultural livelihoods.

## Male Out Migration




Source: An Overview of Out-Migration from Uttar Pradesh Using Census 2011," Journal of Migration Affairs, Vol. II(2): 58–66, March 2020.

As per the above graph, Uttar Pradesh records the highest levels of male outmigration for employment purposes.




Source: An Overview of Out-Migration from Uttar Pradesh Using Census 2011," Journal of Migration Affairs, Vol. II(2): 58–66, March 2020.

Furthermore, graph 4 shows that cities like Mumbai, Delhi are the most preferred locations for migration, reflecting the search for higher paying urban jobs. Consequently, women are left to manage the agricultural activities.

In both Bihar and Uttar Pradesh, where agriculture remains the dominant livelihood, male migration imposes a significant burden on women. These states are characterized by small and marginal holdings, leading to a fragmented system of lands. Nonetheless, these lands form a primary source of economic security and social status and hence require the necessary management, irrigation, agriculture use for it to remain fruitful. While 'feminization of agriculture' is interpreted as empowerment and autonomy given to women, there are multiple other factors which must be examined in its structural context. Women's participation in agriculture is frequently a response to necessity rather than a choice. True empowerment would only reflect if the labor that they put in agricultural activities is paid, compensated and given benefits the same as the male persons did. Otherwise it will be women taking over responsibilities of the males who abandoned their roles in search for better ones.

**Climate-Induced Migration and Household Reconfiguration**

Climate shocks reconfigure more than the harvesting patterns. They reconfigure the households that grow them. Across the Middle Ganga Plain, migration intensifies as the household's way to cope to smooth volatile farm income. Migration, however, is selective: employment-led migration is overwhelmingly male, while female migration is dominated by marriage. In 2011 Census D-5, 82.1% of UP's "work/employment" migrants are men and 76.3% of Bihar's are men. Maharashtra – one of the principal employment destinations for migrants from Uttar Pradesh and Bihar – reflects this male-dominated pattern, with labor demand concentrated in sectors such as construction, manufacturing and engineeringand worksite dormitories, combined with high urban housing costs, discourage family migration.

Migration-intensive districts largely coincide with the state's most flood-exposed regions. According to the Bihar State Disaster Management Authority (2023) and the Census of India (2011), about 6.87 million hectares — roughly 73% of Bihar's geographical area — are flood-prone, concentrated along the Kosi, Gandak, Bagmati, and Mahananda basins. These northern districts not only face recurrent crop losses but also record some of the sharpest increases in adult sex ratios between 1991 and 2011, often exceeding 950 females per 1,000 males in Saharsa, Madhepura, Supaul, and Khagaria — consistent with male-selective outmigration. In contrast, regions where irrigation buffers agricultural risk exhibit a smaller migration footprint. Uttar Pradesh, for instance, had 86.7% of its net sown area irrigated in 2014–15(compared with 61.4% in Bihar), which cushions farmers against rainfall shocks and reduces the need for distress migration. Empirical evidence supports this mechanism: improved water access and irrigation coverage significantly dampen short-term migration responses to climatic shocks.

**Feminization of Agricultural Labor**

When men migrate, women are left to shoulder the on-farm responsibilities. This shift is structurally grounded in India's employment patterns: 76.2% of rural women worked in agriculture in 2022-23, and nearly three-fourths of them were self-employed on family farms. In this context, male outmigration triggers a gendered substitution effect where women backfill the labor gap by managing family plots, coordinating seasonal wage work, and sustaining household production. Consistent with this, the rural female labor force participation rate increased sharply, from 18.2% in 2017-18 to 30.5% in 2022-23. Yet, the adaptive role of women in agriculture remains constrained by structural inequities in land, wages, and finance. The Agricultural Census recorded women as only 13.96% of operational landholders nationally, and 14% in Bihar (2.297 millions of 16.413 million holdings), with 72% classifies as marginal (<1 ha). While the share of women's names on land records has risen, 98% of holdings remain self-operated, indicate limited land leasing and diversification — factors that would otherwise enhance women's bargaining power, market access or collateral for credit.

Wage and finance data further illustrate this asymmetry. The PLFS 2022-23 reports that in Uttar Pradesh, rural men earned ₹405/day compared to ₹197/day for rural women, a 51% gap; in Bihar, the gap narrows but persists (₹404 vs ₹347/day; 14% gap). These disparities mean that when women substitute for migrant men, they do so from a low-control, low-credit position, sustaining production without equivalent economic empowerment. Financial exclusion reinforces this trap. Despite rising liquidity in flood and migration prone districts, formal credit penetration in Bihar remains limited. Structural inequalities persist even through community-based finance projects today expanding in the region, Scheduled Caste and Tribe women access smaller loans and rarely transition into entrepreneurship, and many rural households treat microfinance as a coping mechanism rather than empowerment, substituting for absent formal credit. This ecosystem houses a feminized informal finance frontier where women sustain the regions rural credit flows but remain excluded from institutional finance, operating within low control and low credit conditions.

# Section II: Climate Stress, Male Migration and Increasing Feminization of Agriculture in Bihar and Uttar Pradesh

In Bihar and eastern Uttar Pradesh, the feminization of agriculture unfolds unevenly, far less a wave than a mosaic of actual circumstances. Research indicates that with men away for work, women step in to cover the gap in the fields, taking over responsibilities once considered male. Women till, plant, and harvest, but without access to titles to land, credit, or time, their agency is limited. The narrative only changes when at least three structural pillars are in place: remittances are deposited into her account, land is titled by her name, and access to credit or irrigation is obtained. Thus, by building on the climatic and migration trends detailed earlier, this section examines the social and institutional reallocation that follows male outmigration.

**Structural and Spatial Exclusion in Agricultural Infrastructure**

In east Uttar Pradesh and Bihar, feminization of agriculture is not just a reconfiguration of who works, it is based on a complex geography of socio-spatial contestation that determines whether women are able to convert labour into effective agricultural agency. Firstly, access to water remains highly gendered, women may operate pumps or fetch water, but when canal turns are irregular or tubewells remain out of operation due to pump failures or the cost of diesel/solar, it is the woman farmer who bears the brunt of unpredictable irrigation and lost cropping opportunities. Women's involvement in participatory irrigation institutions has been reported to be zero by east India research, and their concerns are not considered in decision-making. Second, mechanization and hiring-on-a-custom basis (tractors, harvesters) are now the hallmark of timely operations, yet access to such inputs remains disproportionately in men's or external contractors' control. The consequence is that women bear the risk of late input timing or high hiring charges, while remaining excluded from the power infrastructure that such hiring access confers. Third, market access remains a challenge, women have fewer opportunities to take produce to mandi, face travel constraint, may have no transport and storage, and only tend to accept farm-gate prices that are not rewarding many gains from value-discovery. Lastly, information asymmetry and participation deficits continue, Farmer Producer Organisation meetings or extension forums take place at times or locations out of reach for women, women have no representation in governance and can be left open to being

over-charged or to being left out of collective bargaining. Recent studies discover only about 3 % of FPOs are headed by women. Combined, these spatial, institutional and infrastructural constraints show that for female farmers, the work is not only the hoe but also the hours, the pump-switch, the transport journey, the market gate and the meeting agenda. Without structural change in these spheres, feminisation is a descriptive phenomenon, not a shift in agency or equity.

**Negotiating Power within Rural Households**

In rural houses of Bihar and eastern Uttar Pradesh, feminization of agriculture plays out in intra-household conflicts regarding decision-making, cash, and movement. Central to it is a silent conflict over decision-making, what researchers call the decision index, running from crop choice to input purchases and marketing. Though women are increasingly managing the day-to-day farm work, control of income and titles to land still usually remains with distant or older male relatives, limiting their ability to reinvest or diversify. Remittances complicate this picture. When funds are put into a woman's PMJDY or SHG account, studies find expanded autonomy over food, schooling, and inputs; when sent to relatives, it is quickly pulled back into circuits of patriarchal control. The design of empowerment, therefore, depends less on the size of remittances than on whose name the account is in.

Although the Hindu Succession (Amendment) Act (HSAA) of 2005 created a legal pathway for women's land rights, implementation frictions at the village and revenue-office level routinely block effective title transfer. Ground studies in Bihar document low awareness, costly and opaque mutation procedures, and revenue-official practices that delay or omit women's names from records — outcomes that keep formal land control out of reach for many women even as their farm labour expands. Financial access is similarly constrained: NRLM/JEEViKA has massively expanded SHG membership and small-credit flows, yet state mission reports show weak conversion of SHG transactional histories into formal Kisan Credit Card (KCC) credit in a woman's name; commercial banks and KCC processes still tend to favour male account-holders or joint liability groups dominated by men. Childcare and time-saving services are an additional bottleneck: NFHS-5 and district-level ICDS data reveal gaps in Anganwadi/creche availability and usage in many Middle Ganga Plain precincts, limiting women's mobility and ability to attend market or extension meetings.

Finally, irrigation governance and information asymmetries act as filters of empowerment: canal turns, pump scheduling rules, and diesel/operational costs are typically controlled by established (male) users, while market and extension fora remain male-dominated, women frequently gain labour responsibilities without commensurate control over timing, inputs or sales.

Empirical patterns show strong heterogeneity across remittance regimes, irrigation reliability, flood exposure, household type, land size and caste. Where remittances are regular and routed into women's accounts, households are more likely to hire custom services and women are more likely to exercise input and sale decisions; where remittances are irregular or controlled by men, women's role remains unpaid substitution. Reliable irrigation functions as an equalizer: districts/blocks with dependable canal or tubewell supply show smaller time-burden increases for women and a faster narrowing of casual wage gaps compared with flood-prone blocks, where crop losses and erratic water access amplify distress migration and intensify unpaid work. Marginal holdings, smaller land sizes and historically disadvantaged castes are less able to convert feminized labour into agency because tenure insecurity, weak collateral and exclusion from formal credit channels persist.

**Policy Architecture and the Limits of Institutional Support**

Trends in the Periodic Labour Force Survey (2017–24) register rising female shares in agricultural employment in the Middle Ganga Plain, but Agricultural Census data (2005–21) show only limited increases in female-named or joint operational holdings—an empirical gap between labour and legal control. Time Use Survey (TUS) indicators corroborate significant increases in women's combined farm and care minutes in high-migration districts, except where childcare services and hired labour reduce time demands. Evaluations of PMFBY and state insurance performance indicate that slow payouts and limited coverage in flood years reduce insurance's role as a smoothing instrument, disproportionately affecting women who manage post-shock operations but lack formal compensation pathways. SHG program evaluations from JEEViKA show robust improvements in savings and small-credit, but lower downstream linkage to formal agricultural credit and KCCs in a woman's name.

Existing schemes provide building blocks but fall short of assembling the "≥3 pillars" needed for agency. PMJDY/UPI create a technical route to channel remittances into women's accounts, and NRLM/JEEViKA builds credible SHG records that can be leveraged for credit, yet program evaluations document low systematic conversion of SHG history into KCCs targeted at women. PMFBY, PM-KISAN and PMKSY address income support and irrigation, but implementation shortfalls (late PMFBY payouts; uneven PMKSY O&M) blunt their protective effect for female managers in flood-prone Bihar. To move feminization from substitution to agency, policy priorities are clear: (1) proactive title-insertion and streamlined mutation drives under Hindu Succession Amendment Act; (2) SStrengthening the linkage between self-help group lending, joint liability credit models, and formal agricultural credit systems would enable women to progress from collective savings to direct access to institutional finance in their own names; (3) expansion and scheduling-sensitive childcare/Anganwadi services; and (4) irrigation O&M and scheduling reforms that formalize female access. Together these interventions operationalize remittance control, tenure recognition, credit and reliable water — conditions that evidence indicates are necessary for measurable improvements in women's decision indices.

# Conclusion

This study demonstrates that climate shocks trigger male out migration leading to women assuming expanded farm responsibilities but the transformation from mere labor substitution to genuine agency is conditional on the presence of enabling institutional pillars. Without the adequate support structures the feminization will end up representing distress substitution rather than empowerment.

Our findings reveal three critical patterns across Bihar and Eastern Uttar Pradesh: First, female participation in agriculture has increased markedly in migration-intensive districts, but gains in autonomy remain uneven. Wage gaps narrow only where supportive conditions exist such as reliable irrigation, access to remittances, and credit in women's names, while elsewhere women continue to perform equivalent labor for markedly lower pay. Second, women's operational control over productive assets lags behind their labor contributions. Although female landholding has risen modestly, most holdings remain small, self-operated, and legally insecure, limiting women's ability to leverage land for credit or investment.Third, the intensification of agricultural and care work under conditions of climate stress produces a double burden, particularly in areas lacking irrigation reliability or childcare infrastructure. These compounded responsibilities restrict time for market participation and collective engagement.

Across districts, empowerment consistently correlates with the convergence of key institutional pillars: remittances routed directly into women's accounts, land titles formally registered in their names, access to affordable and gender-sensitive credit, and dependable irrigation services. Where these elements align, women demonstrate greater decision-making power over cropping, income allocation, and household welfare. Where they do not, feminization remains a coping mechanism sustained by unpaid labor. As climate volatility continues to drive male migration, adaptation policies must center the women who remain in agriculture. This requires moving beyond symbolic inclusion toward structural recognition of women as primary economic agents, through reforms that simplify land mutation, link SHG credit histories to formal agricultural finance, expand rural childcare and extension services, and guarantee equitable irrigation access. Only by embedding these enabling conditions into agrarian and climate policy can feminization evolve from an expression of vulnerability into a durable pathway for empowerment and resilience.