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Climate–Agriculture–Gender Inequality Hotspots

Insights for Nigeria

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Climate change intensifies risks in Nigeria's agri-food systems, disproportionately affecting women due to social inequalities that increase their vulnerability and limit their adaptive capacity. Hotspot areas are concentrated in northern and north-central Nigeria, notably Bauchi, Benue, Kano, Jigawa, Kebby, Nasarawa, Niger, Sokoto, and Zamfara. Policy actions should prioritize climate-smart agriculture, gender-sensitive climate services, and social protection to improve resilience and equity.

Background

Nigeria's agriculture is highly climate-sensitive, with over 70% of rural households relying on rainfed farming. Increasing climate variability and climate change, marked by erratic rainfall, longer dry spells, and floods, has triggered yield declines, income volatility, and heightened food insecurity. Gender disparities exacerbate vulnerability, as women often lack access to land, credit, and extension services, and face a more restrictive institutional environment. Some studies highlight that gender-sensitive adaptation strategies are critical for resilience in Sub-Saharan Africa (Pyburn and van Eerdewijk 2021; FAO, 2023; Lecoutere *et al.*, 2023). Women are the backbone of Nigeria's agricultural sector, contributing significantly to crop and livestock production. They account for between 60–79% of the agricultural labor force depending on the region and are deeply involved in cereal cultivation (such as maize, sorghum, and millet), root and tuber crops (such as cassava and yam), fruit production, and livestock rearing (FAO, 2023). These activities are often carried out on smallholder farms—typically ranging between 1 and 2 hectares—and largely rely on rain-fed systems, making them highly sensitive to climatic variability.

Women farmers in Nigeria participate in planting, weeding, fertilizing, and harvesting. Cassava and yam are common staples managed by women, while men often dominate rice and yam cultivation on larger plots (Onah *et al.*, 2023) They also engage in small-scale fruit farming, often for household consumption and local markets, and participate in poultry, goat, and sheep rearing, activities that contribute to house-

hold nutrition and income (Galadima *et al.*, 2018). However, despite their central role, women face systemic barriers, such as limited access to land, credit, extension services, and climate-smart technologies—which restrict their productivity and adaptive capacity (Fashogbon *et al.*, 2023).

Box 1: Data used in the hotspot analysis

Indicators of exposure in agriculture
Women's exposure to climate change impacts through agriculture is measured by the share of women in agricultural employment as a proportion of total agricultural workers. Using micro-level data, composite indices are constructed for four agricultural activities —cereals; root, tubers and fruit; livestock; and mixed farming using three standardized sub-indicators:

- Overall labor participation in each activity
- Agricultural activity-specific women's share of labor participation
- Women's share of hours worked relative to men's (relative effort intensity).

Data are sourced from the Nigeria Labor Force Survey (LFS) 2024 (quarter 2). Composite indicators are derived by standardizing and aggregating the three sub-indicators to quantify activity-specific exposure.

Indicators of vulnerability
Individual-level information from the 2018 Nigeria Demographic and Health Survey (DHS), a nationally representative cross-sectional survey, is used to construct three key indicators used in the study:

- Early-married women (15–19 years old): binary indicator on whether a woman in this age range is currently married, in an informal union, divorced, or widowed
- Domestic violence: binary indicator on whether any ever-partnered woman has ever experienced physical, sexual, or emotional violence
- Child sex ratio (0–4 years old): calculated as the number of boys per 100 girls in a population (imbalances often arise from son preference and sex-selective practices).

Finally, a fourth indicator, the Sub-national Gender Development Index (SGDI) is used as the geometric mean of the subnational values of three dimensions: education, health and standard of living. An SGDI value below one indicates gender inequality favoring men, while values above one indicate gender inequality favoring women. A value of one indicates gender parity (Global Data, Lab, 2019).

Indicator of climate hazard
The climate hazard indicator is based on the predominant data on *climate hazard types* developed by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). This comprises five types of climate hazards relevant to changes in crop suitability including drought, flood, climate variability, crop growing-season reductions, and high growing-season temperatures, as well as their combinations (Jarvis *et al.*, 2021). We use the share of rural women of reproductive age (WRA) in the population facing any of the five types of climate hazards or their combinations to approximate the climate impacts on agriculture overlaid at 10 kilometers grids resolution using Global Human Settlement data (European Commission, 2023).

Literature review

Research on climate risk and gender inequality underscores the disproportionate burden faced by women farmers, as climate shocks reduce women's income and food security more severely than men's. According to FAO (2023), gender-responsive policies and interventions, including those that close gender resource gaps, foster women's participation in groups, expand social protection, and integrate gender-transformative approaches, are needed to address inequalities in agrifood systems and increase resilience to climate shocks. By reducing gender gaps in farm productivity and wages, such changes could increase global gross domestic product by 1 percent (or nearly USD 1 trillion) and reduce global food insecurity by about 2 percentage points (or 45 million people) (FAO 2023).

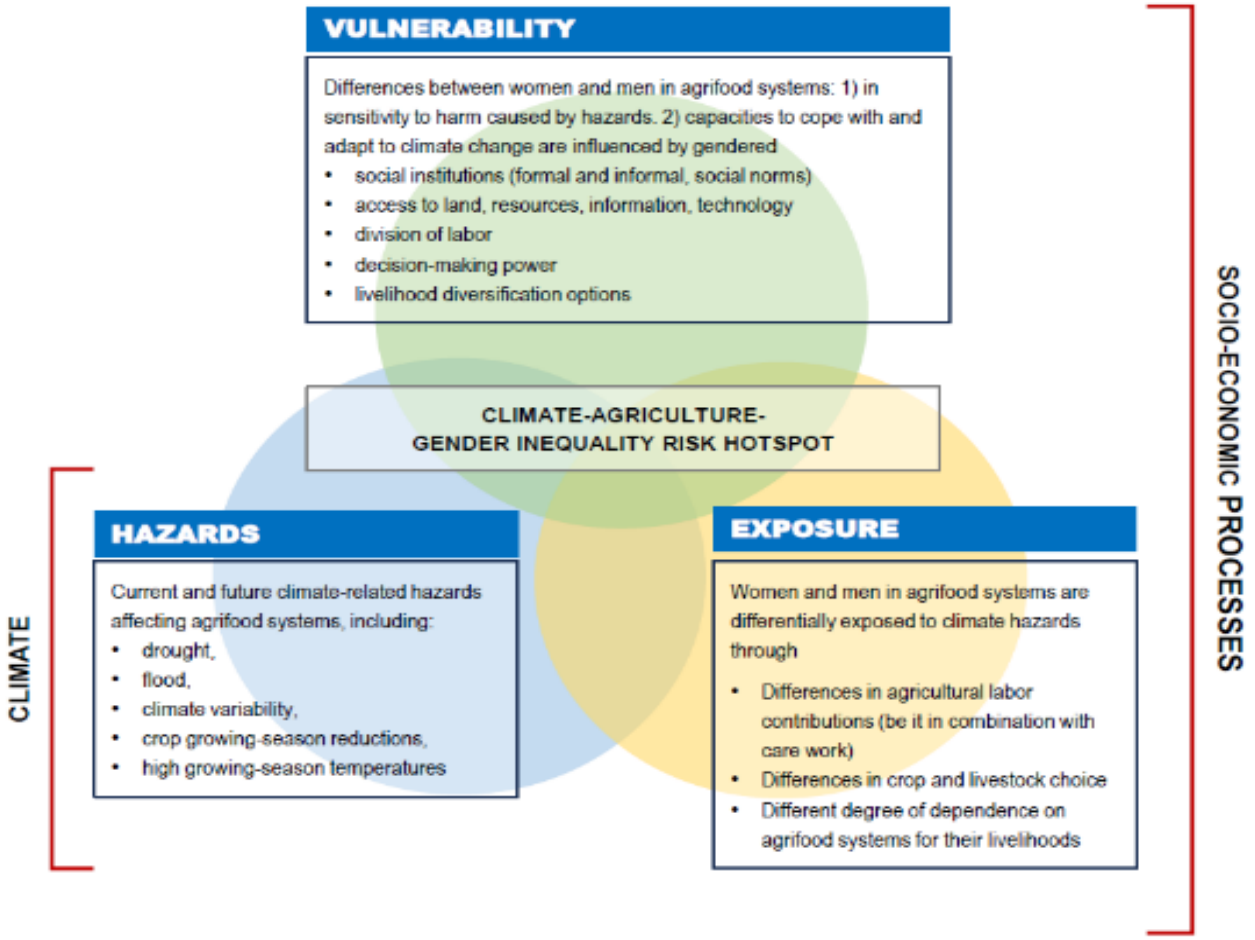
Lecoutere *et al.* (2023) provide a structured approach to mapping the interactions among climate hazard, exposure, and vulnerability, enabling evidence-based interventions and showing that gender inequality compounds climate risk in regions dependent on rainfed agriculture. Recent literature (e.g., Delavallade et., 2025; Chanana and Huyer, 2021) identifies socio-economic drivers, such as cultural norms, labor division, and restricted mobility, as barriers to women's participation in climate adaptation programs. For Nigeria, Pyburn and van Eerdewijk (2021) indicate that climate shocks disproportionately reduce women's farm income and food security compared to men, due to limited adaptive capacity and resource access. These studies collectively underscore the need for integrated policy frameworks that address both climate resilience and gender equity in Nigeria's agricultural sector.

Methodology

The climate–agriculture–gender inequality hotspot mapping analytical approach combines three dimensions to assess overall risk: (1) climate hazard – frequency and intensity of climate shocks; (2) agricultural exposure – importance of specific commodities (cereals, roots/tubers/fruits, livestock) to livelihoods; and (3) gender inequality – share of women engaged in these activities and their associated vulnerability (Figure 1). Weighted normalized composite risk scores are computed for the stratum of statistical representativeness of the original data sources (state level), highlighting areas where women's agricultural activities face the greatest climate-related threats (hotspot areas).

This spatial mapping of individual components as well as combined overall risk at the state-level provides a homogeneous comparison across space, although it assumes static gender roles and does not account for future socio-economic changes. Data used for the hotspot analysis are described in Box 1.

Figure 1: Climate–agriculture–gender inequality hotspots where climate hazards, high exposure and high vulnerability converge for women in agri-food systems



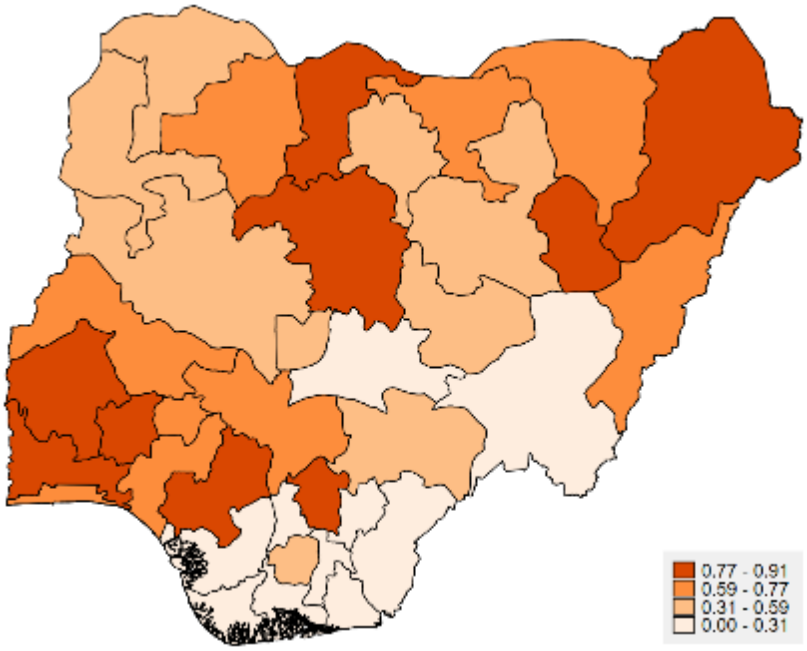
Source: Lecoutere et al., 2023

Key Findings

Climate-gender hazard

The map shown in Figure 2 illustrates exposure to climate hazards among women of reproductive age (WRA) across Nigerian states. Darker shades indicate higher exposure to climate hazards, such as recurrent droughts, floods, and heat stress. These hazards disproportionately affect women due to their roles in ensuring household food security, water collection, and caregiving, which become more challenging under climate stress. (Erman *et al.*, 2021). Northern and northeastern states exhibit the highest climate hazard scores, driven by recurrent drought and heat stress. These regions are highly dependent on rainfed agriculture, making women particularly vulnerable to crop failures and water scarcity. States such as Borno, Yobe, and Jigawa stand out for high hazard levels. While southern states show lower hazard scores (0.00–0.31), localized flooding and coastal erosion remain a concern, particularly for women engaged in fisheries and small-scale farming.

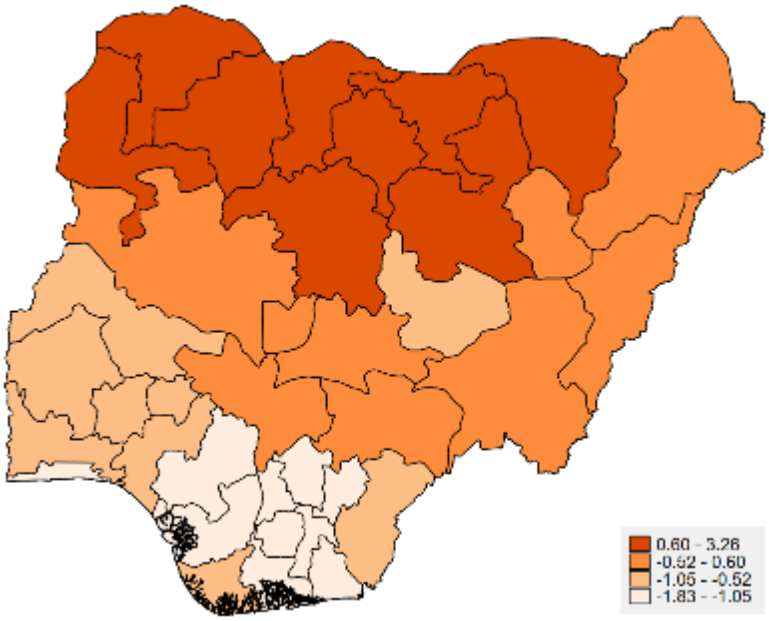
Figure 2: Climate hazard map



Gendered vulnerability

The vulnerability map shown in Figure 3 highlights sub-national disparities, where women in agricultural systems face compounded risks due to socio-economic and cultural factors. The vulnerability index combines four critical dimensions: 1) the Gender Development Index, capturing disparities in education, health, and economic participation; 2) early marriage (15–19 years old), which reflects social norms that limit women's autonomy and long-term opportunities); 3) experience of domestic violence, indicating exposure to gender-based violence, which undermines well-being and decision-making power; and 4) child sex ratio (0–4 years old), signaling potential son preference and gender bias at the household level. Darker shades in the northern states represent higher vulnerability scores (0.60–3.26), driven by entrenched gender norms, high prevalence of early marriage, and elevated rates of domestic violence. These factors severely restrict women's agency, access to resources, and participation in agricultural decision-making. Additionally, skewed birth sex ratios in some areas suggest persistent gender bias, reinforcing structural inequalities. In contrast, southern states, shown in lighter shades, exhibit lower vulnerability (-1.83 to -1.05). While gender disparities still exist, these regions generally have lower rates of early marriage and domestic violence, and more balanced birth sex ratios. However, economic and institutional barriers remain, limiting women's access to land, credit, and climate information. The map underscores that vulnerability is multidimensional and intersectional: social norms, violence, and demographic factors interact with economic inequalities to shape women's resilience.

Figure 3: Vulnerability index map

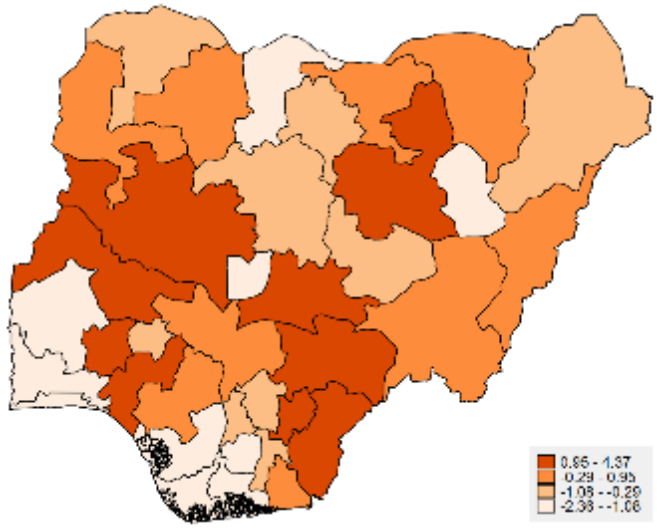


Gendered exposure to climate change through agriculture

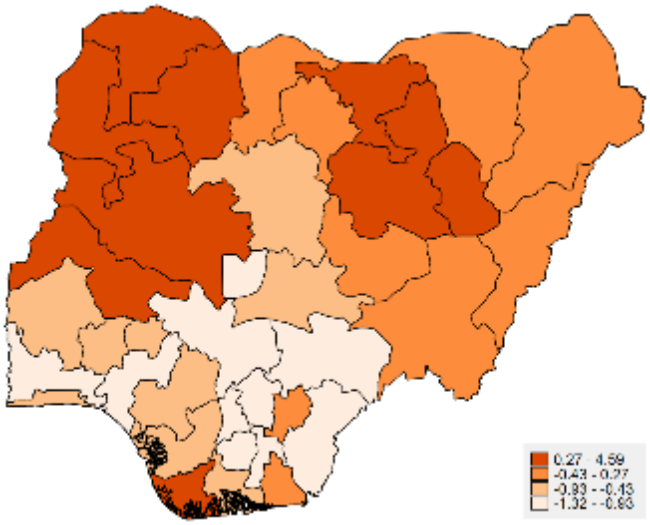
Women's agricultural engagement amplifies their vulnerability to climate change due to several interlinked factors: 1) dependence on climate-sensitive crops and livestock, given that rainfed cereal and tuber cultivation exposes women to erratic rainfall, droughts, and floods, and that livestock is heavily affected by heat stress and water scarcity, reducing productivity and increasing disease risks (Onoh *et al*., 2023); 2) farming low-quality, less fertile, and marginal lands–often allocated through patriarchal systems—which are more prone to erosion and flooding (Sasah *et al*., 2022); 3) resource constraints due to limited access to irrigation, improved seeds, and storage facilities that heighten post-harvest losses—up to 40% of food produced is lost between harvest and consumption in Nigeria—largely due to poor infrastructure (Ogundele, 2022); 4) increased workload and health risks, since climate shocks force women to spend more time fetching water and firewood, while extreme heat and vector-borne diseases (e.g., malaria) pose health challenges (Adebayo, 2022); and 5) low adaptive capacity, highlighted by the empirical literature, which shows that female-headed households have higher exposure and sensitivity indices but lower adaptive capacity compared to male-headed households, making them disproportionately vulnerable (Dev, 2023). Women's climate exposure stems from structural inequalities in access to resources, decision-making, and technology. As climate variability intensifies—through floods, heatwaves, and unpredictable rainfall—these gendered vulnerabilities threaten food security and deepen poverty in rural Nigeria (Anugwa, 2023).

Maps in Figure 4 show that women's exposure through working on climate-impacted cereal systems is highest in central and northern states, where women play a key role in cereal production but face significant climate risks and resource constraints (Malabe and Mustapha, 2025). Women's participation in root, tuber, and fruit systems–critical for household food security—is significant in central and southern states. Women's involvement in livestock systems is moderate and concentrated in northern pastoral zones, with women often managing ruminants vulnerable to drought and disease outbreaks.

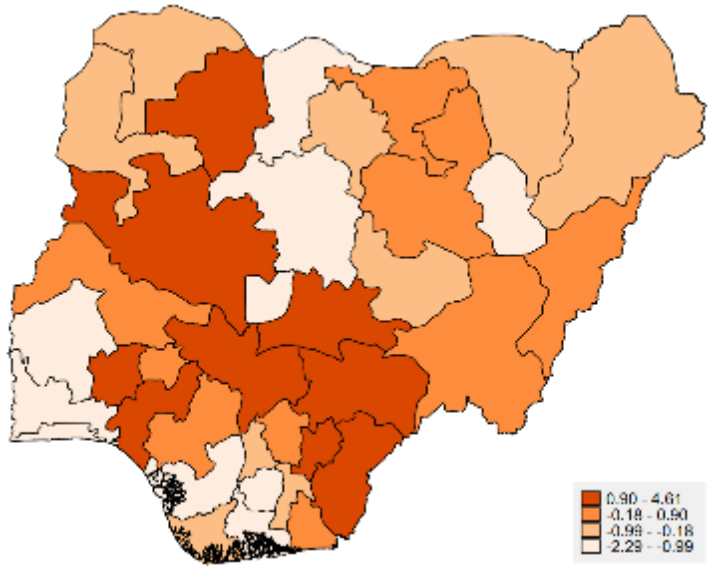
Figure 4: Women's exposure through working in cereals (a); root, tubers, banana, and fruits (b); and livestock (c) systems



(a)



(b)

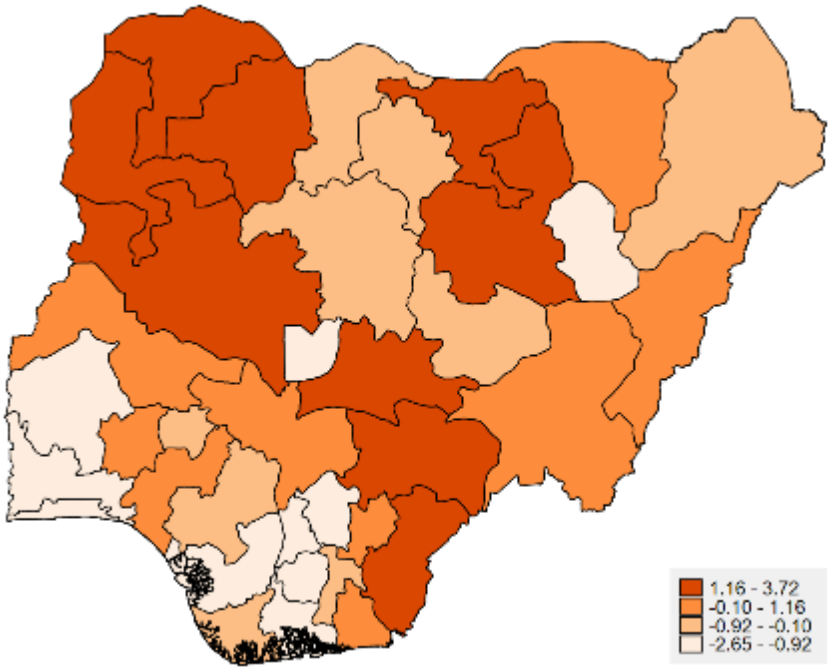


(c)

Overall map of climate-agriculture-gender hotspots

The hotspot map, combining all three elements, highlights in red the states facing a triple burden: severe climate hazards (frequent droughts and heat stress), heavy reliance on climate-sensitive agriculture (exposure), and pronounced gender inequalities (vulnerability) (see Figure 5). These critical hotspots are concentrated in northern and north-central Nigeria, notably Bauchi, Benue, Kano, Jigawa, Kebby, Nasarawa, Niger, Sokoto, and Zamfara, in addition to the only southern state of Cross-River.

Figure 5: Overall climate-agriculture-gender hotspot map



Central belt states show moderate risk; while exposure to cereals and root crops is significant, climate hazards are less extreme than in the north. Gender disparities remain substantial, increasing vulnerability. Southern states show a lower risk as climate hazards are less severe and women's exposure through agriculture is diversified across a diverse set of crops and livestock. However, localized vulnerabilities persist due to socio-economic constraints. Finally, coastal and urbanized areas with lower agricultural dependence and relatively better access to resources show the lowest composite risk.

Conclusion

Climate change amplifies existing gender inequalities in Nigeria's agricultural systems. Hotspot mapping provides a powerful tool for evidence-based policy targeting, ensuring that adaptation strategies and investments reach the most vulnerable women farmers. By focusing on states where climate hazards, agricultural dependence, and gender inequality are particularly severe, policymakers can advance both climate resilience and gender equality through proven approaches including: 1) targeted adaptation investments, prioritizing climate-smart agriculture in high-risk states and promoting drought-tolerant cereals and flood-resilient root crops; 2) gender-sensitive climate services, expanding access to climate information tailored for women farmers and supporting women's cooperatives in high-risk zones for collective resilience; 3) social protection and safety nets, scaling up cash transfers and insurance schemes for women in hotspot states and linking social protection to climate adaptation programs; and 4) research and monitoring, strengthening gender-disaggregated data collection on climate impacts and mainstreaming hotspot mapping for dynamic risk tracking.

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