SHE PAYS THE CLIMATE BILL

How Women-Headed Homes Bear the Hidden Costs of the Climate Crisis

Research and Policy Recommendations

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This report is the outcome of the Global Climate Bills Initiative coordinated by Hivos and implemented in collaboration with global and national partners in Brazil and Zambia.

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Rede Jandyras is a collective of women working for climate justice in Belém, Pará. Learn more at: redejandyras.org

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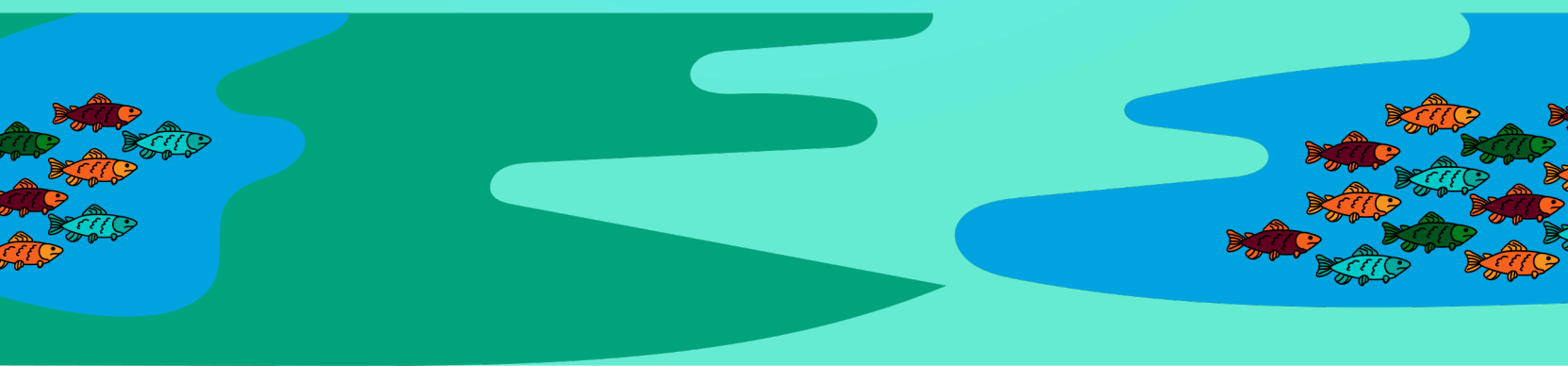

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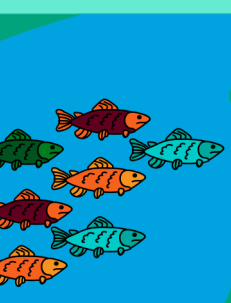
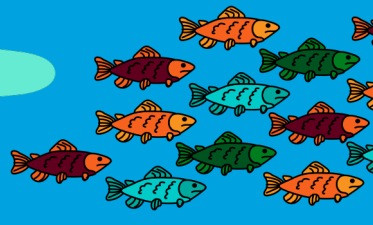
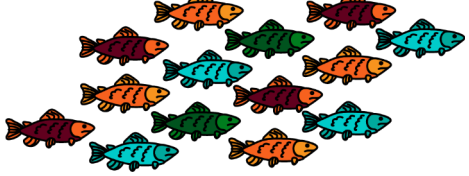






A Strategic Brief

She Pays the Climate Bill

How Women-Headed Homes Bear the Hidden Costs of the Crisis

> "We are now planting early, but still the rains don't come, and the crops end up drying. We are not harvesting as we used to due to unstable rainfall." — *Rural woman farmer, Zambia*

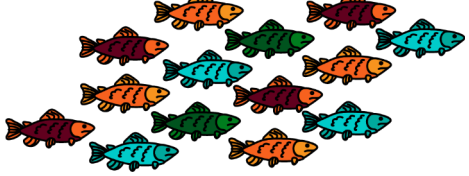
Across the Global South, millions of women are quietly paying the "hidden climate bill"—the unrecorded and unacknowledged costs of climate change that fall not on governments or corporations, but on households. They are paying the price for a crisis they did not create.

Every flood, drought, or heatwave arrives with a bill—one that never reaches corporate boardrooms or state budgets, but lands squarely in women's hands and homes.

This climate bill takes many forms: rebuilding houses after floods or landslides, caring for children or elders during heatwaves, walking farther to fetch water, borrowing money to replace lost harvests, or coping with the anxiety of not knowing when the next disaster will strike. These are the invisible ledgers of the climate crisis—recorded not in fiscal reports, but in women's exhaustion, unpaid labor, and mounting debt.

Climate change is not only a planetary emergency—it is also an economic and gendered injustice. As governments delay decisive action and fossil fuel corporations continue to profit, the costs of inaction are being shifted onto those least responsible and least able to pay—especially women and low-income families.

Between May and July 2025, WRI Brasil conducted a scoping study and literature review covering 2022–2025, shedding light on the gendered dimensions of climate vulnerability. Building on this foundation, from July to August 2025, through Hivos' Voices for Just Climate Action (VCA) program, Open Knowledge Brazil, and the University of Zambia researchers interviewed 236 households to understand how climate change is reshaping everyday life—disrupting food security, straining health systems, increasing energy burdens, and threatening livelihoods.



This paper amplifies the voices behind those experiences and calls on delegates at the 30th Conference of the Parties (COP30) to confront this injustice head-on. It introduces the concept of Climate Bills—a framework to make visible, quantify, and ultimately reallocate the hidden costs of climate inaction from households to those most responsible.

By integrating these costs into public planning and budgeting systems, Climate Bills can help design more equitable fiscal policies, align national budgets with climate justice and just transition goals, and ensure that climate finance reaches those most affected.

The framework also creates pathways to engage the private sector—not only as a contributor to climate impacts, but as a co-responsible actor in financing fair solutions. By linking corporate risk, investment, and fiscal incentives to justice-based climate action, Climate Bills build a bridge between public accountability and private responsibility—a necessary step toward a truly just and sustainable future.

I. The Systemic Failure — Climate Finance that Misses the Poor

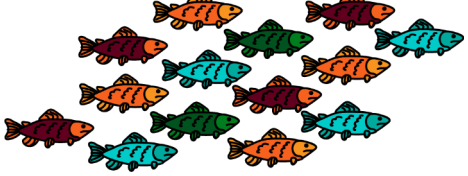
Where the Money Goes

Total global climate finance was estimated to have reached USD 1.3 trillion annually in 2021–2022. Yet only a small fraction—about 5%—is directed toward adaptation efforts.[1] Despite growing awareness of climate vulnerability, most funds continue to flow toward mitigation and large-scale infrastructure rather than protecting the communities most at risk.

Adaptation finance still represents less than 10% of global climate investments,[2] and only a tiny share reaches women-led or community-based initiatives.[3] Weak gender data, inaccessible financing systems, and institutional barriers keep these funds out of reach.

Current tracking mechanisms also fail to capture household-level spending, obscuring the daily, unpaid adaptation work that families—especially women-headed households—undertake. Every rebuilt wall, borrowed loan, and sleepless night represents part of the hidden "climate bill" that ordinary people pay for a crisis they did not create.

[1] Climate Policy Initiative, *Global Landscape of Climate Finance 2023.*
[2] World Resources Institute, *The State of Climate Finance for Adaptation,* 2023.
[3] UN Women, *Gender and Climate Change Finance,* 2022; OECD Development Centre, *Gender Equality and Climate Action,* 2023.



Structural Injustices

The distribution of climate finance reflects deep global and national inequalities:

- In Zambia, nearly 38% of the 2024 national budget went to debt repayments, while less than 5% supported environmental protection.[4]
- Governments worldwide still spend around USD 7 trillion each year subsidizing fossil fuels, diverting public funds that could build household and community resilience.[5]
- In Brazil, only 0.4% of federal spending in 2024 supported climate and environmental programs, while debt servicing absorbed more than 45% of total expenditures.[6]
- Most climate finance mechanisms still exclude gender-responsive budgeting and fail to recognize the unpaid care work that women contribute to adaptation.[7]

Households as the Last Line of Defense

In the absence of robust public systems, households—especially those led by women—have become the de facto responders to climate disasters. Their unpaid labor, lost income, and personal debt now act as a hidden subsidy propping up inadequate climate governance.

This is not adaptation. It is abandonment.

The Broken System: Why Women Keep Paying

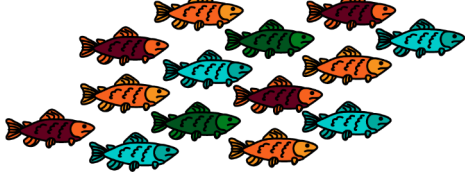
Despite the growing frequency and intensity of climate disasters, state and corporate accountability remain minimal. Social protection systems, though essential, are fragmented and ill-suited for climate adaptation.

Programs such as Bolsa Família in Brazil and Social Cash Transfers in Zambia provide vital relief but fail to address loss, damage, and long-term adaptation needs. Reconstruction grants, when available, arrive too late and are too small to rebuild what was lost.

Meanwhile, global climate finance flows continue to bypass women and frontline communities, filtered through layers of international and bureaucratic intermediaries that rarely reach the local level.

This is not a gap in data or design— it is a gap in justice.

[4] Zambia Ministry of Finance, *2024 Budget Address.*
[5] International Monetary Fund, *Fossil Fuel Subsidy Tracker,* 2023.
[6] Instituto de Estudos Socioeconômicos (INESC), *Análise do Orçamento Federal 2024.*
[7] UNFCCC Standing Committee on Finance, *Biennial Assessment and Overview of Climate Finance Flows*, 2022; UN Women, *Gender-Responsive Climate Finance: Policy Brief,* 2023.



II. Evidence from the Ground — Zambia and Brazil

1. Zambia: The Rural Household's Struggle

In Zambia's agriculture-dependent communities, climate change is no longer a distant threat—it's a daily crisis. Increasingly severe droughts and floods are devastating crops, eroding livelihoods, and pushing families deeper into poverty.

Households now spend 10–30% of their annual income recovering from climate shocks—repairing homes, buying seeds, replacing livestock, or paying for food and health care.[8] For many, adaptation means debt.

Women carry the heaviest burden: walking farther for water, caring for the sick, and managing shrinking household budgets. As food production declines, unpaid care work rises, leaving women with less time for paid work or community participation. Climate change is thus deepening gender inequality and social exclusion.

Social Costs[9]

- 58% of households report skipping meals after a climate shock.
- 37% resort to borrowing from informal lenders at high interest rates.
- 23% of children miss school due to hunger or illness.

> "We adapt with our hands, not with money. Every time the river floods, I pay the price."
> — Woman farmer, Monze District

Zambia's 2024 national budget, which allocates 38% to debt repayments and less than 5% to environmental protection[10] underscores a systemic failure: women are financing adaptation through unpaid labor and personal sacrifice.

2. Brazil: Urban and Rural Inequalities

In Brazil, the intersection of climate impacts, gender inequality, and racial injustice is stark. In Pará and Amazonas, women working in the informal economy lose up to 40% of their income during floods, droughts, or heatwaves.[11]

Afro-Brazilian and Indigenous women remain largely excluded from adaptation funds, credit, or insurance mechanisms. Each flood or drought triggers new cycles of debt, food insecurity, and unpaid care.

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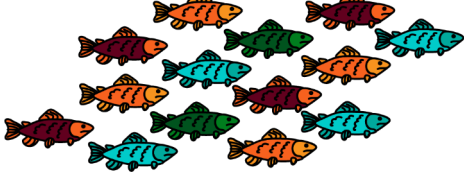
8 Hivos Voices for Just Climate Action (VCA) Zambia Household Study, 2025.
9 UNDP Zambia, *Climate Vulnerability and Social Protection Data*, 2024.
10 IMF & Zambia Ministry of Finance, *National Budget and Debt Overview*, 2024.
11 INESC, *Gender and Climate Inequality in the Amazon Basin*, 2024; IBGE, *Mulheres e Clima: Dados de Gênero e Vulnerabilidade Climática*, 2023.



Social and Economic Costs[12]

- Informal women workers lose R$500–800 (US$100–160) monthly during extreme weather events.
- Households spend up to 15% of annual income replacing damaged goods or rebuilding homes.
- Mental health impacts—especially anxiety, stress, and depression—are rising among youth and women facing repeated climate shocks.

> "We rebuild every year. But no one counts our work, our costs. The climate bill comes to our doorstep."
> — Indigenous leader, Santarém

The feminization of poverty in Brazil is being reinforced by climate inaction and extractive economic models that prioritize profit over resilience. Despite progressive frameworks, gender-responsive climate finance remains less than 2% of national climate spending.[13]

3. Shared Patterns Across Contexts

Across both Zambia and Brazil, women-headed households are paying the true price of climate inaction. The poorer the household, the greater the share of income lost to climate shocks.

Women's unpaid labor, emotional strain, and financial sacrifices remain invisible in national accounts and unrecognized in global climate finance mechanisms.

This is not a failure of data or design—it is a failure of justice.

III. What the Research Shows — Women Are the First Responders, but the Last Beneficiaries

The Climate Bills Initiative conducted scoping and field research in Brazil and Zambia to understand how women and their families are experiencing the impacts of climate change—and to make visible the uncounted costs they bear.[14] The findings are stark, but they echo what movements across the Global South have long known: women are not passive victims of the climate crisis. They are its first responders—and too often, its last beneficiaries.[15]

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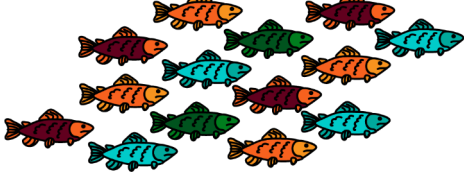
12 WRI Brasil, *Climate Bills Research Pilot Findings*, 2025; INESC, 2024.
13 Ministério das Mulheres & UN Women, *National Plan for Women and Climate*, 2024.
14 Hivos Voices for Just Climate Action (VCA), *Scoping and Household Study on Climate Bills in Brazil and Zambia*, 2025.
15 WRI Brasil, *Gendered Impacts of Climate Change: Preliminary Insights from COP30 Country Studies*, 2025.



Women as Frontline Responders

When climate shocks strike, women do not wait for external help. They mobilize their immediate circles—family, friends, and neighbors—to share food, cash, childcare, and emotional support. These informal safety nets are vital lifelines, yet they are overstretched, under-resourced, and invisible to formal aid systems.[16]

> "Honestly, the assistance doesn't help much, right? Let's say it managed to provide the bare minimum."
> — Respondent, Brazil

Governments arrive late. Corporations never arrive at all.

Adapting Without Resources

Across both countries, families are modifying homes, routines, and livelihoods to cope with rising heat, floods, and droughts. Women build makeshift barriers, raise house floors, plant shade trees, or move to higher ground. These are acts of courage—but they are also symptoms of neglect.

Every home rebuilt by hand is a policy failure. The main barrier to effective adaptation is lack of financial, technical, and institutional support. Women know what they need, but they are rarely heard—and even when they are, they cannot afford to act.[17]

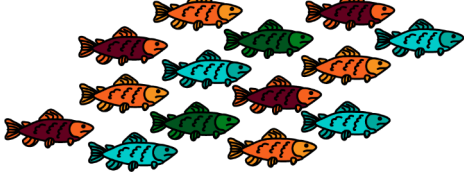
The Gendered Cost of Crisis

Extreme events amplify every existing form of inequality. Women shoulder most unpaid care work—cleaning, cooking, caregiving, and managing the home. After floods or heatwaves, that workload doubles or triples.

Loss of income, unpaid debts, and lack of access to credit or insurance trap women in cycles of poverty and dependence. This is the feminization of climate vulnerability—where economic fragility, social invisibility, and gender inequality collide.

> "There was a time when a very heavy rain broke the roof tiles, and we had to leave, and now I have to pay rent, you know? So, that caused a lot of problems because of the rain. Not to mention that it was also very hot."
> — Respondent, Brazil

16 INESC, *Gender and Climate Inequality in the Amazon Basin*, 2024.
17 UNDP Zambia, *Climate Vulnerability and Social Protection Report*, 2024.



Emotional Resilience Has Its Limits

Beyond economic loss, women describe fear, exhaustion, and growing anxiety about the future. Many are experiencing climate-related mental health impacts, yet these remain unrecognized in policy frameworks.

> "There should be greater public awareness of the link between care and climate. Many people are getting sick... and we can't simply ask for care. You can't go to a health unit and get psychological support."
> — Respondent, Brazil

Intersectional Inequalities Amplify the Crisis

In Brazil, Black and low-income women in flood-prone neighborhoods face disproportionate exposure to heat, flooding, and infrastructure failures.[18] In Zambia, rural women farmers without secure land rights experience repeated cycles of drought and crop loss.

The climate crisis does not create inequality—but it exposes and multiplies it, revealing how structural injustice, gender, and poverty intersect to shape vulnerability.

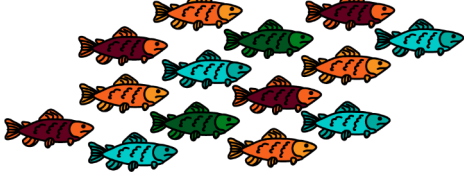
IV. The Climate Bills Approach — Rebalancing Responsibility

The findings from Brazil and Zambia make one thing clear: women and low-income households are already paying the real costs of climate inaction. Their daily sacrifices—rebuilding homes, borrowing to survive, caring for the sick—are the hidden subsidies keeping broken systems afloat. The Climate Bills approach responds directly to this injustice by rebalancing who pays and who benefits from climate action.

What Climate Bills Do

- Identify and quantify the externalized costs of climate change that fall disproportionately on low-income households and marginalized groups.
- Realign fiscal responsibility for these costs toward national governments, high-emitting industries, and multilateral development banks — in line with the principle of *common but differentiated responsibilities*.

[18] IBGE, *Mulheres e Clima: Dados de Gênero e Vulnerabilidade Climática*, 2023.



- Operationalize equitable climate finance mechanisms that are transparent, gender-responsive, and adaptable to multiple dimensions of inequality — not limited to gender — while being embedded in existing budgetary and public financial management (PFM) systems.

Why They Matter

The Climate Bills framework is a critical step toward achieving climate justice and ensuring a just socioeconomic transition. It bridges public finance and the principles of fairness, inclusivity, and accountability that must underpin all climate action.

1. Accountability

Climate Bills transform vague climate finance commitments into enforceable fiscal obligations. By institutionalizing transparency, participation, and public oversight, they advance *procedural justice* — ensuring that those most affected by climate change have a real voice in decision-making and budget priorities.

2. Justice

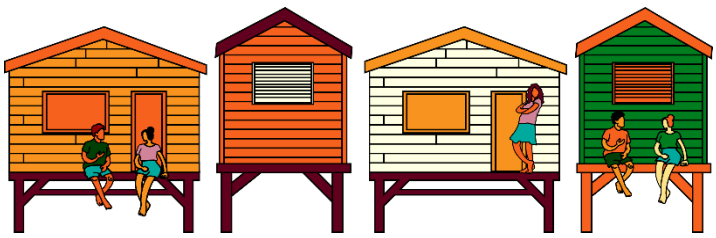
By linking fiscal reform to equity and requiring polluters to pay their fair share, Climate Bills promote *distributive justice*. They help correct long-standing imbalances where low-income and marginalized groups bear the highest climate costs yet receive the least support.

3. Empowerment

Climate Bills equip communities with data, evidence, and legal tools to track public spending and demand fair investment. This embodies *recognition justice* — valuing the lived experiences of historically excluded groups — and *restorative justice*, which seeks to repair the harm caused by past environmental and economic injustices.

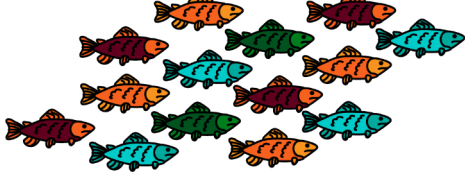
A Path Toward a Just Transition

By integrating these principles, Climate Bills align climate finance with real social and economic transformation. They ensure that national budgets not only decarbonize economies but also restructure them — building systems that are equitable, inclusive, and resilient.



Vision:

"No woman should go hungry or fall into debt because her government failed to protect her from a climate disaster."



V. From Framework to Action — Aligning Climate Bills with the UNFCCC and National Policy

The Climate Bills framework moves beyond analysis into action. By translating justice-based principles into fiscal mechanisms, it offers governments a practical pathway to meet international commitments under the Paris Agreement and the UNFCCC Gender Action Plan (GAP)—while addressing national priorities for inclusion, resilience, and development.

1. Operationalizing the UNFCCC Gender Action Plan (GAP)

The GAP emphasizes integrating gender equality into all dimensions of climate action: finance, capacity-building, technology, and decision-making. Climate Bills provide a way to operationalize these goals by:

- Embedding gender-responsive budgeting in climate and development finance systems, ensuring that expenditures account for women's unpaid care work and the differentiated impacts of climate change.
- Tracking household-level adaptation spending, making visible the invisible labor and financial burdens carried by women and other marginalized groups.
- Creating measurable fiscal indicators that allow governments to report progress on GAP implementation through national communications, biennial transparency reports, and NDC updates.

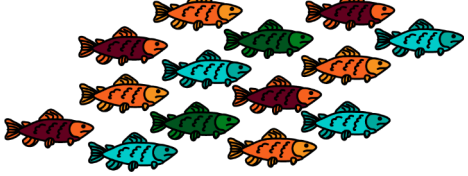
Through these measures, Climate Bills transform the GAP from a policy commitment into a measurable, budgeted instrument of justice.

2. Integrating Climate Bills into National Planning and Budgeting

Climate Bills can be incorporated into existing public financial management (PFM) frameworks to strengthen climate accountability and transparency. Countries can:

- Align Climate Bills with national climate change acts, medium-term expenditure frameworks, and gender-responsive budgeting policies.
- Integrate household-level data into national climate risk assessments, improving planning for adaptation, social protection, and disaster response.
- Link fiscal reforms to polluter-pays principles, ensuring that fossil-fuel subsidies are progressively phased out and replaced by investments in household and community resilience.

In Brazil, this approach could inform the National Plan for Women and Gender Equality, connecting gender policy with climate and fiscal reforms. In Zambia, it could strengthen the Green Growth Strategy and integrate climate resilience into debt and budget management processes.



3. Bridging Global Finance and Local Justice

At the global level, Climate Bills can complement mechanisms such as the Loss and Damage Fund, Green Climate Fund (GCF), and Adaptation Fund by generating data on where climate costs truly fall. This allows donors and governments to direct resources more equitably and supports civil society in holding institutions accountable.

At the local level, Climate Bills can empower communities with open data platforms and participatory budget tools that track whether climate funds reach those who need them most. By connecting fiscal transparency with social accountability, they create the foundation for a people-centered climate finance system.

4. From Justice in Principle to Justice in Practice

Implementing Climate Bills requires collaboration between parliamentarians, ministries of finance, women's affairs, and environment agencies, alongside civil society, academia, and communities. This cross-sectoral approach ensures that justice is not just a principle but a practice—embedded in budgets, laws, and daily governance.

Climate Bills therefore represent more than a policy instrument. They are a blueprint for a just transition, where economic and ecological transformation go hand-in-hand, and where the costs of inaction are no longer borne by the poor, but by those most responsible for the crisis.

V. What Needs to Change — From Coping to Justice

The findings call for a radical rethinking of climate policy, planning, adaptation, and finance — one that begins with women's lived realities and redistributes responsibility from those who suffer to those who profit.

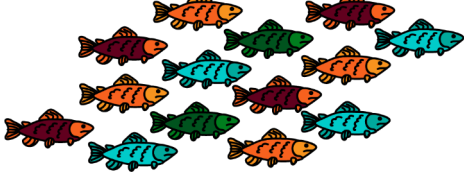
1. Recognize Care as Climate Action

Care work sustains life and resilience. Yet it remains unpaid, undervalued, and invisible in adaptation policies.

- Integrate care work and social protection systems into National Adaptation Plans (NAPs).
- Include unpaid labor as a metric in adaptation monitoring, evaluation, and financing frameworks.

2. Fund Women-Led Solutions

Across the Global South, women's groups, cooperatives, and community movements are driving innovation — from urban gardens to flood-proof housing and community water systems.



- Establish direct, flexible, and rapid-access climate funds for women-led initiatives.
- Channel Loss and Damage finance to local actors, not external consultants.

3. Democratize Climate Finance

Climate finance must be accountable, transparent, and equitable.

- Require participatory oversight mechanisms with civil society and movement representation, particularly women-led organizations.
- Simplify and decentralize funding processes to make them accessible to grassroots actors.

4. Build Resilient, Caring Infrastructure

Public investment should prioritize low-income and high-risk communities.

- Expand affordable housing, drainage, and cooling systems in urban peripheries.
- Integrate mental health and psychosocial care into climate and disaster response frameworks.

5. Shift Power

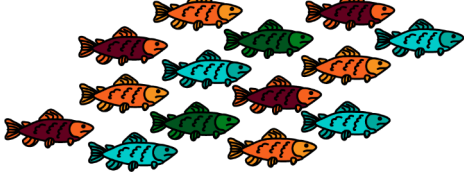
No climate policy will succeed if women are excluded from decision-making.

- Guarantee women's and community representatives' participation in NDC development, national climate councils, and COP30 delegations.
- Recognize care, food sovereignty, and feminist economy networks as essential actors in adaptation and resilience.

VI. From Evidence to Action — Recommendations for COP30

For National Governments

- Adopt Climate Bills to track and offset household-level climate costs, ensuring adaptation finance reflects women's and families' lived realities.
- Integrate gender-responsive budgeting into national adaptation plans and fiscal frameworks to address unequal climate burdens.
- Redirect fossil fuel subsidies toward community-based resilience, healthcare, and livelihood protection.
- Fund grassroots and women-led initiatives through simplified and inclusive access mechanisms, ensuring finance reaches those driving local adaptation.
- Institutionalize public reporting systems on household-level losses and adaptation needs to strengthen transparency and accountability.



For International Climate Finance Institutions

- Recognize household adaptation spending as a key indicator of unmet needs, ensuring finance responds to people's realities — not just process-based metrics under the Global Goal on Adaptation.
- Simplify and expand direct access for women-led and local organizations to climate funds.
- Reform the governance of the Green Climate Fund (GCF) and similar mechanisms to include community and grassroots representation.
- Support debt cancellation and innovative financing tied to inclusive and just climate investments, in line with the Climate Bills framework.

The Role of Civil Society and Media

Civil society organizations are pivotal in monitoring public spending, documenting household-level impacts, and holding governments and financial institutions accountable for equitable climate action. Working across borders, these actors strengthen a global evidence base that connects household-level losses to systemic failures in climate finance.

The media are crucial allies. By transforming technical finance debates into human stories, journalists and communicators can amplify women's unpaid labor, household debt, and daily resilience — ensuring the "hidden climate bills" are visible and impossible to ignore.

Together, civil society, media, and communities can turn the Climate Bills framework into a shared instrument for justice — quantifying the hidden costs of inaction, linking them to systems of accountability, and demanding that the polluters, not the poor, pay.

VII. Conclusion — From Belém to the World

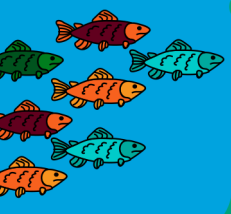
At COP30 in Belém, leaders will gather in one of the most climate-vulnerable regions on Earth — the Amazon. Yet even here, the climate bill is being paid in women's exhausted hands, in children missing school, and in families rebuilding their lives year after year as rivers dry, crops fail, and homes collapse.

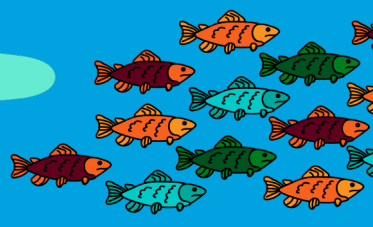
The real cost of climate inaction is not measured in GDP or carbon budgets. It is measured in hunger, debt, illness, and unpaid women's labor.

COP30 must be the turning point — the moment when governments stop sending women the bill for the climate crisis and start holding those most responsible to account.

Climate Bills are more than policy proposals. They are moral imperatives and instruments of justice — charting a path toward a future where the transition to renewables is fast, fair, and funded, and where no woman must pay the price of inaction with her labor or her children's future.

Country Report
Brazil





Climate Bills Research Project

Country Report: Brazil

Authors: Eduarda Batista, Haydée Svab, Juliana de Castro e Edilaine Santos

EXECUTIVE SUMMARY

This report is part of the Climate Bills Research Project, led by Hivos under the Voices for Just Climate Action (VCA)program, in partnership with WRI Brazil. The initiative seeks to document the economic, social, and health costs of climate inaction in Brazil and Zambia. Based on a qualitative methodology that combined a scoping review of the literature with semi-structured interviews conducted in five Brazilian states, this study found that climate change disproportionately affects women, reinforcing the feminization of poverty and deepening gender inequalities. The impacts include rising household expenses, material losses, heavier care workloads, and mental health issues such as anxiety, stress, and depression. The testimonies reveal that floods, droughts, and heat waves reduce economic stability, overburden family care responsibilities, and create invisible costs that intensify social vulnerabilities.

To address these challenges, the report recommends incorporating “climate bills” into public budgets, strengthening early warning systems, expanding gender-responsive housing policies, and investing in resilient infrastructure. It is also essential to involve governments, the private sector, and civil society in developing adaptation and resilience actions that prioritize the most vulnerable populations. COP30 is expected to advance international commitments on resource redistribution and reparative mechanisms, recognizing gender inequalities and promoting climate justice that places gender equity and care work at the core of sustainability.

INTRODUCTION

Country Context and Vulnerabilities

Brazil, located in South America, covers more than 8.5 million km², making it the fifth-largest country in the world by territorial area (IBGE,2022).Its vast geographic expanse, stretching from the Equator to the Tropic of Capricorn, results in great climatic diversity. According to the Köppen-Geigerclassification, the country ranges from a humid equatorial climate in the Amazon to a humid subtropical climate in the South, with tropical savanna climates across parts of the Northeast and Central-West regions (Alvares et al., 2013).

Climate crises have been intensifying both extreme events and long-term gradual risks across the entire Brazilian territory (MCTI, 2024). Severe droughts in the Amazon, recurrent floods in the South, prolonged dry spells in the Northeast and Center-West, and heat waves worsened by urban heat islands (ANA,2024) directly affect food security, water supply, and housing stability, among other dimensions. These phenomena increase socioeconomic risks, particularly for low-income and historically marginalized populations.

More than 8 million Brazilians live in areas at risk of floods, flash floods, and landslides (Brazilian Alliance for Ocean Culture, 2025), often without adequate infrastructure to protect themselves or adapt. From a climate justice perspective, it is essential to recognize that the impacts of the climate crisis are unevenly distributed, disproportionately affecting groups with lower adaptive capacity and limited access to basic rights.

These inequalities, however, are not new. They are rooted in historical processes of colonization, the enslavement of Indigenous peoples and African populations brought by force, which consolidated a power structure based on the high concentration of land and wealth in the hands of a few—primarily European colonizers (Ribeiro, 2015). This patriarchal economic and social model perpetuated unequal access to land, income, housing, education, and political power (Fernandes, 2021). Such legacies persist today in the forms of vulnerability and the limited adaptive capacity of the poorest populations, particularly Black, peripheral, and

rural women, who face structural barriers to accessing credit, securing housing, and rebuilding their lives after climate disasters (FAO,2024).

Therefore, adaptation and mitigation policies and initiatives must prioritize those who suffer the most from the effects of the climate crisis and who have the least capacity to respond. Women stand at the center of this inequality: they have less access to credit, land, and productive resources, are overrepresented in informal and low-paid jobs, and shoulder the majority of unpaid domestic and care work (UN Women, 2015). According to UN Women (2025), 10% of women worldwide live in extreme poverty, a rate that has not improved since 2020, and 351 million women and girls may remain in this condition by 2030.

In Brazil, more than one million people were affected by floods and around 43 million by droughts in 2018 (Civil Society Working Group, 2020). For women, inequality in the distribution of unpaid care work remains stark: they devote eleven more hours per week than men to such activities (IPEA,2023)and are systematically excluded from land ownership, access to financing, and decent employment (UN Women, 2015), all essential components of economic autonomy. These factors, when combined with the impacts of extreme climate events, significantly heighten their social and economic vulnerability. Recognizing and addressing these asymmetries is an essential condition for advancing climate policies that move toward social justice and gender equity.

Research Objectives and Guiding Questions

This research aims to investigate, in Brazil, how climate crises, combined with socioeconomic and gender inequalities, amplify the vulnerabilities of women who take a leading role in household decision-making, whether or not they are heads of households. The ultimate goal was to generate deeper insights into these key issues by testing, refining, and expanding the findings from the literature through field interviews.

The combination of a scoping review and semi-structured interviews allowed for an expansion of the literature findings, a more accurate analysis, and a more comprehensive understanding of the multiple dimensions of climate vulnerability. The investigation was guided by six focal areas: (i) perceptions and observations of

climate change; (ii) impacts on care work and gender roles; (iii) effects on health and well-being; (iv) economic costs and losses; (v) adaptation strategies and barriers; and (vi) intersectional vulnerabilities. The results aim to inform public policies and gender-sensitive climate finance mechanisms, focusing on adaptation strategies that recognize and value women's work and care as pillars of community resilience and climate justice, contributing to global discussions, particularly within the scope of the 30th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

METHODOLOGY

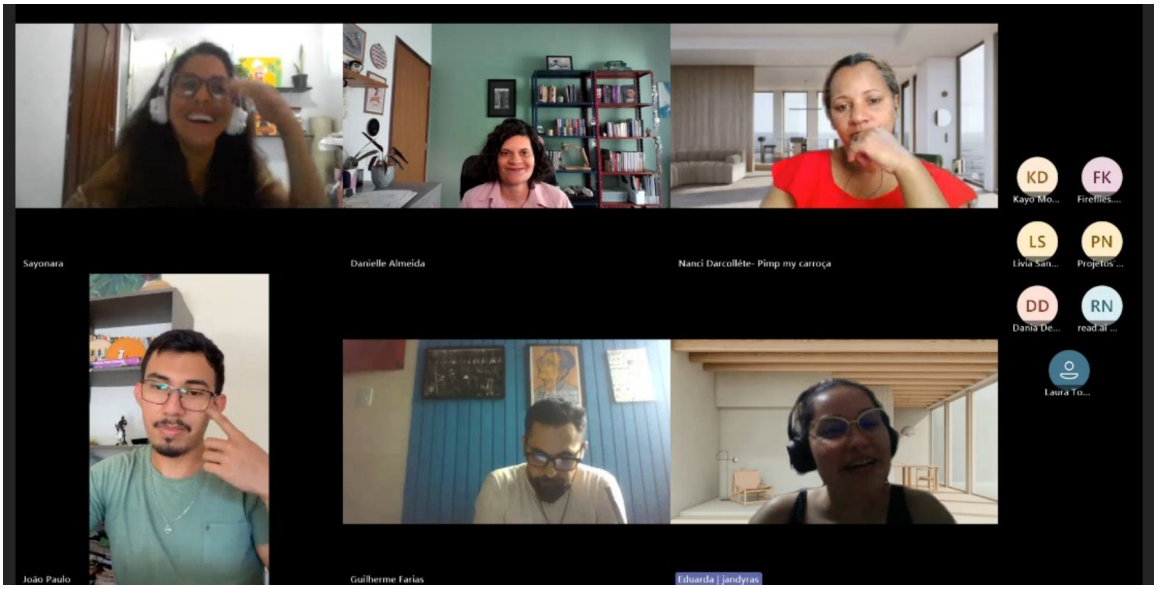
In the context of the Climate Bills, the World Resources Institute – Brazil (WRI) conducted a scoping review of the literature aimed at investigating the economic and social costs of climate change impacts on household budgets in which women play a prominent role in decision-making, covering the period from 2022 to 2025. Based on this review, semi-structured questionnaires were developed to be used in the field in the form of interviews.

The construction of the semi-structured interview guide was informed by content analysis of the main themes identified in the literature. This methodological alignment ensured that the questions were directed toward deepening the most significant aspects while also exploring areas not yet consolidated in existing research. Semi-structured interviews advance the investigation by capturing the experiences and perspectives of experts and key stakeholders. The questionnaire, developed from the scoping review, served as a tool to collect qualitative insights and practical experiences, complementing the literature's findings with new perspectives. This approach ensured interaction between theory and practice, enriching the analysis with real-world data not yet addressed in the existing body of research.

Local committees composed of researchers were established to support the review of the questionnaire and the definition of subsequent research steps. Throughout meetings held between May and July 2025, the questionnaire was formulated and refined (see Figure 1) in collaboration with a group of researchers as well as practitioners working in the territories and members of the VAC network, structured around six main thematic axes:

- Household composition and livelihoods;
- Climate observations and impacts;
- Care, daily routines, and climate;
- Health and well-being;
- Economic impacts and household budgeting;
- Adaptation to climate impacts.

Figure 1 – Feedback workshop on the pilot application of the questionnaire with researchers, held on July 16, 2025



Source: Personal record (2025)

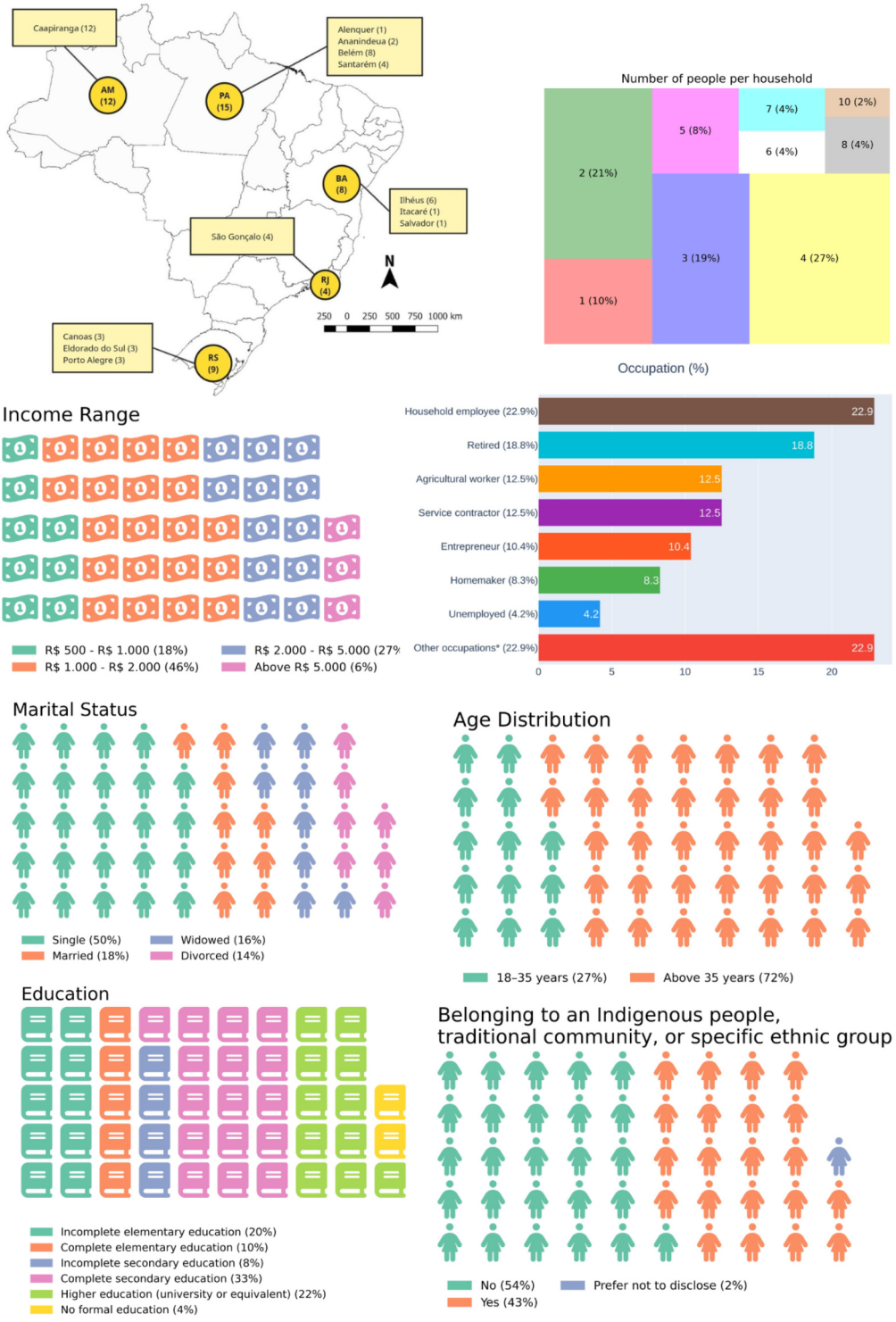
Between July 9 and August 20, 2025, research teams in Brazil and Zambia interviewed a total of 236 households to investigate the impacts of climate change on health, food, energy, and livelihoods, with a particular focus on women, informal workers, and marginalized groups. The dataset was collected and stored using the KoboCollect[1] application, including audio recordings. Quantitative variable analyses were conducted directly in spreadsheets.

Drawing on Laurence Bardin's theoretical framework for content analysis, the qualitative analysis of the interviews followed three main stages: (i)pre-analysis and selection of materials; (ii)coding of relevant excerpts; and (iii)categorization for the identification of patterns.

[1] KoboCollect is a software application used to collect, analyze, and manage data for research, monitoring, evaluation, and investigative purposes.

SOCIODEMOGRAPHIC PROFILE

Figure 2 – Summary of the Sociodemographic Profile



Source: Own elaboration (2025)

Figure 2 presents a summary of the sociodemographic profile of the women interviewed, comprising participants from 25 territories across 12 municipalities in five Brazilian states. The sample was designed to represent diverse regional and socioeconomic contexts, reflecting the country's territorial diversity. This plurality is expressed in the living conditions and challenges faced by the interviewees, demonstrating that climate vulnerability takes distinct forms depending on local characteristics such as infrastructure, access to services, and economic dynamics.

In terms of occupational profile, paid activities are often combined with domestic responsibilities and the care of family members and people who are ill. Among the main occupations, domestic workers stand out (22.9%),followed by retirees (18.8%). It is important to note, however, a limitation of this research: the absence of disaggregated data by race or color, which restricts a more robust analysis of the intersectionality between gender, race, and territory.

The sociodemographic profile of the women interviewed clearly highlights their central role in reproductive and care work. All 48 participants identified as cisgender women, and 8% identified as persons with disabilities. In 73% of cases, they reported being the main person responsible for the household, managing domestic and family affairs alone; only 27% stated that they share this responsibility, typically with a husband or partner, and more rarely with a father or older children.

Although most women responsible for households are in older age groups (above 35 years, representing 54% of the sample), it is noteworthy that even among younger participants, 69.2% have already assumed this role. This demonstrates how the early assignment of domestic responsibilities cuts across generations, perpetuating gender inequalities. Regarding marital status, half of the interviewees declared themselves single, although some indicated cohabitation with partners or partial sharing of responsibilities, revealing nuances that transcend formal categories.

FINDINGS

Perceptions and Observations of Climate Change

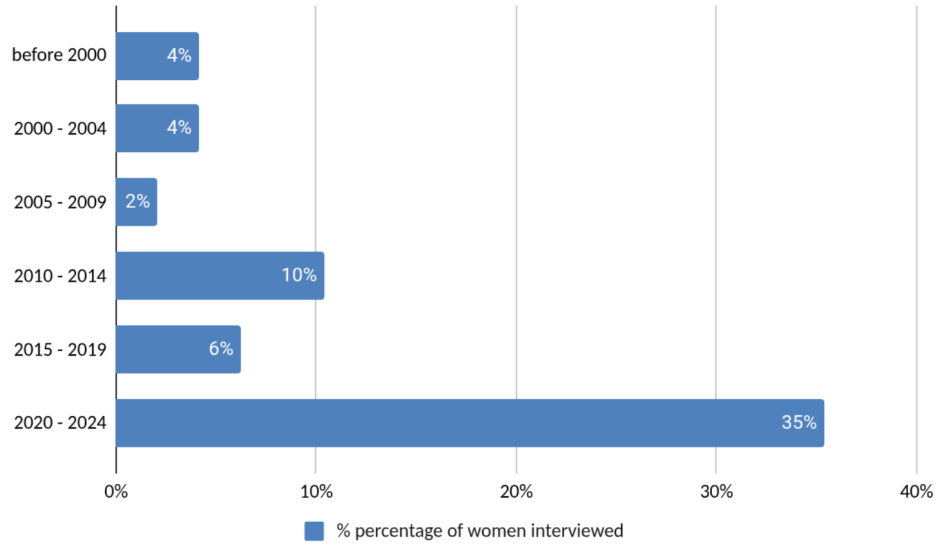
To understand women's perceptions of climate change, participants were asked whether they had noticed changes in the climate, since when they perceived these changes, and how such changes have affected their daily lives, families, and communities over the years. They were also asked whether, in recent years, they had experienced any particularly intense or unusual climatic events, and how these events impacted their work, routines, and family life.

All interviewees unanimously perceived shifts in rainfall and drought patterns, reporting stronger and unseasonal rains as well as more severe droughts that have intensified in recent years (Chart 1). These changes are experienced in tangible and significant ways in their everyday lives, mainly through extreme weather events and altered seasonal patterns.

> "When I was a child, I felt that the weather was much more predictable. I could sense the changes and anticipate them more easily. Now, everything seems mixed up, with no clear definition."

The statement above illustrates that climatic instability and unpredictability have already become part of daily life, generating a sense of insecurity and affecting routines, food production, household economies, and overall quality of life.

Chart 1 – Indication of When Climate Change Began to Be Perceived

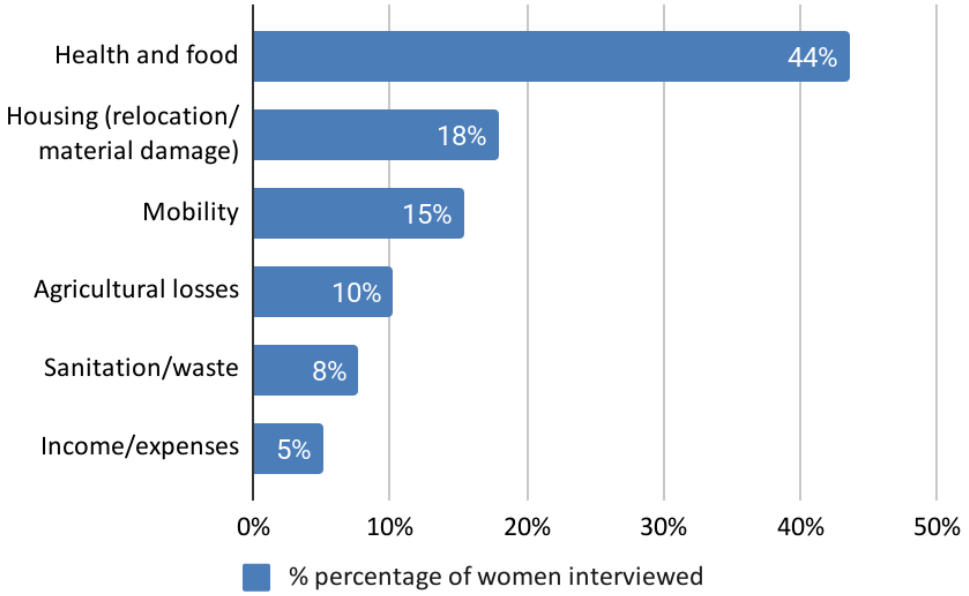


Source: Own elaboration (2025)

Climate change has been affecting families and communities in devastating ways, with floods identified as the most significant impact by 33% of interviewees, followed by extreme heat (31%), heavy rainfall (23%), and drought (13%). The impacts of extreme weather manifest through flooding that damages homes, contaminates drinking water and affects health, causes material losses, forces migration, and generates a constant state of insecurity.

In daily life, mobility becomes restricted, children's school routines are disrupted, and livelihoods are threatened by the loss of crops and the rising costs of electricity, medicine, and transportation. These combined factors undermine the safety, well-being, and stability of families and communities (Chart 2).

Chart 2 – Main Effects of Climate Change Experienced



Source: Own elaboration (2025)

Extreme heat is increasingly being felt, causing health problems such as headaches and nausea, damaging crops, raising energy costs, and making daily activities more difficult, particularly for self-employed women and farmers. The drying up of artesian wells was also cited as a consequence of rising temperatures, further complicating domestic care routines. Climatic instability, marked by changes in rainfall patterns, unseasonal and unpredictable precipitation, has led to floods, crop destruction, and restricted mobility. Strong winds that damage roofs were also mentioned as events that generate financial losses and severe distress.

Extreme weather events have significantly disrupted the daily lives, work, and family structures of the women interviewed. They directly affect daily routines, increasing

the burden of domestic work, especially after floods, as the testimony below illustrates. This climatic instability imposes the need for financial planning for emergencies and changes how women care for their families, generating a constant state of alert.

> “You don’t even feel like doing what needs to be done—washing clothes, cooking, doing other things… how can you do it if everything is underwater? I would usually stay upstairs, waiting for the water to go down so I could clean and do my daily chores…but then you end up not doing it, because you’re so tired that you just rest again. It’s exhausting.”

During the most critical moments of extreme weather events, more than 79% of interviewees reported feeling vulnerable or unsafe when trying to access water, food, support, or safety at home and within their communities. The reception of alerts about extreme climate events is uneven and marked by distrust. While some participants receive early warnings via television, cell phone (apps and Civil Defense alerts), or the internet, others rely on observing nature or communicating with neighbors. Trust in this information also varies: although some consider the alerts accurate, many expressed skepticism, noting that forecasts often fail or arrive too late for adequate preparation against extreme events.

Impacts on Care Work and Gender Roles

To better understand the women’s daily lives and living conditions, participants were invited to describe a typical day in their routine, what they would like to change, and which strategies they use to ensure their household’s livelihood. They were also asked about their perceptions of the stability and security of their main source of income, how financial decisions are made, how much time they dedicate to care activities, and how situations such as floods, droughts, or extreme cold and heat affect their daily life, work, and family.

The daily routine of most interviewees is marked by an intense workday, both inside and outside the home. They juggle domestic chores with caring for children, grandchildren, relatives, and people who are ill. Many of them wake up before dawn and only stop working late at night, describing their routine as a constant “struggle.” On average, the women reported spending 6.4 hours per day on unpaid care activities (such as cooking, cleaning, and caring for children, the elderly, or people with special needs). Statements such as “I only stop when the child sleeps” and “housework never ends” were common among respondents, highlighting the heavy burden of reproductive labor in women’s daily lives.

When asked what they would like to change about their routines, women emphasized their desire for greater autonomy and better financial conditions—often through owning their own business—as well as the need for more time for themselves and for leisure, and a reduction in their workload. Structural issues such as limited urban mobility, long commutes to work, and the lack of family support in household chores were also identified as major challenges they wished to overcome, as illustrated in the testimony below:

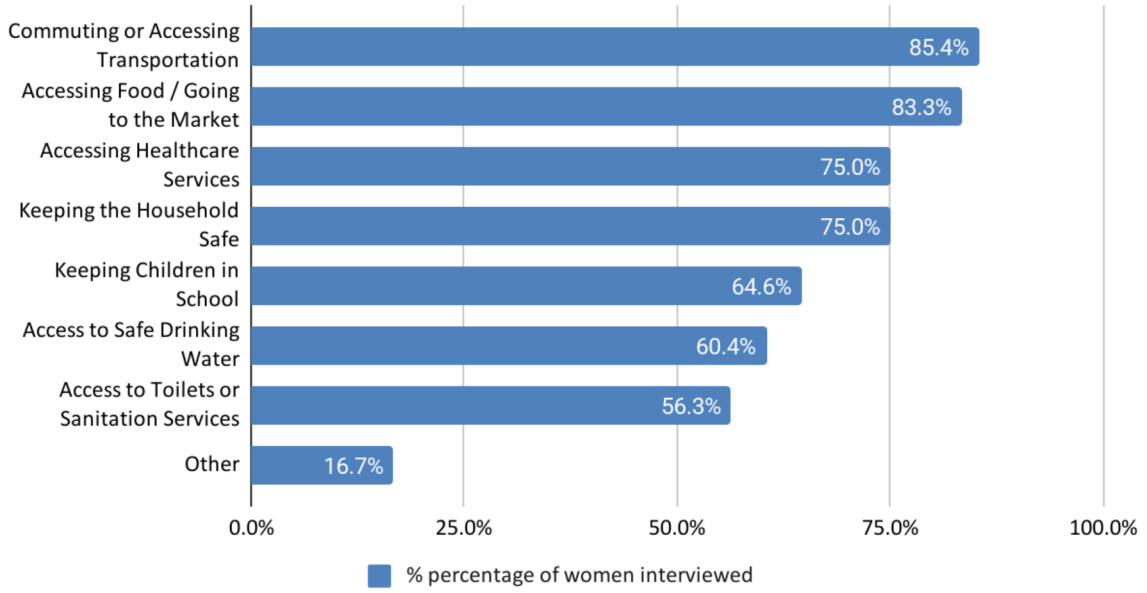
> "I'd like to work less at home, especially with chores like washing the dishes. Because if it were up to my husband, he wouldn't do it. But he works—and I work too, right? So I'd like to see a change, more participation from the whole family, because it's not just my obligation, it's everyone's. You know?"

Extreme weather events drastically disrupt the women's daily lives, halting their routines and intensifying their workload—whether in the formal labor market or within the care economy[2]. Basic activities such as going to work, taking children to school, or grocery shopping become impossible (Chart 3), while domestic and care tasks multiply—either due to cleaning the house after floods or taking care of family members who fall ill.

Routine interruption is a direct and recurring consequence of climate crises for more than 80% of the interviewees. Many reported having to abandon work, studies, or personal care to deal with climate-related emergencies in their homes or communities. Concrete examples include rescuing furniture and appliances after floods, repairing roofs torn off by strong winds, or caring for a child who became ill during extreme heat. In these situations, caring for the home and ensuring family safety becomes the top priority, forcing the suspension of all other activities and often resulting in loss of income and opportunities.

[2] A set of reproductive tasks—both paid and unpaid, formal or informal—that constitute care work, predominantly carried out by women within households. (Rodriguez et al., 2021.)

Chart 3 – Impacts of Extreme Weather Events



Source: Own elaboration (2025)

Regarding household income, 60% of the women reported making financial decisions alone or as the primary decision-makers in their homes, either because they are the main providers, due to widowhood, or because of specific family arrangements. However, 40% indicated that they share these decisions, usually with a husband or partner, and, to a lesser extent, with other family members such as children or grandchildren. When asked directly about household income, 10% preferred not to disclose it. Among those who responded, 74% earn up to BRL 2,000 (US$ 371,48), with the average household income for the sample amounting to BRL2,118.79 (US$ 393,46).

The general perception among women regarding their source of income is one of insecurity and instability, particularly for those who rely on government aid, self-employment, or contractual work. In contrast, women with pensions or public-sector employment tend to feel more secure, although even within this group there are concerns about the long-term guarantee of rights. For the majority, income is considered sufficient only to cover basic needs, without ensuring financial stability or quality of life.

Health and Well-Being Effects

The women were also asked about the impacts of climate change on their own health and that of their families, as well as how they usually seek medical care, considering the difficulties of access during or after extreme events. In addition, perceptions of safety in their living environments during climate crises and the

impacts on mental health were explored. Finally, the study sought to understand if they have any form of support when feeling overwhelmed.

The vast majority of respondents and their family members have already experienced health problems directly linked to climate change. The most common illnesses are respiratory conditions (such as colds, viral infections, asthma, and bronchitis), which worsen with fluctuations in temperature and humidity. Gastrointestinal problems, including viral infections and diarrhea, are also frequently reported. Extreme heat contributes to cases of heatstroke, dehydration, and skin problems. Statements such as: “My daughter has asthma, right? The little one. And during that flood period, she had attacks” illustrate the impact of extreme climate events on children’s health, which adds significant weight to women’s caregiving responsibilities.

Health care is predominantly sought through the public system (health posts and emergency care units), with some relying on private hospitals, home remedies, or self-medication. For many, especially in rural communities, the lack of local health services necessitates long and costly travel to other cities. These challenges are exacerbated during climate events, when floods can physically prevent travel and even close health facilities, further compromising access to care.

Beyond physical health, mental health is notably affected, with reports of anxiety and depression resulting from the instability and stress caused by climate crises. Most interviewees reported significant mental health strain during acute periods of climate events, as illustrated in the testimony below. Anxiety is the most common symptom, often accompanied by difficulty sleeping, sadness, and extreme fatigue. These feelings are triggered by fear of floods, constant alertness, and the physical stress of intense heat, resulting for many in trauma and persistent fear that affect well-being even after the critical event.

> “During the flood? I felt all of that… fatigue, insecurity, anxiety, exhaustion, insomnia… all at once. Extreme tiredness, but many times I couldn’t sleep, right? And that just increased the fatigue and generated more anxiety… because insomnia causes a lot of anxiety, you know?”

Mental health impacts are also linked to a sense of insecurity at home during extreme climate events. About 54% of women reported not feeling safe, primarily due to fear of floods, landslides, and the precariousness of their housing, which may not withstand heavy rain or strong winds. Proximity to rivers, lack of basic sanitation, and the risk of contamination from animals further increase vulnerability. Conversely, women who feel safe generally live in higher areas or in more solidly

constructed homes that are not affected by flooding, although even these women express concern about events such as strong winds and extreme heat.

Economic Costs and Losses

The interviews also aimed to understand the economic impacts of climate change on women's lives, asking whether they had lost important belongings due to such events and how droughts, floods, or extreme cold and heat affect household expenses. Additional costs for responding to or recovering from damages, as well as expenses for preventive measures, were addressed. The study also explored strategies used when finances are strained, the effects of rising food prices, and the need to travel further or spend more to secure food, all of which have direct impacts on time and household budgets.

Losses resulting from climate impacts are a reality for the vast majority of interviewees. The most frequently mentioned losses include furniture, appliances, and clothing destroyed by floods. Many also reported severe structural damage to their homes, with some losing their entire residence. Income sources are also affected, with destruction of crops, death of livestock, and loss of work equipment. Beyond economic material losses, emotional and symbolic losses—such as important documents and photographs representing family history and ties to territory—are also significant. Tragically, some reported deaths, leaving deep scars, as illustrated below:

> "I was nine months pregnant, and he died in my womb. A week before I started feeling unwell, there was a rainstorm that broke the roof, everything, and flooded the entire house. I lost everything belonging to my baby. I lost everything of his. Then it passed. I went to my mother's house, and I started feeling unwell. When I arrived at the hospital, he was already dead. I don't know if it was because I got nervous seeing the house like that."

For the respondents, the highest expenses during extreme climate events are food and home repairs, either to replace furniture and fix flood damage or because of rising food prices. Electricity bills also increase significantly due to the constant use of fans during extreme heat. Health expenses rise due to more frequent illness and medication purchases, and transportation becomes costlier and more difficult. The need to stockpile water and food further strains household budgets during these critical periods.

Interviewees reported an average monthly expenditure of BRL1.464 (US$271,87) to respond to or recover from climate impacts, ranging from 0% to 1,333% of declared

household income, indicating that some families remain in debt. Average monthly spending on preparation and prevention is around BRL 535, corresponding to 0%–67% of declared household income. Considering the sample's average household income (BRL 2.118,79-US$ 393,46), almost 70% is spent on response/recovery actions and 25% on preventive measures. Thus, the economic impact of climate change is more than significant, as it can compromise household budgets and affect other necessary expenses for family subsistence.

To cope with financial strain caused by climate events, common strategies include borrowing money, primarily from family and friends, and reducing consumption, sometimes cutting back on food and electricity. Many also seek to generate extra income through additional work, such as cleaning jobs, or by intensifying sales of their products, increasing women's workload. Social benefits from the government serve as essential support, while other strategies include selling personal belongings or purchasing essential items on credit.

> "The first thing is to ask for help from my husband's family and try to get loans. Skipping meals hasn't been necessary yet, but I think it's very possible. Extra work too."

During difficult periods caused by climate change, 81% of respondents reported being concerned about food availability at home, with food stockpiling being the most cited strategy. Rising food prices during critical periods are an almost unanimous perception among participants: they observed significant increases in the cost of fruits, vegetables, and even coffee. This rise, often linked to scarcity and logistical challenges, directly affects the purchasing power of local populations, forcing people to reduce food quantities, forgo necessary items, or alter the quality of family diets due to budget constraints. In many cases, acquiring food during climate crises requires traveling further or spending more, significantly impacting time and money. For some, this is not feasible, forcing them to buy within their own community despite inflated prices.

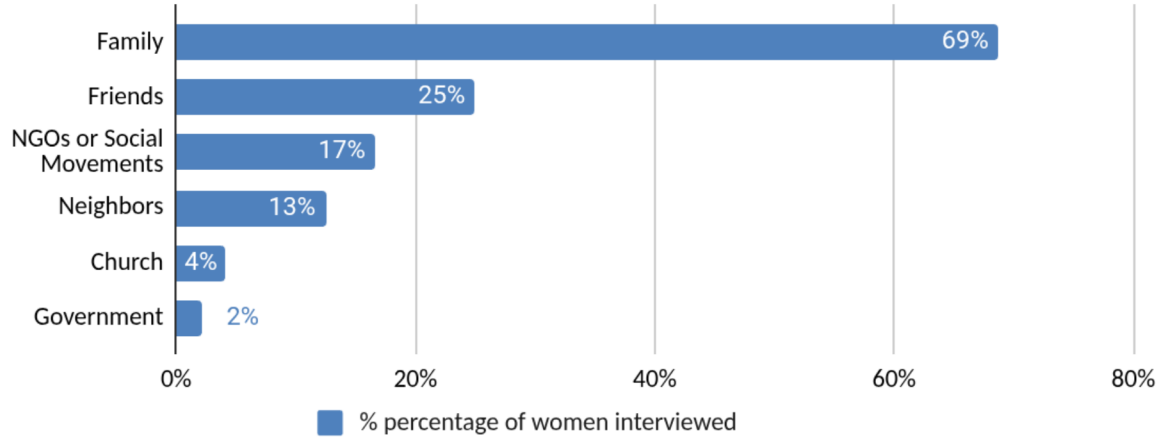
Adaptation Strategies and Barriers

This section investigated the forms of support and adaptation in response to climate change. Women were asked whom they turn to when facing difficulties and what types of assistance they receive. Questions also addressed the existence of collective actions in their communities and their participation in them, as well as experiences with government support programs, evaluating their effectiveness. Additionally, the study sought to understand strategies adopted by families themselves to adapt to or survive climate impacts, including changes made to their

homes, routines, or work, and the obstacles that continue to hinder greater protection or adaptation.

When climate-related difficulties intensify, the primary support network for the respondents consists of their closest and most immediate social circles. Family and friends are consistently cited as the first, and often the only, resource to which they turn for help (Chart 4). At a secondary level, NGOs, social movements, neighbors, and the broader community also play an important role, highlighting the strength of local ties. Institutions such as churches and government agencies are mentioned less frequently, suggesting that assistance is primarily sought within interpersonal and community spheres before turning to more formal support, even though most respondents reported already receiving some form of government aid.

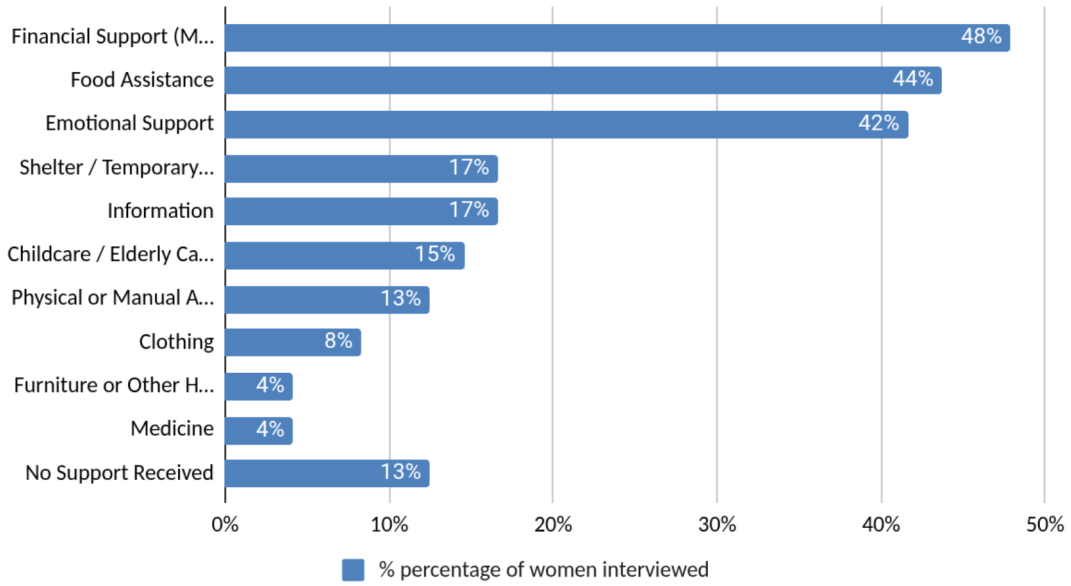
Chart 4 – Support Network



Source: Own elaboration (2025)

The assistance received from these support networks is comprehensive, addressing both urgent material needs and emotional support. Financial aid, whether in the form of money or loans, and the provision of food are the most common types of help (Chart 5). Emotional support emerges as a fundamental pillar. Network support is also manifested through the availability of care for children or the elderly, physical assistance to manage impacts at home, and donations of items such as clothing, furniture, and medicine.

Chart 5 – Types of Assistance Received



Source: Author's elaboration (2025)

Most of the women interviewed either do not know of or state that there are no organized collective actions in their communities to address climate-related problems. Existing initiatives are largely informal and reactive, emerging in response to specific crises, such as constructing improvised bridges during floods or mobilizing donations and temporary shelters. A minority actively participates in more structured groups linked to social movements, neighborhood associations, or NGOs, which organize discussion circles and mutual aid. Overall, community responses tend to be spontaneous and based on immediate solidarity rather than on preventive or long-term strategies.

The vast majority of respondents reported never receiving specific government support related to climate issues. For many, the government assistance they are familiar with includes Bolsa Família (65%) and Auxílio Brasil (17%), which do not directly address adaptation to extreme events. Government programs mostly provide indirect support, functioning more as basic survival aid than as tools for adaptation. A few respondents who experienced disasters, such as major floods, received occasional financial aid, such as the "reconstruction assistance," but the general sentiment is that these amounts were insufficient to cover losses and restart their lives. Rare mentions were made of Civil Defense actions, such as the distribution of basic food baskets. The perception is that when aid arrives, it is delayed and insufficient, as highlighted in the following statement:

> “Honestly, the assistance doesn’t help much, right? Let’s say it managed to provide the bare minimum.”

To adapt to climate impacts, families have adopted various strategies, primarily focusing on modifying their homes and routines. Structural adaptations are the most common, including raising floors and houses, building barriers to prevent floodwater entry, and repairing roofs. Relocating to safer areas was a drastic measure adopted by some. In daily routines, the main change was adjusting work hours and outdoor activities to avoid extreme heat. Additionally, planting trees around homes and creating “microclimates” have emerged as strategies to mitigate high temperatures. At the community level, neighbors coming together to build emergency structures, such as bridges during floods, has proven to be an effective survival tactic.

The main and nearly unanimous barrier preventing families from adapting as they would like, with long-term solutions, is the lack of resources, which makes essential home improvements difficult or impossible. Beyond financial constraints, the lack of government support, either in the form of direct aid or adequate infrastructure, is frequently cited as a significant obstacle. To a lesser extent, lack of time and information is also mentioned as a factor limiting the implementation of additional protective measures.

Cross-Cutting Vulnerabilities

The accounts of the women interviewed reveal that the impacts of climate change cut across multiple dimensions of daily life, deepening pre-existing inequalities. Most bear the primary responsibility for household management and caregiving, so extreme events not only cause material losses but also exacerbate women’s emotional and physical burden. Social reproduction work—which includes caring for the home, children, and family members and is largely unpaid and invisible—becomes even more exhausting during these events, as domestic tasks multiply with home cleaning, repairing damage, and attending to sick relatives.

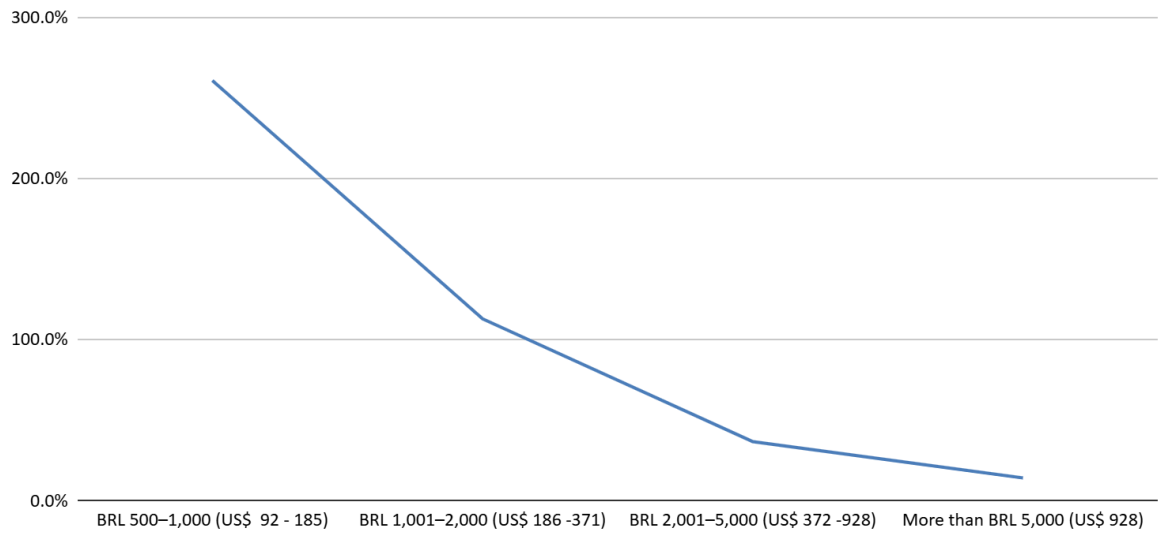
All these factors, such as the increased caregiving workload, income loss, and debt resulting from climate events, contribute to the process known as the “feminization of poverty,” a concept describing how poverty disproportionately affects women compared to men due to structural gender inequalities. This condition manifests concretely in the lives of the respondents, who report material losses and difficulties in rebuilding their homes and routines. As one participant explained:

> “There was a time when a very heavy rain broke the roof tiles, and we had to leave, and now I have to pay rent, you know? So, that caused a lot of

problems because of the rain. Not to mention that it was also very hot."

Women's socioeconomic vulnerability is further aggravated by their occupational status. Many rely on informal work, family farming, or social benefits, and report having no access to credit to recover losses or invest in adaptation measures. This economic fragility translates into disproportionate costs, as for many families, expenses resulting from climate events consume nearly the entire monthly income, increasing the risk of debt and financial insecurity. Comparisons between income allocated to recovery and the declared income bracket (Chart 6) show that the lower the income, the larger the share spent on repairs and adaptations following material losses from extreme events, indicating unequal capacity to respond across different socioeconomic groups.

Chart 6 – Comparison Between Income Allocation and Income Bracket



Source: Author's elaboration (2025)

Beyond the financial dimension, the accounts highlight emotional insecurity and a persistent fear of new extreme events, underscoring mental health as an invisible yet enduring impact. These experiences are closely tied to economic conditions; uncertainty about income, debt, and home reconstruction amplifies stress and feelings of vulnerability. As one respondent stated:

"There should be greater public awareness of the link between care and climate. Many people are getting sick, becoming more unwell because of climate change…and we can't simply ask for care, right? You can't go to a health unit and get psychological support, nor identify the groups

affected by the climate crisis, you know? But that's missing…because if it existed, there would also be a support network."

Thus, women experience the climate crisis intersectionally, with economic, social, environmental, and subjective dimensions intertwining and reinforcing each other. The accounts also reveal the centrality of care work, which is often invisible, and demonstrate how gender inequality, compounded by socioeconomic precarity, limits women's capacity to respond to the climate crisis. Recognizing these intersectional vulnerabilities is essential for designing policies that make women's experiences visible and advance climate justice and gender equity.

SYNTHESIS WITH LITERATURE

The findings of this research corroborate and deepen the results of the escope literature review conducted by WRI, which aimed to investigate the economic and social costs of climate change for families with prominent female participation in Brazil and Zambia between 2022 and 2025 (WRI,2025). The interviews conducted in this study contribute to advancing the concept of the Climate Bills, understood as the set of costs, direct and indirect, monetary and non-monetary, that reflect climate impacts on household budgets. This concept is not limited to a mere analytical framework; it serves as a lens to make visible losses that remain invisible in official statistics, particularly with regard to women's work, which is often unrecognized and unpaid or poorly compensated.

The literature review indicates that climate impacts amplify economic losses and exacerbate historical inequalities affecting women, especially in the Global South. Six main conclusions are outlined below, synthesizing the bibliographic review together with analyses derived from the primary data of this research:

1. Climate events increase women's vulnerability.

The literature indicates that floods, droughts, inundations, and heatwaves act as vulnerability multipliers in both urban and rural areas. This finding was validated by the interviews, in which women unanimously reported perceiving climate changes and their direct impacts on housing, health, and mobility. Accounts of homes flooded, crops lost, and disrupted daily routines reinforce the understanding that women are particularly vulnerable in situations of climate emergencies.

2. The climate crisis destabilizes household economies.

In Brazil, economic costs are most pronounced in urban areas following flood events (Ottoni; English, 2022; Valêncio; Baptista, 2023). In the interviews, this trend proved even more widespread: 72% of respondents who disclosed their income earn up to

R$ 2,000 (US$371,40) per month, with income predominantly from informal work or dependent on social benefits. Expenditures to respond to climate impacts average around 70% of household income and, in extreme cases, exceed 100% of the family budget. This disproportion highlights the high economic vulnerability and the persistent risk of indebtedness faced by these families.

3. Women bear the invisible social costs of extreme climate events.

The social costs of the climate crisis fall disproportionately on women, manifesting as physical and mental illnesses, girls' school dropout, and maternal nutritional sacrifices (Salvador et al., 2023; Fruttero et al., 2023; Malesu et al., 2024). Similarly, the interviewees' accounts reveal that health and nutrition are the most commonly perceived effects of climate change, mentioned in 44% of the interviews. Expenses for home repairs and food were identified as the costs that increase the most during extreme events, placing pressure on already limited household budgets. To cope with financial strain, many resort to borrowing or reducing consumption, even cutting back on their own food. Beyond the economic impact, climate events disrupt work and mobility routines, hinder access to school, healthcare, and sanitation, and intensify domestic and caregiving tasks, increasing women's physical and emotional burden. These social costs, often invisible, undermine women's health, dignity, and autonomy.

4. Female leadership is essential for community adaptation and resilience.

The review highlights the role of female leadership in adaptive processes and the importance of community support networks (Alonso-Población; Siar, 2018). The interviews validate this finding: women reported adaptation strategies ranging from emergency home repairs to tree planting and the construction of improvised barriers. However, it was observed that most collective actions are reactive and lack formal planning, constrained by limited financial resources, technical support, and structured public adaptation policies, and are primarily sustained by solidarity networks composed of family members and neighbors. Only a small portion of respondents participate in organized social groups, such as neighborhood associations or social movements.

5. The climate crisis intensifies women's workload.

Ferreira de Lima et al. (2024) indicate that the climate crisis exacerbates the gendered division of labor, with women devoting, on average, more than 10 additional hours per week to caregiving activities compared to men, a burden intensified during extreme events. In the interviews, women reported spending an average of 6.4 hours per day on care work, in addition to facing increased workloads during floods and droughts, which require home repairs, care for sick family members, and replacement of lost belongings. These factors heighten

economic vulnerability and directly affect women's physical and mental health, including chronic stress, anxiety, and exhaustion.

6. Climate justice and the care economy should be integrated into public policies.

Core concepts such as climate justice, intersectionality, adaptive capacity, empowerment, and the recognition of local knowledge guide the discussion on inequalities and responses to climate change. In terms of climate justice, there is a clear inequality in the capacity to respond to extreme climate events, while intersectionality allows for understanding how gender, race, and class shape overlapping vulnerabilities. In addition, this study highlights two complementary concepts that deepen the analysis of inequalities: the care economy and the feminization of poverty. The care economy encompasses the set of activities essential for the reproduction and maintenance of life, such as cooking, cleaning, and caring for children, the elderly, and the sick, which have historically been assigned to women and are economically undervalued. The feminization of poverty describes how poverty disproportionately affects women, especially Black, peripheral, Indigenous, and rural women, due to the care burden, precarious labor market participation, and unequal access to resources and credit. These concepts emphasize the importance of understanding gendered vulnerabilities in their structural dimension, showing that addressing the climate crisis also requires transforming the social and economic foundations that sustain such inequalities.

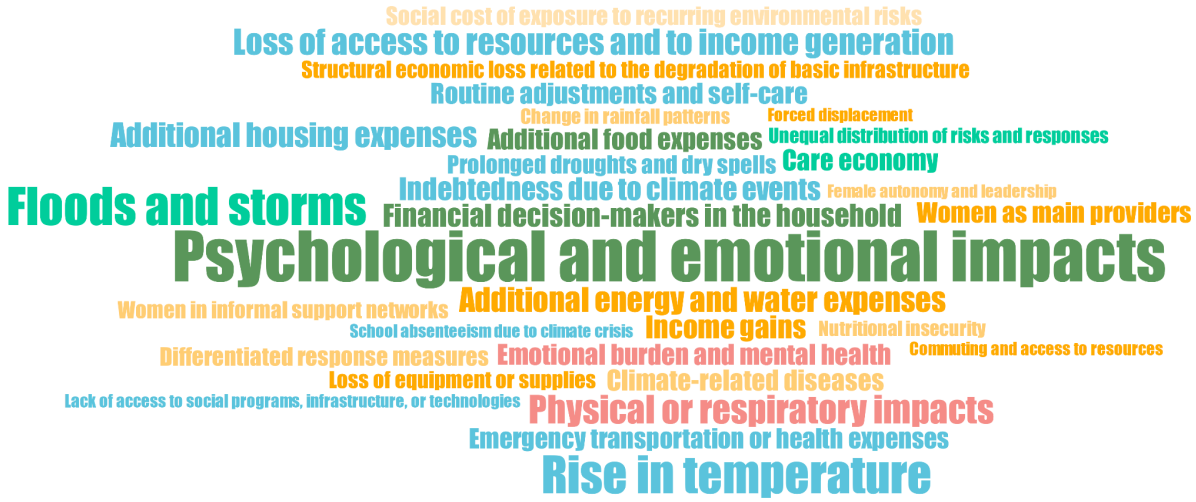
The findings of this research illustrate these dynamics. Interviewed women manage multiple work shifts, both inside and outside the home, with 22.9% employed as domestic workers, revealing the overlap between reproductive labor and paid care work. On average, they devote 6.4 hours per day to caregiving activities, and most perceive their source of income as insecure or unstable. Climate impacts exacerbate this vulnerability, leading to increased expenses for medicine, energy, and repairs, in addition to material and income losses. An intersectional analysis of vulnerability further shows that the lower the income, the greater the proportion of resources devoted to responding to climate events, indicating that environmental disasters deepen the feminization of poverty and reinforce structural gender and class inequalities.

7. Identified gaps.

Two significant gaps emerge from the comparison between the literature and the interviews. While the literature review predominantly maps impacts on physical health and nutrition, field reports strikingly reveal the effects on mental health, including anxiety, depression, and chronic stress, which remain underexplored in research, yet become increasingly relevant when combined with the domestic workload disproportionately borne by women. Figure 3 illustrates the

predominance of psychological and emotional impacts within the code cloud of this study. Furthermore, the absence of racial disaggregation in the field data limits a more robust intersectional analysis and restricts understanding of how race, territory, and gender intersect in shaping climate-related vulnerabilities.

Figure 3 – Code cloud generated by MAXQDA



Source: Author's elaboration (2025)

RECOMMENDATIONS

The recommendations presented here result from the synthesis of the systematic review conducted by WRI, the field evidence collected, and the literature review carried out from the analysis of data by the Brazil research team, highlighting urgent responses to the identified intersectional vulnerabilities.

To mitigate the invisible costs imposed on women and address vulnerabilities exacerbated by environmental crises, coordinated action by multiple actors is crucial. Governments, funders, multilateral development banks (MDBs), foreign direct investors (FDIs), media, communities, and the private sector each have distinct and complementary roles in promoting gender equality and strengthening women's resilience in a rapidly changing world.

The recommendations outlined below, organized by key actor, point to concrete pathways for national public policies and international commitments, such as those to be discussed at COP30, to effectively incorporate gender and climate justice perspectives. Their importance lies in recognizing the so-called Climate Bills Research Project, the economic, social, and invisible costs of climate change, by all relevant stakeholders and in the need to transform them into instruments for action.

1. Governments

1.1. Recognizeand account for “Climate Bills” in public budgets.
National and subnational governments should include the direct and indirect costs of the climate crisis — economic losses, increased household expenses, care work overload, and impacts on physical and mental health — in their socioeconomic assessments and public budgets. Integrating these costs will allow a fairer understanding of the burden of the climate crisis on women-headed households, supporting more effective policies for compensation, income transfers, and the mitigation of inequalities.

1.2. Align the implementation of the National Care Policy with climate policies.
It is essential to integrate the National Care Policy with adaptation and mitigation climate policies, recognizing care work — especially that carried out by Black, peripheral, Indigenous, and rural women — as a pillar of social resilience. Recommendations include valuing, remunerating, and ensuring labor protections for caregivers, expanding childcare services, formalizing community-based care, and extending paternity leave, simultaneously promoting social justice, gender equity, and combating environmental racism.

1.3. Strengthen early warning systems by integrating different levels of government. Climate monitoring and early warning systems should be expanded and coordinated across federal, state, and municipal levels, ensuring communication that is accessible, inclusive, and rights-based. This integration is essential to guarantee that marginalized communities receive timely information about risks and can take effective preventive measures.

1.4. Integrate health, education, and social assistance policies to address intersectional vulnerabilities. National and local adaptation plans should include intersectoral actions that encompass: (i) targeted care for mental health and climate-related illnesses; (ii) programs to prevent school dropout during extreme events, with special attention to girls; and (iii) support for vulnerable single-parent families. This integrated approach is essential to mitigate the invisible social costs borne by women. In this context, it is recommended that CRAS (Social Assistance Reference Centers) receive specific training on climate-related anxiety and health issues, enabling them to provide more qualified and sensitive support to those affected.

1.5. Incorporate vulnerability, climate justice, and international perspectives into international negotiations. At COP30 and other multilateral forums, governments should advocate for commitments that ensure the fair redistribution of resources, mechanisms for loss and damage compensation, and accountability for the highest

greenhouse gas–emitting sectors. It is essential that the vulnerabilities of women and girls are recognized as a core component of the global climate justice agenda, rather than as a peripheral issue.

1.6. Ensure housing access and gender-responsive adaptive credit.
Housing policies should allocate a portion of social housing units to families affected by disasters and climate-related displacement, giving priority to women in situations of greater vulnerability, such as single mothers.

1.7. Prioritize the construction of resilient infrastructure in high-risk areas. It is recommended to adopt nature-based solutions and drainage works, taking into account and respecting rainfall cycles. These actions should align with local adaptation strategies and sustainable territorial planning.

2. Funders and Multilateral Development Banks (MDBs):

2.1. Promote the adoption of resilient infrastructureIt is necessary to prioritize investments in resilient urban and rural infrastructure, focusing on reducing the impacts of extreme climate events.

2.2. Implement gender- and vulnerability-sensitive climate finance mechanisms It is essential to expand credit programs and financial assistance that prioritize women, traditional communities, and marginalized groups, ensuring access to resources for local adaptation, housing improvements, basic sanitation infrastructure, and livelihoods.

2.3. Promote gender-focused adaptive credit. It is recommended to expand accessible credit mechanismsfor post-disaster reconstruction and home repairs, ensuring low interest rates and dedicated lines specifically for women

2.4. Promote gender-responsive investments Direct investments toward companies and projects that advance gender equality, both in their products and services and in organizational structure, prioritizing initiatives led by women at the community level.

2.5. Support the care economy
Finance the creation and expansion of care infrastructures, such as daycare centers and senior care facilities, which are essential to reducing the burden of unpaid care work on women.

2.6. Incorporate gender equality into projects
Multilateral development banks (BMDs) should integrate a gender perspective at all stages of their projects, from design to implementation and evaluation.

2.7. Promote cooperation and knowledge sharing.
Encourage collaboration among financial institutions to exchange best practices and data on financing women-led businesses.

3. Foreign Direct Investors (FDIs)and the Private Sector
   3.1. Adopt Gender Equality Policies.
   Implement policies that ensure equal opportunities and pay, while promoting women's participation in leadership positions, equitable parental leave, and flexible work arrangements.
   3.2. Investir em infraestruturas de cuidado.
   Similar to financiers, it is recommended that FDI and the private sector prioritize investing in care infrastructure in the communities where they operate, benefiting both their employees and the local population. Additionally, it is recommended to provide or subsidize childcare services for employees.
   3.3. Promote Gender-Sensitive Value Chains.
   Prioritize suppliers that also adopt gender equality practices, extending the positive impact throughout the value chain. Whenever possible, support and promote women-led businesses within their supply chains.
4. Communities
   4.1. Strengthen Support Networks Create and reinforce networks of women who can share resources, caregiving, and mutual support, especially during crises.
   4.2. Promote Engagement in Disaster Prevention. Through spaces for listening and co-creation of collective solutions and public policies, active participation of women, both in disaster risk management and in the development of resilience plans, is crucial for the effectiveness of these actions.
   4.3. Promote Gender Equity.
   Communities act like invisible threads that shape people's daily lives. In this way, they play a key role in challenging social norms that overburden women with caregiving responsibilities.
5. Media
   5.1. Highlight Invisible Work.
   Promoting awareness campaigns on gender inequality in domestic and caregiving tasks can foster social change.
   5.2. Responsible Representation
   Avoid perpetuating gender stereotypes and provide space for the voices and experiences of women from affected territories, especially in crisis contexts.
   5.3. Advocate for Effective, Efficient, and Auditable Public Policies. The media still has the power to shape public debate and pressure for policies that recognize and value caregiving work. This role is particularly crucial during environmental crises, where both traditional and independent media can promote social accountability and discourage misconduct.

RECOMMENDATIONS FOR FUTURE PROJECTS

This study did not aim to exhaust the topic of intersectionality between gender, care work, and the climate crisis. Its main objective was to foster debate, serving as a starting point for future research. Based on the gaps identified in the literature review, it is suggested that subsequent investigations could:

1- Deepen the analysis of the effects of extreme climate events on women's mental health;

2- Incorporate specific focus on Indigenous and quilombola populations;

3- Advance the understanding of racism as a central axis in the intersectionality between gender, climate, and care work.

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APPENDIX 1 – ACCOUNTS OF THE INTERVIEWED WOMEN

These accounts were selected from the audio transcriptions of the interviews, preserving the anonymity of the women and aiming to present their speech as directly as possible, with minimal interventions. Some reports may be sensitive; please consider reading only what contributes to your reflections, without causing distress.

The invisible work of care

“[RESEARCHER] Alright. If you could give an idea, counting only the care activities—cooking, tidying the house, taking care of the children—how much time does that take in your day? How many hours, roughly?

[INTERVIEWEE]Wow, if I said 24 hours it would sound exaggerated, right? But, in practice, it’s almost that. BecauseI only stop when the child sleeps.”

“Look, I, actually, I spend the whole day dedicated, you know? BecauseI don’t leave the house; some days I don’t even go to the gate, you know? So, I stay at home all the time.”

“We try to optimize our routine, because I’m the only one who takes care of the food. So, worrying about fruits and vegetables is extra work for me. But when we are sick, we also take on this work because it helps us recover faster.”

Perceptions and Observations of Climate Change

“Because the rain we had now doesn’t even last an hour, two hours, a rain like that—30 minutes, 15 minutes—I was already worried: will the street flood? Won’t it flood? Will we be able to get through?”

“Every day we feel the heat more intensely, right? And that also affects us, because our bodies aren’t used to it…and the children’s, even less.”

“Oh, everything changed…it’s because the climate system has heated up, right? It got too hot, and people kept deforesting, destroying, ruining nature, right? So, when you plant a tree, you plant a seed, it grows, and gives fruit…Then the rain comes from above, goes down, and on the hills it ends up causing landslides, destroying the city and everything else. I see that when nature is destroyed, it comes back to claim its due, right? That’s what happened. So, we suffered here…we ended up suffering because of the flood and lost everything.”

“The calendar has spring, summer, fall, winter, but here it rains almost all year round. This greatly affects the flowering of plants. We were expecting for a flowering

now in June, but it didn't happen. We believe it was because of the excessive rain, which prevented flowering. And on the farm, we feel this a lot, because the seasons are no longer stable like before. Every year it changes, and you can't know if it will rain or be dry in spring. For those working with beekeeping, this is even more impactful, because the bees need flowers. The plan was to harvest honey twice a year, but this year we only managed once. Now we're hoping to harvest again in September, but it all depends on the flowering."

"There was a very heavy rain, with winds that tore off the roofs and caused landslides. It was a night full of despair, people running without anywhere to go, seeking shelter in schools. Many houses lost their roofs, roofs flying like sheets of paper. Many people were desperate, some even died. It was very sad and frightening."

Impacts on Care Work and Gender Roles

"You don't even feel like doing what you need…washing clothes, cooking, doing other things…how are you going to do it if there's only water? Usually, I stayed upstairs, waiting for the water to go down so I could clean and do my daily tasks… but then you don't even do it, because you get so tired that you end up resting again. It's very exhausting."

"And another thing…because of the flood, you can't move. You wait for the house to empty to be able to wash. Zezé, the carpenter here, almost died eight years ago because he got leptospirosis. Your head doesn't think… instead of putting on the boots right away, you worry about saving things, the furniture, lifting everything. And when you notice, your feet and legs are already submerged in water. And this water…it's very contaminated, there are a lot of rats."

"My daughter was traumatized, had to see a psychologist and psychiatrist. She spent 20 days on top of a bed. A 9-year-old child, just to give you an idea, and we prayed, with a lot of faith in God. On the boat, she prayed a lot. She said: 'My God, get us out of here. Don't let us die.' And that started affecting me. We prayed, and God got us out of that torment. Some people don't believe in God, but everyone has their own belief. But if it hadn't been for God at that moment, we would have capsized. We were in a stretch where if the boat turned, we would have had nothing to hold on to and we would have drowned. So, I say it was God's hand…She stayed 20 days, and we took her to the health center. They gave her medicine for headaches, paracetamol."

"No one takes care of us. No one takes care of the woman. No one takes care of those who care. When I get sick…I cook. I have a wonderful partner, my boyfriend, I won't marry again for now, but he's great. But currently, I…I've developed a bunch of skills so I don't need anyone."

“I was going to work, it started raining heavily, I had to go back, because I left the kids at home, and I was scared.”

“Yeah, actually you never feel completely safe, right? For example, when I leave to work and it starts raining, I think, wow, how’s everything at home?”

“But I think I feel it affects my mental health a lot, right? I get more stressed, more worried, more tired…and that directly affects my caregiving, because I can’t take care the way I’d like. A lot of what I feel, the fear, the anguish inside me, ends up spilling over onto the people I live with…my husband, in this case. I end up losing patience, I can’t be as present, so I can’t provide care the way I would want to.”

“I don’t have a support group, because my support group itself needs support. So, I do everything I can to avoid having to turn to that group. It’s just God and my husband, and we each take care of ourselves, and God takes care of everyone.”

Health and Well-Being Effects

“Even now, I feel it, right? There are nights when I don’t sleep, I wake up early, at four-thirty I’m awake.”

“I felt a lot of heat when I was pregnant. I felt it so intensely, I would cry because of it.”

“Anxiety, yes, right? Oh my God. But I don’t know, because I haven’t gone to the doctor to see if it’s depression.”

“Even right now, he (my son) is having health issues, he has mucus and isn’t going to school. We went to the ENT, and she said this allergy isn’t a virus. And I notice that, in moments of environmental changes, like I told you, it gets worse for him. And when it’s an extreme situation, I also feel that he gets worse, gets congested, has more trouble breathing.”

“But because of the heat, I always feel tired and stressed.”

“I was nine months pregnant already, he died in my womb. And a week before I started feeling sick, there was a rain that broke the roof, broke everything, and flooded the whole house. I lost everything of my baby. Lost everything of his. Then it passed. I went to my mother’s house and started feeling bad, when I arrived at the hospital, he was already dead. I don’t know if it was because I got nervous seeing the house like that.”

“We get tired faster, serenity is lost…we sweat a lot, get headaches, any extra effort gives me a headache. Lately, I wake up with a headache… right now I have a headache. So to get through what I need to do, I live on medication, to be able to be

useful, because that's always expected, right? This usefulness, readiness, calm…but the climate doesn't adapt to us, we have to adapt to it."

"There should be a greater popularization of the issue of care linked to the climate. Many people are getting sick, getting sicker because of climate change…and we can't just ask for care, right? There's no way."

"During the flood? I felt all of that… exhaustion, insecurity, anxiety, fatigue, insomnia…all at once. Extreme tiredness, but many times I couldn't sleep, right? And that only made the fatigue worse and generated anxiety…because insomnia causes a lot of anxiety, you know?"

"And I almost died in the flood too. I got caught in a terrible current. I was in the water trying to save my son, with him on my back, and the current was too strong to get from my mother's house to the street. The jetski couldn't get in. I went in to save him because we couldn't get in touch with the city hall, with anyone."

"I am afraid of losing everything I have, and it has reached a point where I fear losing my life, my partner's life, and the lives of my pets. It reached a moment where we are filled with fear, experiencing generalized anxiety whenever we talk about climate, you know?"

"I became very worried, which is one of the things about having children, because it's just us and we have to manage on our own. Our boat almost capsized, and in that moment I felt death face to face — either me, my children, or everyone. It was very difficult."

"And my mother also became ill… Psychologically, we had to take her to receive psychological care. The doctor gave her sedatives, because she would cry and cry. Then we panicked, realizing that no one could take care of my grandmother except my mother. So, with my mother breaking down, everyone else was breaking down too."

Economic Costs and Losses

"Leafy greens get more expensive. Legumes that come from the land get more expensive. Carrots, potatoes, onions, everything gets pricier during the rainy season. Leafy greens in general—kale, chives—everything is more expensive. They say it's because of the rain."

"I'll just say that I didn't lose the most important thing to me, so among all my losses, the essential was with me, which were my children and the little one. But still, I had losses. I had an apartment that had been furnished for five years, right? So my

children lost their toys, clothes, school supplies, we lost furniture. I really had to start from scratch."

"Last year, on May 1st, the flood started. By May 13th, I had all the machinery ready for the farm. And the water came and even covered the house, so we couldn't farm, you know?"

"There was a huge increase in my expenses. If I used to spend around three thousand, now I spend five."

"I had to renegotiate my bank debts because the debt is very high, and you can't get financing while you owe. No bank releases anything. If I took a PRONAF loan and didn't pay, or a cost financing and didn't pay, my name gets blacklisted and I can't access another credit. But I have to plant, buy oil, fix the machinery, buy seeds we lost. And it's impossible to do that. So, it's the federal government who should help us. It's the government, right?"

"When the heat starts, I turn on two fans. And that increases the electricity a lot. Then I also increase the fridge's power. Because my fridge is on a wall that gets a lot of sun. So, after that, my electricity bill goes up."

"Wow, when I think about my house, you know? I imagine it a certain way…tidier, with the floor done, the little door looking nice, all the holes patched. My children inside, warm…Our Lady."

"And there was a time when there was a really heavy rain, it broke the roof tiles, and we had to leave, and now I have to pay rent, you know? So, that affected us a lot because of the rain. Not to mention it was very hot too."

"The flood took everything we had, right? Nothing was left. The household items rotted and we had nothing. The fridge broke—two fridges—wardrobe, bed, closet, sofa…everything was gone with the flood. Even the chickens we raised were carried away, so much was lost."

"It's precisely during the rainiest periods that we notice that the price of vegetables goes up a lot. Tomatoes, right? It's precisely the things we use most: vegetables to cook for the kids, potatoes, carrots…the basics of our list. And when we go to the market, we notice it increased drastically. Then we start looking around to see where it's cheaper, to be able to eat well without straining our finances. That's exactly what we notice."

"Energy consumption goes up because the fan is on all the time. You also spend more on the fridge, which we open constantly, and more on water, because we have

to buy more water jugs, one per day, because we cook, and the water isn't very healthy."

"There was a time when the water came in so fast that this drawer at the back, full of personal documents, my son's school documents, got soaked. All the copies were ruined, some documents, some books, photos of my son as a child, so the memory of photos—I lost everything, everything! At that moment, that sadness hits, you know?! And the anger."

"I had to lift a fridge by myself because there was no one around. The house started filling up, filling up, and the water rose very fast. I don't know where I got the strength, and I lifted the fridge onto some bricks. I hadn't even emptied everything from it, I did the best I could, but the water was coming in so fast that I don't know where that strength came from. I put it on a pile of bricks. Later, people asked me, 'How did you do that?' And I said, 'I don't know! I think it was the adrenaline of losing,' because you never know if you'll be able to buy another. Not everyone says, 'Ah, if it's lost, it's lost.'"

"If I take out a loan, like the one I took for R$16,000,?I think you know that most people did the same, right? And with this R$ 16,000, I never saw the money, you know? I received it, but I never actually saw it. Why? Because I gave it to my son, so he could build a mezzanine. Thank God, if he hadn't started that mezzanine, which isn't finished yet, we would have lost our belongings again."

"I realized, as a housewife, that food became much more expensive. So, besides having suffered a nutritional setback in our diet, access to certain items also became more difficult because they are more expensive. All of this is impacted by climate change, which we especially feel during extreme heat."

Adaptation Strategies and Barriers

"I called the bricklayer and told him: make a little 'barrier' here so the water doesn't come in. He put a brick, made kind of a wall like this."

"My transportation costs go up, because in hot moments I start only using Uber to get around."

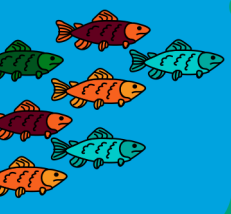
"Ah, yes…I've already done some things at home to adapt. Like, not using rugs to avoid dust, mold… We even built a two-story house, to live upstairs, because the walls downstairs get very damp. And upstairs it even helps more, but still there's some mold."

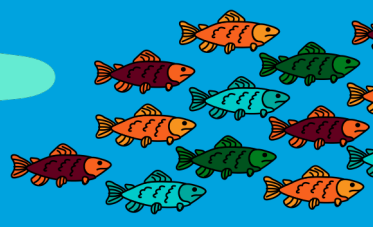
"So, in the Quilombo, in Painho's case too, he had to build a block house, right? When the water came, it was very cold. And, like, in the Quilombo, it wasn't just

Painho, several people started building block houses to be better during that time. It's like a two-story house, medium height, more or less. Before it was made of planks."

"Yes, we get more worried about floods because here it has already filled… especially my father, who had to be carried on my brother's back. Before, it didn't flood this much, but when the water entered the house, took over the house, he had to stay for a while with my sister. He even became a bit depressed because of the rain, afraid of floods, when it rains heavily, he gets desperate. We already had to move twice, live in rented houses because of the water. We were away from here for about three years, raising the house. Then we managed to recover it, but a year later the rain came back. So we get desperate, especially when it rains at night, because you don't know what's coming, waking up with water arriving…we get very worried. But we just don't leave here because we have nowhere else to go."

Country Report
Zambia





Climate Bills Research Project

Country Report: Zambia

Author: Hope Sabao

Executive Summary

Climate change in Zambia is no longer a distant threat. It is a lived reality. Between 2022 and 2025, households across Zambia have faced intensifying climate shocks, with the 2024 drought marking a critical turning point. The country experienced the driest agricultural season in more than forty years, resulting in significant crop losses, increased livestock deaths, and worsening poverty, with over 9 million people in 84 out of the 117 districts being affected.

The main objective of this study was to document the household-level economic and social costs of climate inaction, with a focus on healthcare, food, energy, and livelihoods, with an extended consideration to have a deeper look at how women are disproportionately impacted compared to men. This report, based on mixed-methods research with 183 households, reveals how climate inaction deepens gendered inequalities, undermines livelihoods, and erodes community resilience. Women endure the most of climate-induced burdens, especially in care work. Further, informal workers, and marginalised groups bear the brunt of these impacts, yet remain excluded from decision-making and climate finance flows.

Some key findings from the study are:

i. There is near-universal awareness of climate change among Zambian households, with 99.47% of respondents affirming noticeable shifts in climate patterns. These perceptions are grounded in lived experiences of erratic rainfall, prolonged droughts, and extreme heat. These disruptions have destabilised agricultural livelihoods, especially for smallholder farmers dependent on rain-fed systems.

ii. Climate change has intensified the burden of unpaid care work for women in Zambia. On average, women perform 6.8 hours of care work daily compared to 2.1 hours for men. This disparity is exacerbated during climate shocks, where women must walk longer distances to fetch water, cook with scarce fuel, and care for children under increasingly difficult conditions.

iii. Women's health and emotional well-being are significantly affected by climate-induced stressors. The report documents widespread fatigue, anxiety, and emotional distress among women who bear the primary responsibility for household survival.

iv. Climate shocks have imposed severe economic strains on Zambian households, particularly those led by women in the informal sector. The 2024 drought resulted in maize crop failures across 43% of cultivated land and a 53% decline in grain production, the lowest yield in five years (ACAPS, 2025). This downturn has disrupted livelihoods and increased household spending on food and transportation.

v. Households primarily rely on informal networks and sporadic piecework to cope with

vi. Input Support Programme and Social Cash Transfer, are insufficiently accessible, especially for women-led households.

vii. The report underscores that climate change disproportionately affects women and marginalised groups. Of the 183 households surveyed, 84% of respondents were women, and 61.1% of them were in the lowest income bracket . Despite carrying the bulk of household responsibilities, women remain underrepresented in climate governance structures.

The report recommends that to build equitable climate resilience that intentionally supports vulnerable groups, coordinated and gender-responsive investments and prioritising women's leadership, access to resources, and inclusion in decision-making, to ensure that adaptation efforts are locally grounded, socially just, and systemically effective. At international level, donors, multilateral banks, and climate finance institutions can play a transformative role by shifting from top-down funding models that are bureaucratic, inflexible and streamlining the application process to be accessible by small scale local level organizations that have direct relations to grassroots movements supporting women's initiatives on adaptation. This support should include capacity building in leadership development for women in climate governance roles and gender budgeting that is able to allocate specific portions of climate finance to women's empowerment. At national level, government should establish a gender-responsive climate adaptation fund that prioritises women-led and low-income households by directly funding women's access to irrigation, drought-resistant seeds, and small-scale enterprises that would strengthen family resilience and reduce poverty.

1.0. Introduction

This report presents a detailed analysis of climate change impacts in Zambia, drawing on recent study data. Zambia faces increasing climate variability, marked by more frequent and severe droughts, floods, and heatwaves (National Adaptation Plan, 2023). With approximately 90% of agricultural land dependent on rain-fed systems, shifts in weather patterns threaten household income, nutrition, and well-being (Beyer et al. 2015). Rural communities are particularly vulnerable due to weak infrastructure and limited social protection. The energy sector, reliant on hydropower, is also affected by reduced rainfall, leading to load shedding and economic disruption.

Climate change disproportionately affects women, especially in rural areas, where traditional roles assign them responsibility for food, water, and fuel provision (UN Women, 2022). As these resources become scarcer, women's workloads increase, limiting opportunities for education and income generation, and weakening household resilience. Their participation in decision-making around resource management and climate adaptation remains minimal, despite their essential roles (UN Women, 2022). However, research underscores that empowering women and integrating gender-sensitive strategies can bolster community resilience and improve development outcomes. These insights are crucial for shaping effective climate policies and interventions in Zambia.

1.1 Research Objectives and Guiding Questions

The primary research objective is to document the household-level economic and social costs of climate inaction, with a focus on healthcare, food, energy, and livelihoods. The study outlines six thematic areas, each with corresponding questions to guide analysis:

i. Perceptions and Observations of Climate Change:
ii. Impacts on Care Work and Gender Roles:
iii. Health and Well-Being Effects:
iv. Economic Costs and Losses
v. Adaptation Strategies and Barriers:
vi. Cross-Cutting Vulnerabilities:

By examining lived experiences, particularly those of women, Zambia can shape equitable reforms. The COP presents a strategic platform to strengthen climate finance and policy reform that is responsive, resilience-focused and gender-aware, while at national level gender-responsive budgeting (GRB) is identified as a key tool for accountability, government to monitor allocations, especially for women-led adaptation initiatives and vulnerable populations. Overall, the findings emphasize the importance of GRB, participatory governance, and targeted climate finance.

1.2 Methodology

This study used a mixed-methods approach and purposive sampling from 183 households. Data was gathered via KoboCollect, with audio recordings and field notes for depth. Interview respondents were selected from the lower Kafue basin in Southern and Lusaka Provinces, i.e. Rufunsa, Kafue, Luangwa, Chikankata, and Mazabuka. This region was selected on the basis of its economic significance to the country's GDP and its vulnerability to climate-induced challenges. Sampling was intentionally biased toward women to assess the burden of climate-related care work. Quantitative data was refined using IQR-based winsorization, while qualitative data focused on women's lived experiences. This approach ensured both statistical accuracy and rich narrative insights into the gendered dimensions of climate vulnerability. To ensure analytical rigor, intercoder reliability testing was conducted in MAXQDA, with two analysts independently coding transcripts using a shared codebook. In addition to manual coding in MAXQDA, the team ethically applied AILYZE, an AI-assisted analysis tool, to cross-check emerging qualitative themes and identify overlaps across transcripts. This helped confirm that the final themes reflected participants' lived experiences rather than researcher bias. All AI-generated insights were reviewed and validated by human researchers to maintain transparency, analytical integrity, and adherence to ethical standards.

A key limitation of the study is its geographic scope, as it was confined to the lower Kafue basin hence the data may not fully represent the national context. Another limitation was the potential biases from self-reported data and the limited generalizability due to the sample size. Ethical standards were strictly observed in line with the Zambia Data Protection Act, ensuring informed consent, data anonymization, and confidentiality. The methodology was further strengthened through a comprehensive literature review from the World Resources Institute, grounding the research in global best practices and current evidence.

1.3 Sociodemographic Profile

The majority (74.3%) of the study participants were drawn from Lusaka Province, while 25.7% were from Southern Province. The distribution by age showed that 66% were adults, 33% were youth (between 18-35 years) and 1% represented children under 18 years of age. In terms of gender, 84% identified as women while 16% identified as men. For marital status, 59% were either married or in common law partnerships, 15% were widowed, 14% were single, while 12% were separated or divorced. Regarding occupation, 58% were farmers, 28% were in business or entrepreneurship, 4% were unemployed, 3% were in formal employment and 7% were not falling in any of the categorised occupations. Out of all the respondents, 95% did not identify with any disability. In terms of household responsibility 47% were female headed while 16% had shared responsibility. Below are the table summaries:

Summary of respondent characteristics

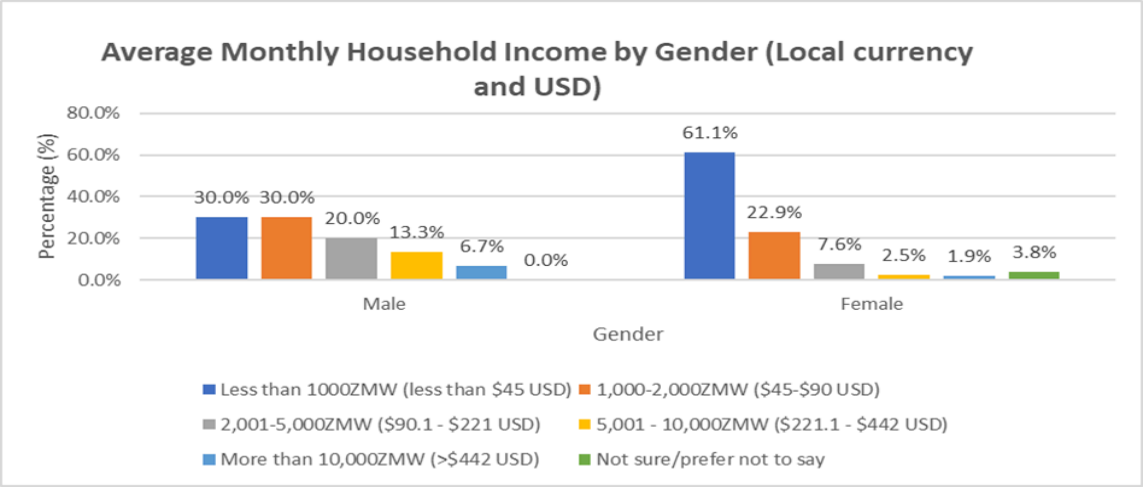
Category	Sub-Category / Response	Frequency	Percentage
Gender	Cisgender woman	157	84.0
	Cisgender man	30	16.0
Age	Above 35 Years	124	66.3
	18–35 Years	62	33.2
	Below 18 Years	1	0.5
Occupation	Farmer	109	58.3
	Business/Trading/Entrepreneur	52	27.8
	Other	14	7.5
	Unemployed	7	3.7
	Employed	5	2.7
Marital Status	Married / Common-law partnership	111	59.4
	Widowed	27	14.4
	Single	26	13.9
	Divorced / Separated	23	12.3
Household Composition	Nuclear	127	67.9
	Extended	54	28.9
	Adult-only	6	3.21
Disability Identification	No	178	95.2
	Yes	9	4.8

Geographical	Categories	Frequency	Percentage
Group State/Province	Lusaka	139	74.3
	Southern	48	25.7
	Total	**187**	**100**
Group Municipality/District	Rufunsa	97	51.9
	Kafue	39	20.9
	Chikankata	24	12.8
	Mazabuka	24	12.8
	Luangwa	3	1.6
	Total	**187**	**100**

Gender	Primary Household Responsibility	Frequency	Percentage
Male	No	3	1.6
Male	Yes	27	14.4
Female	No	39	20.9
Female	Shared Responsibility	30	16.0
Female	Yes	88	47.1

Geographical distribution province and district

Gender and Household Responsibility



2.0. Findings

This section presents the findings from the data. The section outlines the following thematic questions.

2.1 Perceptions and Observations of Climate Change

Study findings reveal a strong, near-unanimous perception among Zambian households that the climate is changing. Only one respondent from the survey had a perception that Zambia's climate is not changing. Respondents cited disruptions to long-established rainfall patterns, prolonged droughts, and extreme heat as being the most frequently faced challenges.

2.1.1 Change in rainfall patterns

The findings demonstrated that the most prominent observation relates to rainfall, which is now widely perceived as erratic and unreliable. Respondents consistently described rains that either arrive too late, end too early, or fall with uncharacteristic intensity, leading to floods. Over 85% of respondents who identified as farmers noted that these changes have directly impacted their agricultural calendars. The once-predictable seasons for planting and harvesting have been thrown into disarray, increasing risk and uncertainty. A male farmer from Kafue District articulated a common sentiment:

> "In the past, we would prepare our fields in August to October, and the first rains would be experienced in November, and we would plant and be able to harvest in three months around April. These days, however, the rains have not been stable and unpredictable, so it has made our farming very difficult. This has become expensive as we have to continuously replant costing us money for seeds and fertilisers". (Male Farmer, Kafue Zambia)

Another farmers also held similar views and commented that:

"A long time ago, rainfall was very predictable and would come in good quantities. Now it's either too much or too little. So, when you plant it either dries or is carried away by too much water". (Farmer, Zambia)

"I noticed in June, it rained, hail rain. The weather was very unusual. Rains used to start in October but now it starts in December". (Female Farmer, Zambia)

These shifts began to intensify for many within the last decade, with several respondents pointing to the period between 2015 and 2020 as a turning point. It is evident from the sentiments from the study participants that variability in rainfall has affected their farming practices resulting in changes or shifts in planting and harvesting seasons.

2.1.2 Extreme Weather Events

The study findings pointed to prolonged droughts and extreme heatwaves as the second major category of observed changes, often linked directly to the erratic rainfall. Farmers who participated in this study described these events as having severe consequences, including the drying of rivers, streams, and boreholes, which impacts access to water for domestic use, agriculture, and livestock. Below are a few responses on how extreme weather events have affected them. These quotes highlight the lived experience of climate variability and environmental stress. Communities describe rising temperatures, strong winds, and drying rivers, which disrupt livelihoods and family well-being.

“When it's cold, there are no fish. When it rains it's continuous non-stop which makes it hard to do business”.

"Low rainfall, Increased winds and temperatures"

"Sometimes you sweat a lot, sometimes you feel extremely cold"

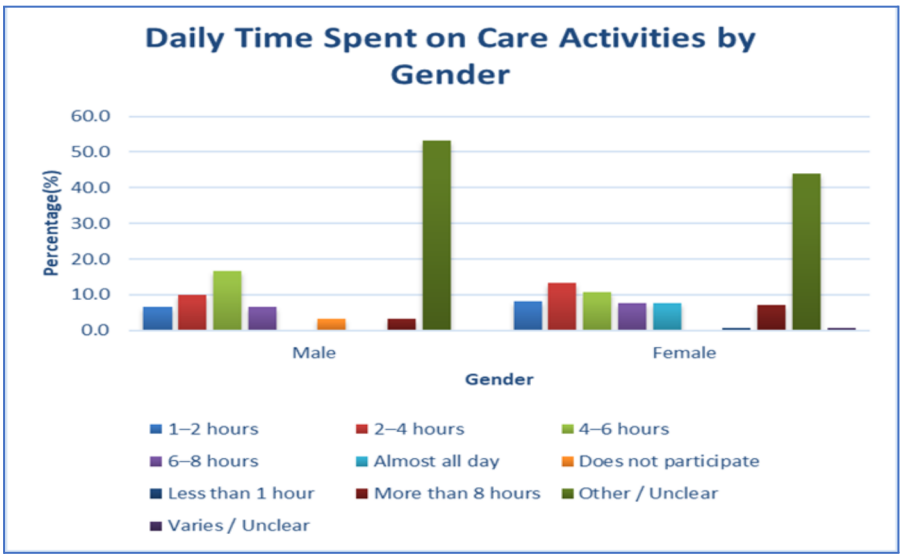
We experienced a lot of winds and heat which became unfavourable for our families. We would have moved, but have nowhere to move to."

"Rivers had dried up, and there were wild fires"

2.2 Impacts on Care Work and Gender Roles

The study reveals that the burdens of adapting to climate change at the household level are not shared equally; instead, they fall disproportionately on women, who assume expanded unpaid care and domestic responsibilities. The figure below presents results on the daily time

spent on care activities by gender.



Day Time Spent on Care Activities by Gender

As climate events disrupt access to essential resources like water, food, and energy, it is predominantly women and girls who are tasked with filling the gaps, often at great personal cost to their health, education, and economic opportunities. The study found that a significant majority of female respondents reported a noticeable increase in the time and effort dedicated to care activities. The data indicates that women spend an average of 6.8 hours per day on care work (e.g., cooking, cleaning, fetching water, caring for children and the elderly), compared to an average of 2.1 hours reported by male respondents. During climate-related crises, this disparity is exacerbated. For instance, with the drying of nearby water sources due to drought, the findings revealed that women and girls are forced to travel longer distances to fetch water, a time-consuming and physically demanding task. One female farmer from Rufunsa explained:

> "During times of drought, we start telling the children to do the chores so that we go looking for food for them. Sometimes when they can't manage, we do chores after coming back from piece work"

This quote highlights a critical trade-off: women must sacrifice either their limited time for income-generating activities or their children's labour (and education) to meet basic household needs. Another respondent noted that during droughts, her daily routine shifts entirely to survival: "I have to work harder to look for food for my grandchildren".

2.2.1. Vulnerability and Insecurity in Accessing Basic Needs

Several respondents expressed feelings of vulnerability and unsafe conditions directly linked to climate events. The most commonly affected services by extreme weather events were food and market access (91.4%) followed by drinking water (83.4%). Other services affected

by extreme weather events included children' s education (49.7%), healthcare (44.9%), transportation (43.3%), sanitation (32.1%) and home safety (25.7%).

2.2.2 Water Scarcity and Access Challenges

The study findings demonstrated that climate events, particularly droughts, lead to dried-up water sources, forcing households particularly women and children to travel long distances to access water. This increased travel time was often perceived as unsafe due to potential dangers on the roads or the quality of the water itself. The following were some of the expressions from the respondents:

> "Most of the well and streams dried up so we had to walk long distances to access water. This alone was not safe because a lot could happen while moving on those roads."
>
> "We have to wake up early to look for water in the Wells and at times no money to buy water"
>
> "We fetch water from a distant place, I am fatigued. Water is becoming less by day. Soon we will be drawing water far away"
>
> "Water is either dirty or not enough. During floods rivers are full. Sanitation is poor"
>
> "We had to start drinking unsafe dirty water but there was nothing we could do about it"
>
> "We have been vulnerable because taking long to fetch water means we get home late and can be attacked"

"We no longer have enough rains and this is evident by the dry boreholes we have been trying to drill in the communities".

These quotes highlight how climate-induced water scarcity intensifies women's unpaid labour, forcing them to walk unsafe long distances, wake up early, and sacrifice rest or income opportunities to secure water. The burden exposes them to physical exhaustion, insecurity and gender-based violence, while also compelling families to consume unsafe water in violation of their right to health. Such realities highlight how inequitable access to water deepens gendered vulnerabilities, erodes dignity and perpetuates systemic injustice in already marginalized communities.

2.2.3 Food Insecurity

Many participants reported feeling vulnerable due to the inability to provide food for their families, leading to no peace of mind and constant stress. Further analysis indicated that the distances to access food, especially from government distribution points, also contribute to feelings of unsafety for women.

"I used to feel unsafe and vulnerable while going to access food as it was a shift in life style"

"I used to feel vulnerable, because I didn't know where to get food for my family and the baby"

"There was less food on the market hence we became vulnerable to food insecurities"

These narratives highlight how food insecurity resulting from climate change has deepened women's vulnerability, as they often bear the burden of searching for food under unsafe and exhausting conditions. Women who participated in this study described feeling unsafe while accessing food, struggling with uncertainty about feeding their families, and working longer hours to secure meals. The unequal labour of securing food reflects gendered injustices, where women's safety, dignity, and rights to adequate nutrition are compromised by systemic inequities and climate-induced scarcity.

2.2.4 Impact on Livelihoods

The study findings revealed that respondents' inability to farm or fish due to climate impacts directly translates into food insecurity and financial vulnerability, especially for breadwinners.

"I feel vulnerable because through this business I am able to fend for my family and send children to school."

"During floods mobility is hard and I feel vulnerable doing odd jobs for food and other household essentials"

"Climate change affects our access to water and especially income sources for me who depends on farming. This has actually impacted my community and family access to most of the basic needs."

"We are unable to do our farming well, hence affecting our food security and household income. Our lives are solely based on farming and without water we cannot manage to do anything."

"When I am not able to produce enough in my fields, it means there will be hunger and poverty in the family."

"The cost was high because there was no food available near my home. And I had to spend transport to go there. That reduced my money to buy food."

These quotes highlight how climate change has eroded farmers' livelihoods, making it harder for them to farm, access markets, and secure income for their families.

2.2.5. Shifting Household Dynamics and Decision-Making

The study findings provided insights into how climate impacts influence household decision-making processes, particularly concerning resource management like water storage

and routine changes.The study findings revealed that, although many respondents participate in household decision-making, the influence and value of their opinions vary. Single mothers or female-headed households often make decisions independently, while in other households, decisions are made jointly with spouses or family members, and opinions are generally respected. Household decision-making continues to reflect entrenched gender norms, though signs of shared responsibilities are evident in several households. For example, 45% of respondents reported that financial decisions are shared between spouses, whereas 38% of widowed, divorced, or single women make decisions alone, bearing the full burden of household management. This intensifies during climate crises. A widowed farmer noted, "*I make decisions alone since I am the household head*", illustrating the solitary burden of navigating climate shocks. Other respondents expressed that:

> "I make it by myself but engage my children to participate."
> "I make the decisions and they are valued given I am the only adult in the house."
> “I make them with my husband and children. The whole house participates.
> "Most of the time I do it because I lead my house. My children and grandchildren also help in decisions we make."
> “My decisions are valued and respected by all in the house. We make decisions as a couple"
> "I usually make decisions alone but sometimes have my children around and all opinions are valued”.
> “We all participate with the children leading in ensuring we have clean water all the time."
> "We make with my husband and both of us participate. Although I do most of the things."
> "Yes, my opinions are valued. Mostly decisions are made by my husband since he is the bread winner. Sometimes he asks for my input"

The findings revealed that household decision-making is strongly shaped by gendered roles. It is evident from the quotes that single mothers often bear full responsibility, making decisions independently to manage their households and children. This reflects both autonomy and burden. In married households, the findings revealed that decisions are generally shared, yet women frequently shoulder the majority of daily tasks, while husbands especially as primary earners retain the final authority, occasionally seeking their wives’ input. These patterns highlight how traditional gender expectations influence who makes decisions and how responsibilities are distributed within households.

2.3 Health and Well-Being Effects

The study findings showed that participants linked the changing climate directly to a range of negative physical and emotional health outcomes, with existing vulnerabilities in the

healthcare system being amplified during and after extreme weather events. The findings highlighted an increase in climate-sensitive diseases, significant mental health strains, and formidable barriers to accessing care, particularly for rural and marginalised households.

2.3.1 Prevalence of Climate-Sensitive Diseases

Malaria and diarrhoeal diseases were the most frequently reported physical health issues connected to climate change. Over half of the respondents (54%) indicated that someone in their household had experienced malaria, diarrhoea, respiratory issues, or heatstroke linked to climate events. Complementing this, qualitative data revealed that diarrhoea, malaria, colds, coughs, and respiratory problems were commonly described as health conditions exacerbated by climate events. The study demonstrated that beyond identifying these illnesses, respondents also associated them with specific climate-related conditions. For example, many linked diarrhoeal diseases to contaminated water sources following floods and to water scarcity during droughts, both of which were associated with a rise in cases. Some examples of responses are given below:

"Diarrhoea diseases have increased in children",

"We get diarrhoea because water becomes a challenge".

Respiratory issues, such as coughs and flu, were also commonly associated with extreme cold or dusty conditions during dry spells. Overall, the study findings revealed that climate shocks strain entire households, exacerbating pre-existing health inequalities.

2.3.2 Emotional and Psychological Distress

The emotional toll of climate change is profound and widespread. A significant proportion (71%) of respondents reported experiencing anxiety, sadness, exhaustion, or sleep difficulties during climate events. The psychological stress stems from multiple sources: the anxiety of food insecurity, the grief of losing crops and livestock, financial worries, exhaustion from an increased workload and the physical discomfort of extreme weather. A female trader from Luangwa expressed a feeling of sadness "because lack of fish in the river has reduced income and reduced food security". Another woman, a divorced farmer from Kafue, captured the pervasive sense of worry: "I wonder and think what the family will eat in the wake of climate change". Other respondents also added on to comment:

"I felt very vulnerable as a breadwinner. Always stressed. Didn't have much support from the community as a widow"

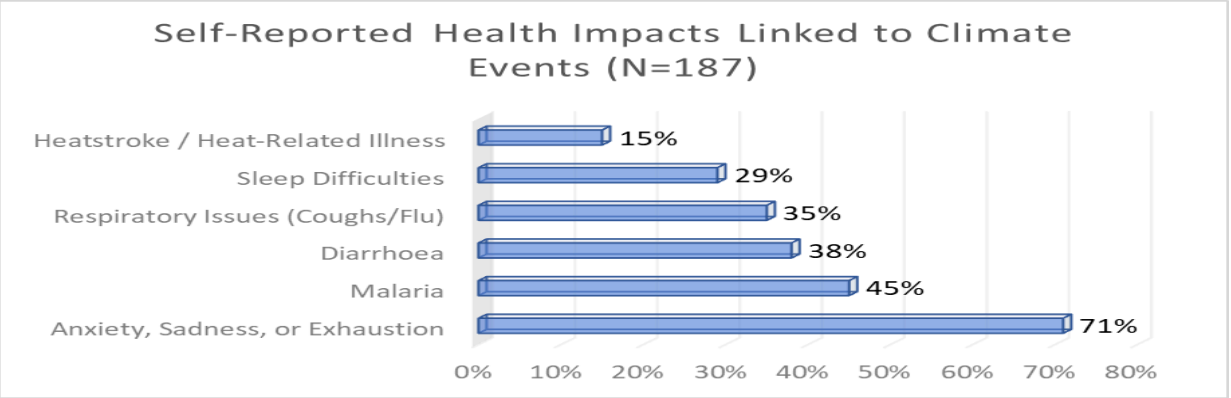
"I often feel vulnerable because we have to worry about water and food for the family"

"We find ourselves doing things or work which we are unhappy with because all we want is to buy food"

"I was worried about food security for my family and water as well as pasture for our animals

"I get scared of winds when the rains are heavy and scared for the children when they go to school as they cross streams"

These findings highlight the emotional and psychological toll of climate change, particularly stress, fear and exhaustion among households. Overall, the accounts reveal how climate change compounds insecurity and emotional distress, especially for those with caregiving or livelihood responsibilities.



Self-Reported Health Impacts linked to Climate Change

The figure above presents a snapshot of the self-reported health impacts linked to climate events among households. The findings revealed that the most common self-reported health impacts of climate events were psychological in nature, with 71% experiencing anxiety, sadness, or exhaustion, with the other health impacts between 45% and 15% underscoring the disruptive effects of extreme temperatures on daily life and wellbeing. These findings align with qualitative accounts, where participants described diarrhoea, malaria, coughs, and heatstroke as recurrent problems during floods, droughts, or extreme heat. Overall, the findings suggest that climate change affects both mental and physical health, with emotional strain emerging as the most prevalent impact.

2.3.3 Challenges in Accessing Healthcare

The study established that accessing healthcare becomes significantly more challenging during climate crises. It was observed that while many households have access to clinics or health posts, significant challenges arise during or after weather events. These include long distances to health facilities, lack of transport (especially during floods), cut-off roads, and drug shortages. Floods were cited as a major barrier, with respondents explaining that they were unable to cross the stream to access the health centre or that transport was an issue. The findings pointed to the fact that lack of reliable transport and damaged infrastructure disproportionately affects women, children, the elderly, and those with disabilities,

compounding their health risks. The following were some of the concerns from the respondents:

"I seek medical care from the health centre but faced a challenge to cross the streams"

“I seek medical care from the health centre and have faced challenges such as lack of transport due to the rains"

“We have faced transport challenges due to bad road network"

"We access treatment at the health centre. Due to floods, we have been unable to cross the stream to access the health centre”

“We go to the clinic although it's a bit far. We booked a motor bike, which is a bit costly."

"We go to the hospital, sometimes there are drug shortages at the clinic, hence we have to buy drugs from the pharmacy"

"During flooding we risk to cross the river to access health care."

2.4 Economic Costs and Losses

The study findings indicated that economic impacts of climate change on Zambian households are direct, severe, and multifaceted, manifesting as significant income losses, damage to essential assets, and a sharp increase in household expenditures. It was noted that these financial shocks are pushing already vulnerable families deeper into poverty, forcing them to adopt negative coping strategies that compromise their long-term security and well-being. Findings on economic costs and losses were presented under two (2) broad themes.

2.4.1 Increased costs of living and economic strain

The study findings revealed that climate events place substantial financial pressure on households, forcing them to spend more on essential needs such as food, transport, healthcare and home repairs. Survey data on mean climate spending indicated that households experience spikes in expenditures during floods, droughts, and extreme weather events, reflecting both direct costs and coping-related expenses. The table below presents findings on mean climate spending by gender identity among the sampled households.

Mean Climate Spending Grouped by Gender Identity (ZMW)

Gender	Response	Prevention	Emergency
Male	1789.83 ($79.1 USD)	1526.33 ($67.5 USD)	2053.33 ($90.7 USD)
Female	363.32 ($16.1 USD)	359.43 ($15.9 USD)	367.2 ($16.2 USD)

The results indicated that male-headed households spend substantially more on climate-related expenses than female-headed households across all categories. On average, male-headed households reported monthly spending of ZMW 1,789.83 ($79.1 USD) on

responses, ZMW 1,526.33 ($67.5%) on prevention, and ZMW 2,053.33 ($90.7 USD) on emergency measures, compared with female-headed households spending ZMW 363.32 ($16.1 USD), ZMW 359.43 ($15.9 USD), and ZMW 367.20 ($16.2 USD), respectively. These figures highlight that low-income households, often headed by women, face disproportionate financial strain, as they have limited resources to cope with climate shocks.

The table below depicts that climate-related spending increases with household income, though lower-income households still faced significant relative burdens.

Mean Climate Spending Grouped by Income Bracket (ZMW)

Income Bracket	Response	Prevention	Emergency
Less than 1000ZMW (less than $45 USD)	271.72 ($12 USD)	304.86 ($13.5 USD)	238.57 ($10.5 USD)
1,000-2,000ZMW ($45-$90 USD)	812.89 (35.9)	748.0 ($33.1 USD)	877.78 ($38.8 USD)
2,001-5,000ZMW ($90.1 - $221 USD)	1170.28 ($51.7 USD)	1146.11 ($50.7 USD)	1194.44 ($52.8 USD)
5,001 - 10,000ZMW ($221.1 - $442 USD)	1165.0 ($51.5 USD)	1055.0 ($46.6 USD)	1275.0 ($56.3 USD)
More than 10,000ZMW (>$442 USD)	3048.0 ($134.7 USD)	1496.0 ($66.1 USD)	4600.0 ($203.3 USD)

Households earning less than 1,000 ZMW (less than $45 USD) spend on average ZMW 238 ($10.5 USD) to ZMW 305 ($13.5 USD) per month on responses, prevention, and emergency measures, while those earning 1,000–2,000 ZMW ($45-$90 USD) spend ZMW 749 ($33.1 USD) to ZMW878 ($38.8 USD, and middle-income households (5,001 - 10,000ZMW, [$221.1 - $442 USD]) spend ZMW 1,055 ($46.6 USD) to ZMW1,275 ($56.3 USD). High-income households (>10,000 ZMW, [>$442 USD]) report the highest spending, with emergency costs averaging ZMW 4,600 ($203.3 USD) per month. These findings suggest that while absolute costs are higher for wealthier households, low-income households bear disproportionate financial strain relative to their limited resources. This makes low-income households vulnerable to climate shocks.

The qualitative findings demonstrated that direct losses of productive assets are a primary driver of economic hardship, particularly for the majority of respondents (58%) who identified as farmers. The most commonly reported loss was crop failure due to drought, floods, or pest infestations. A male farmer from Kafue described losing his entire maize field to floods, "*resulting in compromised income gains at the family level*". Another respondent lamented,

"*We lost our chicken and crops from heat*". These losses are not just one-time events; the unpredictability of the weather means farmers often have to replant multiple times, draining their limited financial resources. As one farmer explained, the unstable rainfall "has become expensive as we have to continuously replant costing us money for seeds and fertilisers".

Respondents linked poor or erratic rains to crop failure, loss of inputs such as seed and fertilizer, and higher food prices. For small-scale entrepreneurs, such as those relying on maize for traditional beer brewing businesses, these changes undermined income generation. Overall, the accounts illustrate how climate variability imposes both economic strain and livelihood insecurity, particularly for household that depend on farming and agriculture-based enterprises.

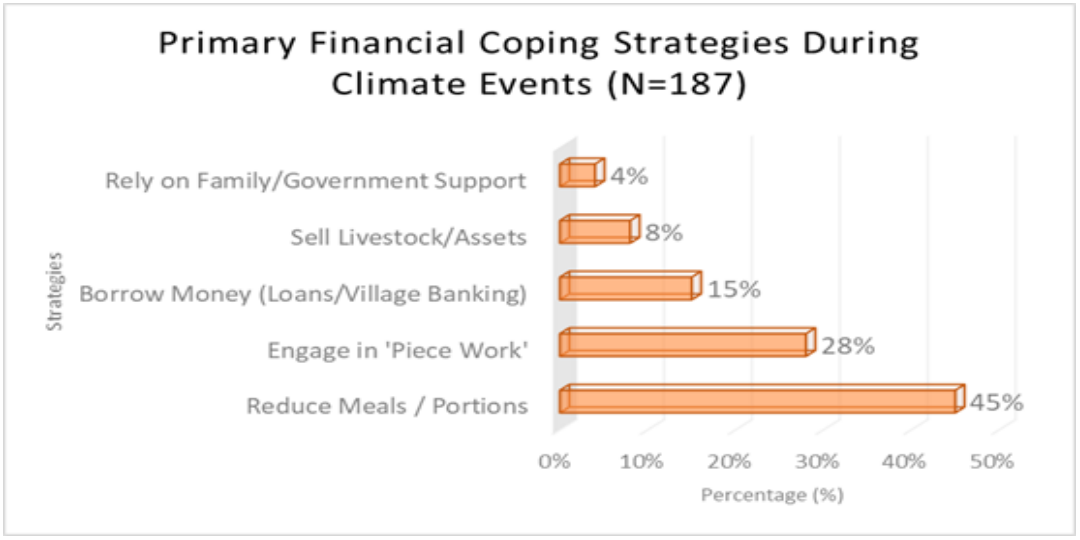
Beyond crops, households also reported losing livestock, homes, and appliances to floods and storms. In the face of these losses, household expenses simultaneously increased across several key areas. Nearly all respondents (92%) stated that their expenses rise during climate events. The most significant increase is in the cost of food. With subsistence farming failing, families are forced to purchase food, often at inflated prices. A female entrepreneur noted, "*Food becomes expensive*", and a male farmer added that "*prices have gone up as such it has become very expensive for us to survive*". Other increased expenses include transportation to access markets or water, home repairs after floods or storms, and healthcare for climate-related illnesses.

2.4.2 Loss of income

It was noted from the study findings that unpredictable rainfall patterns emerged as a major driver of income loss, particularly for households that depend on farming, fishing and small businesses. Respondents repeatedly emphasized how changing rainfall disrupted their livelihoods, with one noting, "*Irregular rainfall patterns affecting income source since we depend on water*." Others linked reduced rains to falling food production and business closures: "*Mealie meal was hard to come by, we never used to have food for days on end. We would close the restaurant because we didn't have mealie meal*." Another farmer also lamented that "*Rainfall patterns have changed. In the past we used to have more rains but now we have less rains. We have not been making money from farming like we used to in the previous years*."These accounts highlight how rainfall variability undermines household income security, leaving both rural and urban livelihoods vulnerable to climate shocks. To cope with these financial strains, households resorted to a range of strategies, many of which have negative long-term consequences . The most common strategy, reported by 45% of respondents, is reducing the number of meals or portion sizes. A female farmer stated, "We reduce on the meals only eating lunch and only cook small portions at night. We do not have breakfast". Other strategies include borrowing money (often from informal lenders or village

banking groups), taking on extra "piece work," and selling off valuable assets like livestock. These are not sustainable solutions but rather short-term survival mechanisms that erode a household's asset base and increase its vulnerability to future shocks.

The figure below presents a snapshot of the distribution of the primary strategies households use to manage financial strain caused by climate events.



Primary Financial Coping Strategies During Climate Events (N=187)

Very few households accessed family or government support (4%), highlighting limited external safety nets. Overall, these findings revealed that climate events force households to adopt short-term, often precarious coping strategies, with food insecurity and income supplementation as central responses.

2.5 Adaptation Strategies and Barriers

The study findings demonstrated that households are not just passive victims of climate change; they are actively employing a variety of adaptation strategies to mitigate risks and manage impacts. These strategies ranged from individual adjustments in agricultural practices to collective community actions and engagement with government support programmes. However, their efforts are consistently hampered by significant structural barriers, most notably a lack of financial resources and insufficient institutional support.

2.5.1 Agricultural adaptation

Among farmers, a common reported adaptation was shifting agricultural practices. This includes planting drought-resistant or early-maturing seed varieties, practicing conservation farming techniques like "gampani," and diversifying into gardening or livestock rearing. A farmer in Kafue explained, "*We are now planting early but still the rains don't come and the crops ended up drying. We are not harvesting as we used to due to unstable rainfall*". This highlights both the attempt to adapt and the persistent challenge of climate unpredictability.

"Diversification of crops such as cowpeas and also chicken and livestock rearing"
"Gardening and this has helped us to survive in the wake of climate change"
"I have been planting fruit and also other trees, and it has really worked. I encourage everyone to plant trees"
"Keeping goats and chickens which we sell during hard times"
"We are continually planting vegetables to have food and sell some for income generation. We have also taken the organic farming knowledge in practice to enable us to thrive in dry times."
"We are preparing our fields early and practicing conversation farming that helps crops survive in difficult conditions"
"We have been practicing smart agriculture practices as well as using local knowledge to preserve food and reduce post-harvest losses."

These quotes highlight how households are adopting diversified and climate-smart agricultural practices to enhance food security and income generation. Overall, respondents demonstrate proactive adaptation by combining traditional knowledge and modern agricultural practices to cope with climate variability.

2.5.2 Livelihood diversification

For non-farming households, the findings revealed that diversifying income sources through small businesses such as selling fritters, trading tomatoes, or brewing local beer was seen as a key strategy. Respondents emphasized that engaging in extra work or business ventures has been critical for survival, especially during seasons of poor harvests. The following were some of the expressions from the respondents:

"After conducting piece work, we work for material stuff like tomatoes which we will sell for cash and get some Vegetables from the gardens to feed the children"
“Engaging in extra work It has helped to sustain the little food we had and we have managed to survive the hunger which was coming
"I am working on charcoal production to get money to sustain my family
I do extra work to raise money to buy food even when crops don't perform well
"I have started a business at the markets for extra money and this has been good for us in that we manage to pay for other bills."
"I sell at the market to raise some money for food since we didn't harvest a lot of maize from the last farming season. The business is really working well and helping us as a family"
"Trading, buying and reselling vegetables has helped me a lot."

"We do a business of kacasu to raise money for the house other than depending on farming."

These quotes highlight how households are diversifying their livelihoods beyond farming to cope with the economic pressures of climate change. It was noted that many of these activities are driven by women, reflecting their central role in sustaining household welfare and filling income gaps when farming fails. By engaging in such entrepreneurial efforts, women demonstrate agency and resilience, even as they bear a disproportionate share of the economic and caregiving burdens during climate stress.

2.5.3 Household Actions

The study findings revealed a range of actions that households take to cope with the impacts of climate change. These included adjusting mealtimes, reducing the number and size of meals and engaging in extra income-generating activities to secure food. Others focused on agricultural and environmental measures such as planting trees, expanding gardens, rebuilding livestock shelters, and conserving natural resources by avoiding tree cutting. Households also emphasised food storage, keeping essential drugs, setting aside emergency funds, and minimizing food wastage as part of their coping mechanisms. Overall, these household level actions reflect a blend of short-term consumption adjustments and longer-term livelihood and environmental strategies.

"Rebuild shades for our livestock, increasing our fields and gardening in our back yard. It is working well"

“Reduced meals reduced portions food, engaged in extra works to raise money.

“Reduced meals, Reduced portions have helped us have food for a long time. That the strategy that has worked."

"Store enough food at home, essential drugs for diseases related to climate change. Also have emergency funds; and continue farming"

"We are helping each other in business with my daughter to find money to purchase food"

"We are not wasting food anyhow because the weather is unpredictable."

"We stopped cutting trees around our home, we stock enough food and money all the time, gardening and livestock keeping"

2.5.4 Community Actions

The study findings revealed that community-level support networks, such as village banking groups and savings clubs, have emerged as critical safety nets. The study established that these groups provide a crucial source of informal credit and mutual support that is often more accessible than formal financial services. For example, one respondent noted, "*We have groups, I do participate as I am the secretary*", while another explained, "*When overwhelmed, I rely on my family and village banking group*". The quotes below reinforces these findings:

"I am in a club for climate change which is helping us to know how to address certain climate challenges"

"We have community crops such as sunflower and we make cooking oil and sell them in order to make money as a community."

“We help each other a lot like cultivating in fields"

"Village banking has helped a lot. With support from NGOs like Hivos and Others"

"We do gardening, joined cooperative"

"We have constructed bore holes in order to improve water access. With regards to energy, we are now using solar energy for lighting."

These quotes highlight the collective efforts communities are undertaking to adapt to climate change. The findings demonstrate how people in communities are engaging in organised groups and cooperatives, practicing joint farming and gardening, and benefiting from initiatives like village banking. They also demonstrate community-driven investments in resources such as boreholes for water and solar energy for lighting, reflecting both social cooperation and sustainable resource management.

2.5.5 Government Programs

Engagement with government support programs yielded mixed results. The Farmer Input Support Programme (FISP) was widely reported, with many respondents participating through cooperatives by paying a fee (e.g., K400) to receive subsidised fertiliser and seeds. While many found it helpful, its effectiveness was entirely dependent on adequate rainfall. As one woman stated, "*It has not been helpful as 10kgs can only plant a small area*", and another explained, "*The FISP is dependent on rain and without rain, it does not work out well*". Other programs like "Food for Work" or "Cash for Work" provide temporary relief during crises induced by climate change, but the support was often described as insufficient. A common sentiment was that while helpful, it was not sufficient.

In addition to FISP and other ongoing initiatives, respondents also highlighted various government-led climate emergency interventions. These included direct support in the form of food, cash transfers, and disaster response funds delivered through social protection programs such as emergency social cash transfers. Others mentioned infrastructure and agricultural support, such as the provision of boreholes, irrigation schemes, and land for farming, which were seen as critical for enhancing community resilience. The following were some of the responses shared by the respondents:

"We get support from the government through climate emergency support"

"There were meeting at the schools, there was an introduction of social packages like food and cash for work initiative"

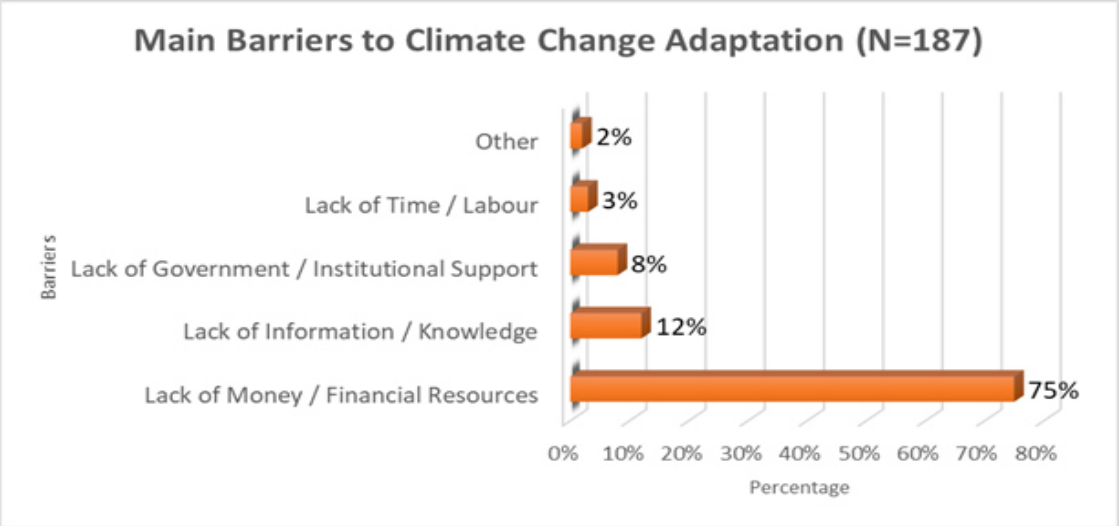
"The Disaster Management and Mitigation Unit (DMMU) introduced social packages such as emergency social cash transfer, cash and food for work and we registered"

"We have received a borehole from the government and 2 hectares of land to plant avocadoes and vegetables. The government is working on pumping water from the kafue River into the farms to enable irrigation."

"We pay K400 to the Cooperative chair person who make the payment at the government, the Cooperative members are then given 6 bags of 50 kg fertilizer and 10 kg seeds"

2.5.6 Barriers to Adaptation

The study identified a number of barriers to effective adaptation to climate change. The primary barrier preventing households from adapting more effectively is overwhelmingly financial resources. When asked what prevents further adaptation, lack of money emerged as the most frequent response. A farmer planning to implement irrigation stated, "*Irrigation farming and solar tanks are part of our plan but we haven't yet had money*". This financial constraint traps households in a cycle of vulnerability where they cannot afford to invest in resilient infrastructure or practices, leaving them exposed to the very shocks that perpetuate their poverty. Other barriers include a lack of timely and reliable information, limited access to technical support, and insufficient government aid. The figure below shows a snapshot of the reported barriers to effective climate change adaptation among households.



Primary barriers preventing households from implementing further adaptation measures

The results indicate that financial constraints are the primary barrier to climate change adaptation, with 75% of respondents. A smaller proportion highlighted lack of information or knowledge (12%) and limited government or institutional support (8%) as obstacles. Barriers related to time, labor, or other factors were minimal, suggesting that the main challenge for households is securing the resources needed to implement adaptive measures.

Qualitative data also confirmed the barriers identified in the quantitative findings, showing that households faced challenges such as lack of financial resources, limited access to information and insufficient technical support. In addition, attitudinal challenges such as low interest or resistance to changing behaviours further constrained their ability to implement effective climate change adaptation strategies.

2.5.7 Financial Barriers

The qualitative findings reinforced that lack of funds is a major barrier preventing households from effectively adapting to the impacts of climate change. This was more profound among female headed households and low-income households. Respondents emphasised that this limits their ability to adequately cope with the impact of climate change. The following were some of the concerns from the respondents:

"We have not taken any actions due to lack of finances"

"Insufficient funds to explore further"

"Lack of enough money to cover all expenses"

"Lack of money and places to buy trees seedlings"

Lack of money prevent us from expanding our businesses"

"Less money in the community impacts negatively on my business."

Respondents consistently point to a lack of money as limiting their ability to purchase inputs (e.g., tree seedlings), expand businesses, or implement alternative strategies. Overall, the quotes underscore that resource scarcity is a key factor restricting both individual and collective adaptive capacity.

2.5.8 Informational Barriers (Lack of Information/Knowledge)

The study found that lack of information and knowledge was a significant barrier to climate change adaptation for many households. Respondents highlighted limited access to accurate and consistent information on weather patterns and expected climate events, often due to factors such as lack of electricity or communication channels. This information gap, coupled in some cases with financial constraints, hindered households' ability to make informed decisions and implement effective adaptation strategies.

"We lack access to electricity as such we are unable to know of expected weather events."

2.5.9 Technical and Support Barriers (Lack of Technical Expertise/Support)

The study found that a lack of technical expertise and support limited households' ability to fully implement climate change adaptation strategies. Respondents reported needing assistance with technical aspects such as accessing irrigation pumps to expand gardening, understanding adaptation techniques, and applying effective practices. Without this guidance and support, households faced challenges in maximizing the benefits of their adaptation efforts.

> "Lack of support to buy pumps for water to increase the size of land for gardening"
>
> "Lack of money and technical support"
>
> "We require more technical support so as to fully appreciate climate change adaptation strategies."

2.5.10 Attitudinal Barriers

The study found that attitudinal barriers hindered effective climate change adaptation at both individual and community levels. It was observed that while programs and initiatives exist, changing people's behaviours and mindsets such as stopping charcoal burning or actively participating in adaptation activities remained a challenge. Some individuals reported a lack of interest or commitment, which limited the overall effectiveness of adaptation efforts. The following were some of the comments:

> "I participate in climate change programs though changing people's attitudes is a challenge"
>
> "Climate adaptation programs do not work because people's attitudes do not change"
>
> "People do not follow what has been agreed upon like stopping charcoal burning"

These findings highlight that negative or uncooperative attitudes among community members can limit the effectiveness of climate change adaptation efforts. Even when programs or agreements exist, some individuals show a lack of interest or fail to follow recommended practices, demonstrating that behavioural and motivational factors are important barriers to successful adaptation.

2.6 Cross-Cutting Vulnerabilities

The study reveals that climate change impacts are deeply unequal, disproportionately affecting socially and economically vulnerable households. Women—especially those who are widowed, divorced, or single heads of households—face the greatest burdens due to intersecting vulnerabilities linked to gender, occupation, household structure, and location. These women endure intensified care responsibilities, health risks, and limited economic opportunities, with a single climate shock capable of triggering catastrophic outcomes.

Occupation plays a critical role: 58.29% of respondents are rain-fed farmers, highly exposed to climate volatility, reporting crop losses, debt, and food insecurity. In contrast, those in formal employment, like engineers or officers, experience greater income stability and resilience,

though still affected by disruptions such as power cuts. Rural communities, particularly in remote districts like Rufunsa and Kafue, face compounded challenges due to poor infrastructure, limited healthcare, and inadequate access to information. These locational disadvantages amplify climate impacts.

The intersection of gender, occupation, and geography creates a cycle of disadvantage. A widowed female farmer with low education and multiple dependents exemplifies this: she faces occupational, gendered, locational, and economic vulnerabilities simultaneously. Overall, climate change acts as a threat multiplier, deepening existing inequalities and reinforcing systemic injustice.

3.0 Synthesis with Literature

This section presents a cross synthesis as a way of validation the findings from literature and from the field data. The synthesis of the field study and literature review reveals a strong correlation and notable consistency between the two sources regarding the impacts of climate change on Zambian households and, in particular, on women.

3.1 Areas of convergence between the Study and Literature

Both sets of findings highlight that climate change has intensified existing gender and socio-economic inequalities. The field study provides firsthand accounts of how climate shocks, such as erratic rainfall, droughts, and extreme weather, disrupt agricultural cycles and household routines, disproportionately increasing women's unpaid care burdens and exposing them to heightened risks in securing food and water. Similarly, the literature review corroborates these experiences, emphasizing that women, especially in female-headed and low-income households, are more vulnerable to the economic fallout of climate events, including reduced agricultural productivity, food insecurity, and increased reliance on coping mechanisms that compromise long-term well-being.

Furthermore, both sources underscore the limited access women have to critical resources such as land, agricultural extension services, and financial means to respond to emergencies. The literature review extends this analysis by documenting structural barriers that further marginalize women, while the field study details the daily realities of these constraints, including the physical and psychological toll. Both note that male migration due to climate shocks exacerbates women's workload and responsibilities, often without a corresponding increase in decision-making power or support.

Despite these challenges, both the field study and literature review recognize women's resilience and leadership in adaptation efforts, from spearheading home gardens to organising mutual support networks. However, these initiatives remain limited by inadequate policy support and restricted access to resources. Further, the field study and the literature review

converge on the point that climate change exacerbates gender inequalities in Zambia, with women bearing the greatest burdens and facing the most significant barriers to adaptation.

3.2 Areas of divergence between the Study and Literature

The divergence between the study and literature are essentially five.

Care Work and Gender Roles

The study provides a quantitative perspective on the care burden, revealing that women spend an average of 6.8 hours per day on care-related activities, compared to just 2.1 hours for men. In contrast, the literature review emphasizes the gendered exclusion from agricultural extension services, noting a patriarchal bias in service delivery that limits women's access to vital resources and information.

Economic Coping Strategies

The field study indicates that households employ a variety of coping strategies during economic hardship: 45% reduce meals, 28% rely on casual work, 15% borrow money, and 8% resort to selling assets. The literature review, however, focuses on the use of informal loan networks, where high interest rates prevail due to the absence of inclusive and accessible financial mechanisms, further disadvantaging women.

Access to Support Systems

The field study identifies significant barriers for women in accessing the Farmer Input Support Programme (FISP) and Social Cash Transfer programs, particularly highlighting that women are often left to make crisis decisions independently. The literature review corroborates these challenges by noting that 70% of women lack access to credit or agricultural insurance, and limited land ownership further restricts their participation in public support programs.

Intersectionality and Vulnerability

Both sources recognize the layered vulnerabilities faced by Zambian women. The field study emphasizes gender and income disparities, noting that 61.1% of women occupy the lowest income bracket. The literature review expands on this by explicitly framing intersectionality, considering gender, class, age, geographic location, and asset ownership as interlocking factors that shape vulnerability.

Migration, Digital Exclusion, and Infrastructure

The literature review discusses the impact of male migration, which increases the domestic and productive responsibilities of women during periods of drought. Additionally, digital exclusion emerges as a significant barrier, with women's limited access to digital tools, skills, and connectivity undermining their ability to adapt to changing economic and environmental conditions. The literature review also notes a 20% increase in electricity costs, leading female-headed households to rely more on generators and solar panels. The field study however, does not addressed these issues

4.0 Recommendations

- **Government**-Zambia has in place multiple instruments to ensure gender-responsive climate adaptation. The main instrument used is the climate change gender action plan, being monitored and guided by Zambia's broader climate governance framework, including the National Policy on Climate Change and the Green Economy and Climate Change Act. However, as evidenced in this research, the impact of this effort is clearly not translating into meaningful lived experiences at grassroot level. As such new innovative climate financing mechanisms that prioritises women-led and low-income households should be put in place. Financing mechanisms such as the Next Level Grant Facility (NLGF) championed by the Voices for Climate Action program, that are designed to support grassroots groups and informal networks should be adopted by government. Such facilities target small organizations and community groups that struggle to access conventional grants due to bureaucratic barriers, and encourage bottom-up climate solutions that are locally led. These funds would directly fund women's access to irrigation, drought-resistant seeds, and small-scale enterprises etc thereby strengthening family resilience and reduce poverty.

  Further, local authorities and national ministries should ensure that women are represented in all climate governance structures at district and national levels. The study revealed that although women are the most affected by climate impacts, they remain largely excluded from decision-making. Ensuring women's leadership and participation will make adaptation planning more responsive, inclusive, and effective.
- **International Climate Financing Mechanisms**- This research undoubtedly showcased that Zambia still has structural and cultural challenges related to women's care work that needs to be addressed. These include land rights for women, division of labor (gender roles), access to empowerment funds, absence from decision making etc. International climate finance can better respond to these challenges by transforming how funds are designed, delivered, and governed at international level. Currently, most grassroots organizations are not accredited to receive funds directly from major climate finance bodies like the Green Climate Fund or Adaptation Fund. This needs to be addressed as it is clear that the current application process excludes women and grassroot organizations. This should be accompanied by capacity building of women on available climate finance opportunities and their governance, and other gender transformative solutions that challenge and invest in structural inequalities that prevent women from fully participating.
- **Media-**From the data on attitudinal barriers, it is clear that there is an important role for the media to play in ensuring that climate change prevention and adaptation initiatives are welcomed at individual and community level. The current participation may not be impactful because climate change is still based on mere scientific facts that may not be

relatable. More usage of storytelling through visuals like art and drama will create empathy and engagement by showcasing personal narratives of farmers, youth, or women adapting to climate change.

Research and Private Sector-This research showcased many examples of how agroecology, seed banking, and sustainable farming has been identified as a key adaptation measure in the face of climate change. However, these practices still remain insignificant because of lack of finances making them be applied sporadically and not fully supported. Their potential for scalability has not fully been explored. The role of research and private sector funds become very critical in this aspect. Private sector should support investment in this sector by moving beyond traditional Corporate Social Responsibility (CSR) toward Corporate Social Investment (CSI). CSR, often functions as a compliance exercise or reputational checkbox. However, once turned into CSI, private sector can invest in climate adaptation for their sustainable future and turn this into an opportunity for investment.

- **Local NGOs-**Grassroot organizations such as local NGOs, should strengthen local savings and cooperative groups as engines of resilience. The study showed that village banking and community savings groups are effective safety nets but lack capital and formal support. Providing technical training and seed grants will improve access to credit and help households avoid harmful coping measures like reducing meals or selling assets. Accountability can be ensured through local financial reporting and cooperative registration systems.

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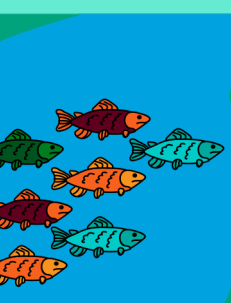
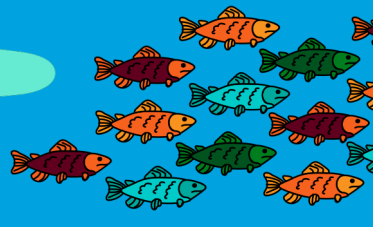
Literature Review





Climate Bills from a Gender Perspective: Economic Impacts of Climate Change on Women and Household Budgets in Brazil and Zambia

WRI Brasil

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EXECUTIVE SUMMARY

How climate change affects women's household budgets and daily life in vulnerable areas. Climate change is increasingly affecting the living conditions of urban and rural populations, with disproportionate impacts on women in situations of social vulnerability (Tinker; Koch Alvarenga, 2019). In a scenario of intensifying extreme events of long duration, the costs borne by families headed or supported mostly by women are growing, especially in the Global South (UN Women 2020; Chanana-Nag and Aggarwal 2020; Deininger et al. 2023). It is in this sense that this study seeks to answer the following question: *what are the social and economic costs of climate change on the income and spending of families with a significant presence of women in urban and rural environments in Brazil and Zambia between 2022 and 2025?*

The choice of the two countries reflects the intention to analyze contrasting contexts, but equally marked by structural vulnerability, that is: peripheral urban areas in Brazil and rural agricultural areas in Zambia. In both cases, women play a central role in the sustenance, care, and organization of community life, but they face historical barriers in accessing resources, services, and social protection.

The study's main lens of analysis is what is being called climate bills — understood as the set of records and costs, direct or indirect, that express the impacts of climate change on family budgets. These costs resulting from the impacts of climate change, according to the research, are multiple — and not just monetary — and fall more intensely on these women, affecting their economic and domestic security in a broader way, physically and even emotionally.

Goals

The main objective of this study is to investigate the economic and social costs of the impacts of climate change on the budgets of families with prominent participation of women in decision-making, in the contexts of Brazil and Zambia, in the period from 2022 to 2025. To this end, the following specific objectives were structured:

I. Organize the technical and academic literature consulted based on the creation of key themes that guide the analysis of documentary data.
II. To map, based on this literature, the main types of climate threats, economic, social and other emerging costs that affect household budgets in Brazil and Zambia, identifying which of these costs result from the impacts of climate change.
III. Understand how women experience and respond to these costs, considering the specificities of Brazil and Zambia

Methodology

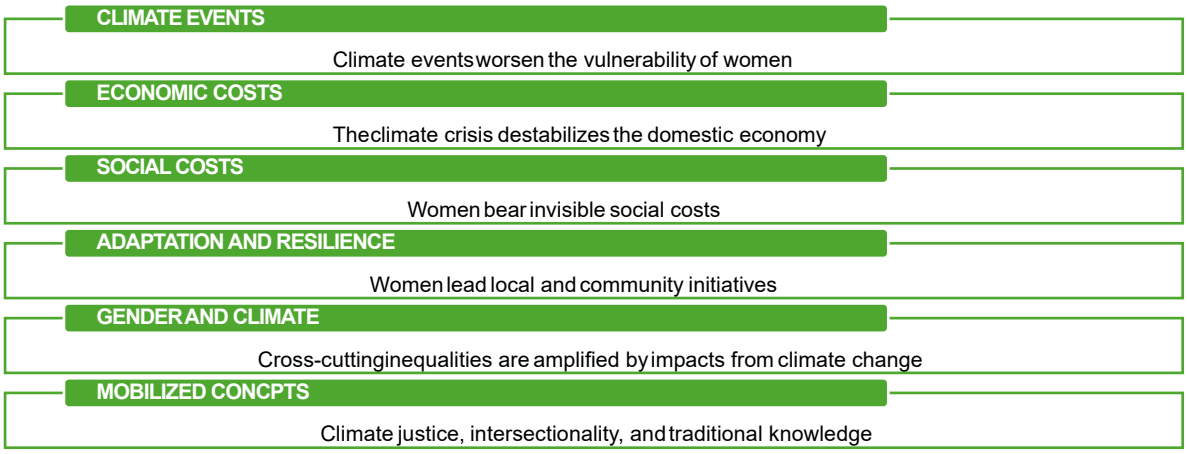
The research was based on a scoping review of the literature with selection criteria that covered studies published between 2022 and 2025. In all, 23 empirical studies were analyzed, focusing on the effects of climate change on households with a significant presence of women in Brazil and Zambia.

The data were organized based on a thematic content analysis, structured into six analytical categories: (1) climatic events; (2) economic costs; (3) social costs; (4) adaptation and resilience strategies; (5) structural inequalities; and (6) mobilized concepts.

The qualitative approach of content analysis allowed us to understand patterns of impact, response and exclusion, as well as to identify emerging solutions in the territories analyzed.

Key findings

The patterns extracted from the data for Brazil and Zambia show that climate change not only amplifies economic losses in female households, but also aggravates historical inequalities related to care work, access to resources and social protection. Women in vulnerable contexts accumulate multiple costs — visible and invisible — that destabilize their budgets and their physical and emotional health, while leading local responses that are little recognized by public policies.



In this case, the *economic and social costs stand out* as the central objectives of this research, as well as other emerging aspects that emerged based on the consulted literature, such as *climate events, adaptation and resilience, gender and climate, mobilized concepts* and *climate events*. These themes reflect the structuring dimensions of the literature analyzed, articulating from conceptual aspects to empirical evidence on the impacts of climate change, with specific attention to the intersection of gender, climate, and vulnerabilities.

The analysis reinforces that addressing the climate crisis fairly requires recognizing these structural inequalities, financing community-led strategies led by women, and

ensuring equitable access to adaptation tools. Ignoring these dimensions undermines the effectiveness of climate action and perpetuates the vulnerabilities that the climate itself intensifies

Conclusion

The climate bills lens therefore emerges as a promising analytical approach to interpret the complexity of the climate theme and its sensitivity to gender. By making it possible to map economic and social costs, he points out that this approach can support the qualification of those who bear the brunt of the impacts of climate events. In view of this, the following are three strategic questions for future research agendas:

- How to incorporate climate bills — especially those that fall on women in vulnerable contexts — into budget planning and execution instruments, ensuring their visibility in public accounts?
- What data collection, systematization, and monitoring mechanisms would be needed to more accurately map the economic and social costs of the climate crisis on different groups of women, considering territorial, racial, and generational cuts?
- How can the "climate bills" approach be scaled up to capture the impacts of the crisis on other marginalized groups — such as Black people, Indigenous peoples, peripheral communities, and informal workers — guiding climate justice action?

SUMMARY

1. INTRODUCTION

Although climate change poses risks to everyone, some groups are more likely to experience more severe impacts (Gicheru, Mwenda; Omwami, 2024). When we turn to the Global South, the impacts of climate change appear to act as multipliers of structural inequalities, producing and deepening pre-existing vulnerabilities among women and other marginalized groups. According to the IPCC report (2023, p. 43), exposure to climate risk is deeply linked to the social, economic, and political conditions that make certain population groups—or even entire territories—more exposed and less able to respond to the impacts arising from the materialization of climate risks.

Among the groups most directly affected by climate-induced droughts, heat, floods, and similar events are women, children, the elderly, persons with disabilities, and the poorest (Tinker; Koch Alvarenga, 2019). As Zape (2023, p. 2) points out, women and men experience climate change differently due to entrenched stereotyped roles and discrimination against women in society. According to the authors, this inequality limits women's political decision-making power, restricts their access to water and land in several parts of the world, and offers fewer opportunities to secure an adequate standard of living for themselves and their families (Tinker; Koch Alvarenga, 2019).

For this reason, women—particularly those living in the Global South—are, according to some literature on gender and climate, the most vulnerable to the negative impacts of climate change because most of them rely on informal, natural resource-based livelihoods with unstructured work arrangements (agriculture, fishing, and forestry) (UN Women, 2020; Chanana-Nag & Aggarwal, 2020; Deininger et al., 2023). They are also vulnerable due to biased laws and regulations in some countries (Erman et al., 2021), with limited legal land ownership rights, which hinders access to other associated resources such as loans, credit, and infrastructure.

It is important to highlight that the lack of income opportunities, deprivation, and poverty have many subsequent repercussions, such as conditions that restrict women from accessing reproductive and maternal health services (Van Daalen et al., 2020), school dropouts and/or early marriage to alleviate financial hardship (UNFPA, 2022; Women Deliver, 2021), and even increased exposure to gender-based violence, domestic abuse, transactional sex, sexual abuse, and exploitation. Evidence shows that extreme weather events, environmental stress, and climate-induced conflicts lead to increased trafficking (Masson et al., 2019; Nzinga et al., 2021; Desai; Mandal, 2021).

Thus, in light of the above evidence that climate change can exacerbate the vicious cycle of women's vulnerability, the following research question was posed:

What are the economic and social costs of climate change impacts on the budgets of households with a prominent role for women in Brazil and Zambia between 2022 and 2025? This formulation stems from the recognition that the effects of climate change—such as prolonged droughts, floods, and extreme events—disproportionately affect women, especially in contexts of poverty and structural inequality. For the purposes of recording the social and economic costs arising from climate change, we will refer to them here as *climate accounts*, which may include income losses, increased energy costs, and healthcare expenses.

The mapping and study of the set of records and costs—direct or indirect—that express the impacts of climate change on household budgets is an exercise that directly intersects with broader efforts under the umbrella of the United Nations Framework Convention on Climate Change (UNFCCC). This approach to climate accounts is intricately linked to a network of instruments that, in their own ways, seek to recognize, mitigate, and compensate for these losses: the Warsaw International Mechanism for Loss and Damage (WIM)[1], the Santiago Network[2], the Adaptation Committee (AC)[3], the Standing Committee on Finance (SCF)[4], and perhaps the most important mechanism, the Gender Action Plan (GAP)[5].

The latter introduces the intersectional dimension into this framework, highlighting how gender, race, and class shape the incidence and intensity of climate costs. By showing that climate accounts are not neutral but shaped by social structures, the GAP urges the entire UNFCCC response architecture to incorporate this complexity into the formulation of strategies and the design of financing. Far from being an isolated accounting exercise, climate accounts are understood as a central element to understand, legitimize, and address the impacts of the climate crisis, integrating with UNFCCC mechanisms as both a diagnostic and political tool capable of articulating recognition, reparation, and systemic transformation.

That said, with the aim of gaining an in-depth understanding of the types of economic and social costs, the research was structured around a scoping literature review, considering the need to understand how these aspects are being mapped and analyzed in scientific and technical literature. The review was conducted based on four inclusion criteria: (i) focus on households with active participation of women or marginalized groups; (ii) analysis of the social and/or economic costs of climate change; (iii) geographic scope limited to Brazil and Zambia, in both urban and rural contexts; and (iv) time frame between 2022 and 2025.

In this sense, the document collection process began with a database of more than 126 million records available on Semantic Scholar through Elicit. The initial

[1] Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts | UNFCCC
[2] About the Santiago Network | UNFCCC
[3] https://www4.unfccc.int/sites/NWPStaging/Pages/Adaptation-Committee.aspx
[4] About the Standing Committee on Finance | UNFCCC
[5] The Gender Action Plan | UNFCCC

search automatically selected 500 documents deemed relevant according to specific inclusion criteria. After the automated search, another 42 documents were included based on manual searches in national and international academic and institutional databases, such as Google Scholar, Web of Science (Clarivate), and EBSCO Information Services, as well as specific repositories such as those of the Coordination for the Improvement of Higher Education Personnel (CAPES) and the Getulio Vargas Foundation (FGV Conhecimento). Documents and data from multilateral organizations, including the United Nations Development Programme (UNDP), UN Women, and the UNFCCC, were also used. In the African context, contributions from the Southern African Institute for Policy and Research (SAIPAR) and the Zambia Statistics Agency (ZamStats) were considered.

After screening based on the criteria mentioned above, 117 studies were selected for preliminary title and abstract analysis, resulting in 23 documents included in the final corpus.

The final mapped and analyzed corpus made it possible to identify six recurring thematic findings that suggest the existence of climate accounts. In this case, economic costs and social costs stand out as the central objectives of this research, but other emerging aspects also arose from the reviewed literature, such as climate events, adaptation and resilience, gender and climate, mobilized concepts, and climate events. These themes reflect the structuring dimensions of the analyzed literature, articulating conceptual aspects with empirical evidence on the impacts of climate change, with specific attention to the intersection of gender, climate, and vulnerabilities.

Documentary analysis revealed that extreme weather events—such as floods, droughts, and storms—disproportionately affect women, increasing social and economic risks in urban and rural contexts (Ottoni & English, 2022; Valencio & Baptista, 2023; Diwakar et al., 2024). These events act as vulnerability multipliers (Fruttero et al., 2024; Adam et al., 2023). On the economic costs side, impacts include loss of production and income in rural Zambia, exclusion from access to credit, and increased urban expenses in Brazil (Muleya et al., 2023; Diwakar et al., 2024; Fialho & Álvares, 2022). In parallel, social costs affect women through illness, girls' school dropouts, and maternal nutritional sacrifice (Salvador et al., 2023; Fruttero et al., 2023; Muthoni & Okoth, 2023; Malesu et al., 2024).

Among the emerging themes, women-led adaptation and resilience strategies stand out, such as productive diversification, the use of native seeds, and the strengthening of support networks (Manyanga et al., 2023; Phiri et al., 2023; Alonso-Población & Siar, 2023). However, institutional precariousness limits their effectiveness (Milupi et al., 2023; Chisanga et al., 2023). The gender and climate dimension highlights that intersectional inequalities—involving gender, class, and territory—structure exclusion in both countries (Carr & Thompson, 2014; Crenshaw, 1989), with care overload in Brazil (Ferreira de Lima et al., 2023; Cordeiro et al., 2023)

and agrarian exclusion in Zambia (Makate et al., 2023; Muleya et al., 2023). Male migration exacerbates this burden (Chikopela et al., 2022).

Finally, the concepts mobilized by the studies—such as climate justice, intersectionality, empowerment, and local knowledge—reinforce the need for approaches that combine equity, participation, and institutional support to tackle the climate crisis based on justice (Neumayer & Plümper, 2007; Zulu et al., 2022; Batista, 2023; Gicheru et al., 2024; Antwi-Agyei et al., 2022; Nakamura et al., 2022; Milupi et al., 2022).

Accordingly, the technical report is structured into eight chapters. Chapter 2 presents the research question guiding the study. Chapter 3 outlines the general and specific objectives. Chapter 4 describes aspects of the research area. Chapter 5 presents the methodology adopted, including the systematic literature review process and content analysis procedures, with details on eligibility criteria, research sources, screening stages, and coding strategies. Chapter 6 presents the findings organized by theme, identified in the 23 articles analyzed. Chapter 7 discusses these findings across six thematic categories: relevant climate events, economic costs, social costs, response and adaptation strategies, differentiated vulnerabilities, and mobilized concepts. Chapter 8 offers a comparative analysis between the Brazilian and Zambian contexts. Finally, Chapter 9 presents the final considerations.

2. RESEARCH QUESTION

This research is guided by the central question: what would be the economic and social costs of the impacts of climate change on the budgets of families with a prominent role for women in Brazil and Zambia between 2022 and 2025?

3. OBJECTIVES

3.1. General objective

To investigate the economic and social costs of the impacts of climate change on the budgets of families with prominent participation of women in decision-making, in the contexts of Brazil and Zambia, in the period from 2022 to 2025.

3.2. Specific objectives

IV. Organize the technical and academic literature consulted based on the creation of key themes that guide the analysis of documentary data.
V. To map, based on this literature, the main types of climate threats, economic, social and other emerging costs that affect household budgets in Brazil and

Zambia, identifying which of these costs result from the impacts of climate change.

VI. Understand how women experience and respond to these costs, considering the specificities of Brazil and Zambia

4. STUDY AREA

4.1. Overview of Brazil

Brazil is a South American country with a vast territorial extension and the largest population on the continent, estimated at 212.6 million people in 2024, according to the Brazilian Institute of Geography and Statistics (IBGE). The country faces deep social, racial and regional inequalities. In 2017/2018, 63.8% of the population lived in some degree of social vulnerability, and 22.3% were in multidimensional poverty (World Bank, 2024).

Northern states have poverty rates three times higher than those in the South, a per capita income about 50% lower, an average of 1.5 fewer years of schooling, and less access to water and sanitation services. Women and blacks are the most affected: in 2007, the unemployment rate among black women reached 12.4%, the highest among all the groups analyzed. In 2023, women still earned, on average, 21% less than men (World Bank, 2024).

Brazil has a wide climatic diversity, with a predominance of equatorial climate in the North, tropical in the Midwest, Southeast and Northeast, semi-arid in the interior of the Northeast and subtropical in the South. This variety of climates directly influences agriculture, water supply, and living conditions. In recent years, the country has faced an increasing frequency and intensity of extreme weather events (World Bank, 2024).

Droughts affected millions of people, especially in the Amazon and the Northeast, while floods accounted for 88% of disaster-related deaths between 2000 and 2018. Deforestation in the Amazon and *Cerrado* biomes further exacerbates these risks and can lead to a tipping point with irreversible damage to ecosystems. According to the Inter-American Development Bank (IDB), the economic impacts of this scenario could reach US$ 184.1 billion by 2050, equivalent to 9.7% of Brazil's GDP in 2022 (World Bank, 2024).

4.2. Overview of Zambia

Zambia is a landlocked country in Southern Africa, covering approximately 752,000 square kilometers. It borders eight countries and had an estimated population of 19.7 million people in 2022, with an annual growth rate of 2.7%. The country faces high levels of poverty, with over 58% of the population living below the international

poverty line, and a heavy economic dependence on copper mining, which accounts for about 70% of its exports. In terms of gender, 80.5% of employed women are in vulnerable jobs, compared to 62.2% of men. The female labor force participation rate is 53.9%, below the 65.1% recorded for men (World Bank, 2024).

Zambia's climate is predominantly tropical, with a rainy season concentrated between November and April. The country is highly vulnerable to climate variability, regularly experiencing prolonged droughts and seasonal flooding that affect agriculture, food security, and access to water and energy. In 2023/2024, Zambia faced its worst drought in more than two decades, aggravated by the El Niño phenomenon, affecting an estimated 9.8 million people in 84 districts.

The consequences included declines in agricultural production, increased power outages due to reliance on hydroelectricity, and worsening food insecurity. Projections indicate that the country's average temperature could rise between 1.8°C and 2°C by 2030, with significant impacts on livelihoods, especially in rural areas (World Bank, 2024).

5. METHODOLOGY

To ensure methodological rigor and relevance, this study follows the scoping review framework proposed by Arksey and O'Malley (2005) and adopts the PRISMA flowchart to increase transparency, although it is not mandatory for this type of review (Tricco et al., 2018).

The step-by-step process was developed iteratively with the support of AI tools. Using the paid versions of ChatGPT (GPT-4), Julios AI, and Claude, a methodological guide was built and refined through the hu-man review. The use of these tools met the Generative AI Use at WRI: Guidelines for Programmatic Use (World Resources Institute, 2025), emphasizing transparency, human authorship, and academic integrity.

ChatGPT was also used for specific tasks such as translation, always based on content previously developed by the researchers involved. Claude and Julios supported stages of textual analysis and language refinement.

At no time did these tools replace the author's analytical reasoning or conceptual elaboration. All AI contributions have been carefully reviewed, adapted, and validated, ensuring the ancillary role of AI and maintaining the centrality of human agency throughout.

The study also integrated platforms such as Elicit Pro (AI-assisted evidence synthesis), [6]Rayyan[7] (screening for systematic and scoping reviews), Biblioshiny (bibliometric analysis interface in RStudio),[8] and MAXQDA (qualitative and mixed methods analysis software),[9] increasing transparency, replicability, and analytical depth.

5.1. Eligibility criteria

The review was guided by four inclusion criteria, aligned with the conceptual and empirical objectives of the study:

- **Target population:** Households with active participation of women or marginalized groups in decisions related to income, expenditures, or adaptation to climate change. This criterion focuses on households where gender, social vulnerability, and adaptive agency intersect, reflecting the study's commitment to understanding climate impacts through a justice-based lens.
- **Object of analysis:** Social and/or economic costs associated with climate change. This includes monetary (e.g., lost income, increased household expenses) and non-monetary (e.g., health, food insecurity, education) costs, recognizing the multidimensional nature of climate-related impacts on household well-being.
- **Geographic coverage:** Urban and rural areas in Brazil and Zambia. These two countries of the Global South were selected to allow comparative analyses in different sociopolitical and environmental contexts, while maintaining thematic coherence in relation to gender, inequality and vulnerability.
- **Analysis period:** Studies published from 2022 onwards. This time frame ensures the inclusion of the most recent scholarly contributions, reflecting up-to-date evidence, methodological standards, and conceptual developments in the field of gender-responsive climate research. The cut from 2022 to 2025 was also chosen precisely to avoid the most acute period of the pandemic and the initial economic shocks of the war in Ukraine.

The exclusion criteria mirrored the inclusion criteria. Studies that did not meet one or more of the four dimensions above were excluded to ensure analytical coherence and methodological consistency.

[6] Available at: Elicit: The AI Research Assistant

[7] Available at: Rayyan: AI-powered systematic review management platform

[8] Aria, M. & Cuccurullo, C. (2017). *bibliometrix: An R tool for comprehensive analysis of scientific mapping*. *Jornal de Informática*, 11(4), 959–975.

[9] MAXQDA. (2025). *Software for qualitative data analysis*. VENTI software. Consult. Sozialforschung GmbH, Berlin, Germany.

5.2. Research sources and search strategy

The selection of the databases used in this review was guided by the objective of ensuring thematic coverage, methodological quality, and geographic and institutional diversity of the evidence analyzed[10]. (See Figure 1)

Figure 1: Search strategy

Source: WRI Brasil.

The Elicit Pro platform, which operates from the Semantic Scholar database and gathers more than 126 million scientific records, was used as the main tool for the systematic search, as it offers broad multidisciplinary coverage and filtering mechanisms by relevance, recency, and type of study.

This automated search was complemented by manual searches in consolidated academic databases, such as Scopus, Web of Science, Google Scholar, and EBSCO, in order to retrieve publications not indexed uniformly across platforms. To capture data and technical-institutional reports relevant to the context of the research — especially in terms of gender, climate, and public policies — repositories of international and national organizations were consulted, such as UN Women, the United Nations Development Program (UNDP), the Getulio Vargas Foundation (FGV), the Coordination for the Improvement of Higher Education Personnel (CAPES), and the Southern African Institute of Policies and Research (SAIPAR).

For the manual search, the following semantic component was used for Boolean titles in English and Portuguese:

[10] To expand the number of relevant studies, the scope initially limited to "households headed by women" was relaxed, given the emerging nature of the theme. However, whenever possible, the analytical focus remained on these households during the stages of thematic analysis.

Table 1: Structure *string* search by semantic component and theme

Thematic Axis	Keywords / Search Terms
Climate Events	"climate change" OR "climate variability" OR "extreme weather" OR "drought" OR "flood*" OR "heatwave*" OR "slow-onset event*" OR "sea level rise"
Gender and Household Structure	"female-headed household*" OR "women-led household*" OR "single mother*" OR "women-headed famil*"
Socioeconomic Impact	"economic cost*" OR "social cost*" OR "household budget*" OR "income loss*" OR "expenditure*" OR "financial impact*" OR "livelihood*" OR "economic vulnerability"
Geographic Focus	"Brazil" OR "Zambia"
Spatial Context	"urban" OR "rural"

Source: Prepared by the authors.

This combination of academic and institutional sources made it possible to gather a solid, multidimensional final corpus that was coherent with the thematic, territorial and temporal aspects of the research.

5.3. Document selection and sorting

The screening process was carried out in three successive stages. Initially, an automated screening was applied using the Elicit Pro tool[11], which filtered 500 documents initially identified. In addition, 42 documents were manually included through gray literature supplementation, resulting in an initial sample of 542 documents.

Then, based on the inclusion and exclusion criteria developed for this study and applied automatically via Elicit Pro, 425 documents were excluded due to lack of adherence to the criteria[12]. As a result, a subset of 117 studies met the defined semantic inclusion criteria. From then on, all subsequent steps were conducted exclusively through manual review, without the use of automated tools.

The titles and abstracts of the 117 studies were evaluated in Rayyan, with blinded application of the inclusion criteria by two independent reviewers. After this

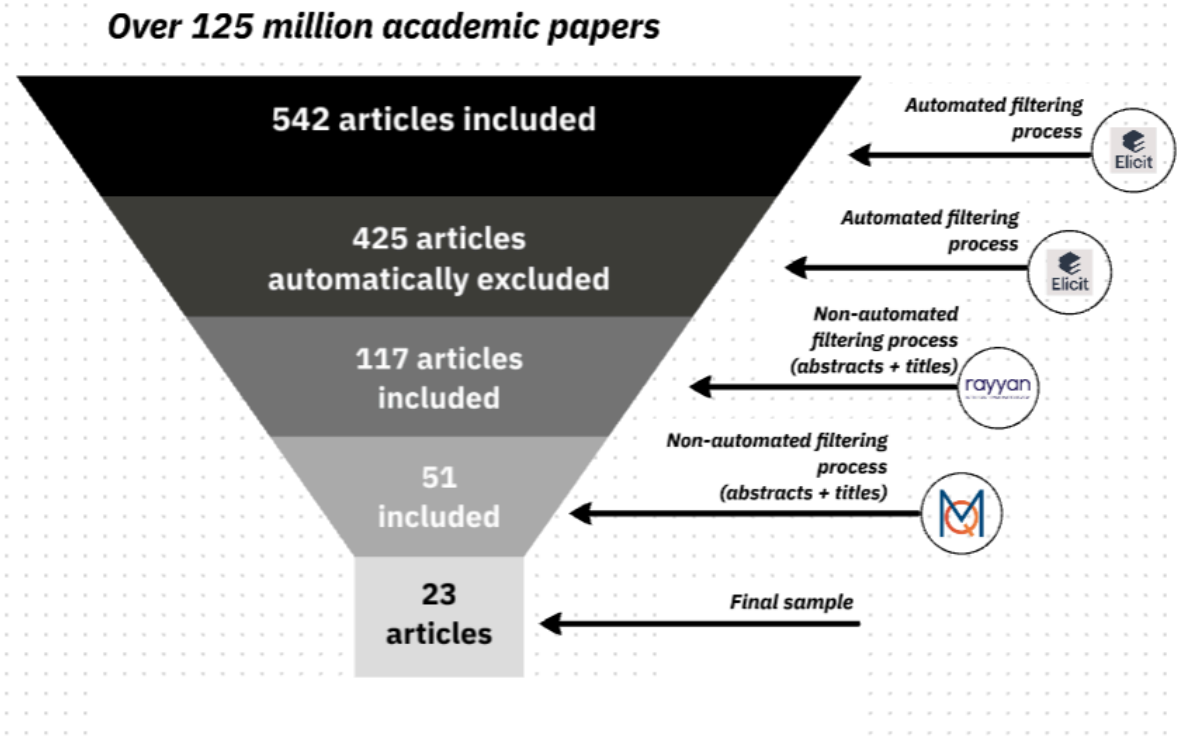
11 Despite its usefulness, Elicit Pro has important limitations: its database is restricted to Semantic Scholar, with a limited number of results per search and reliance on full metadata. In addition, it does not access closed databases or automate the collection of gray literature, requiring manual search supplementation.

12 A score threshold of 2.7 was adopted in Elicit Pro to prioritize articles with higher automated relevance, ensuring thematic focus and analytical feasibility given the volume of documents retrieved. The score threshold is an automated relevance filter. It helps reduce the number of articles to be manually reviewed, but it should be used with caution as it can rule out potentially important studies based on automated inference alone. Therefore, the use of 2.7 is a reasonable methodological decision to maintain rigor and focus, especially when complemented by a manual review of titles and abstracts, as was done in this research.

stage in Rayyan, the resulting sample consisted of 51 documents, with disagreements resolved by consensus or with the support of a third reviewer.

The next stage was carried out in the MAXQDA, with the full reading of the 51 pre-selected documents. At the end of the process, 23 documents were selected to compose the analytical corpus of this review. (See Figure 2)

Figure 2: Filtering Process



Source: WRI Brasil.

5.4. Content analysis

This subsection describes the methodological approach to content analysis applied to the documents selected in the review. Guidelines based on Bardin (2016) were used.

For data analysis, the qualitative analysis software MAXQDA was used, combining deductive and inductive procedures. The deductive procedure — that is, the one that starts from previously defined theoretical or objective categories — guided the initial creation of codes related to economic costs, social costs and climatic events. These themes derive directly from the research question and the basic literature — for example, we sought to identify evidence of loss of income, increased expenses, or family overload as ways in which climate impacts manifest in household budgets.

In addition, the inductive procedure was also adopted, which starts from the open reading of the documents to allow the emergence of themes from the data. Thus, categories such as "gender and climate", "adaptation and resilience", and "mobilized

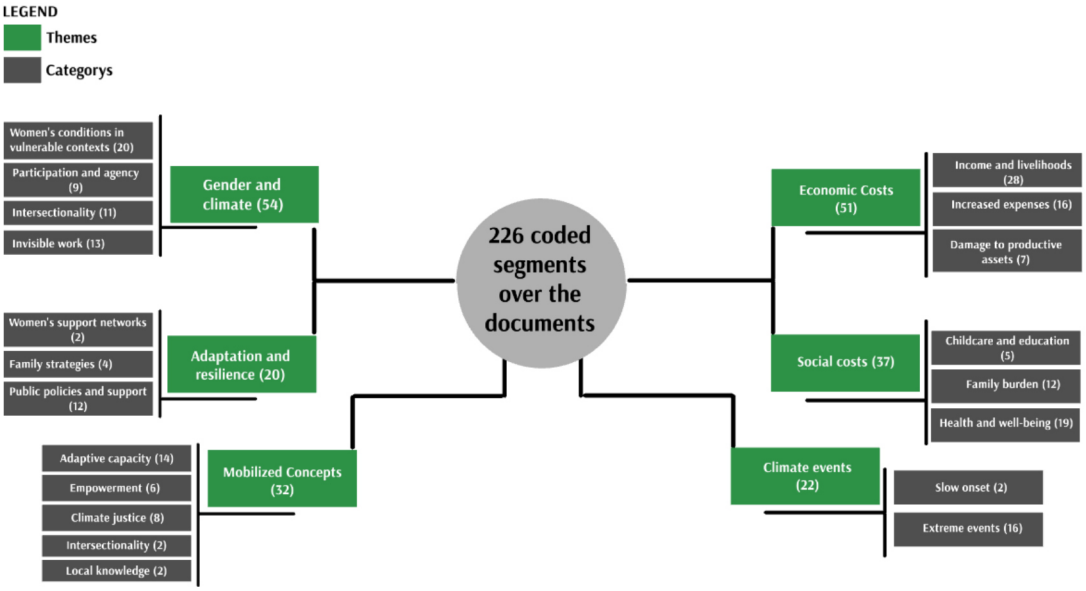
concepts" were constructed based on the recurrence and empirical relevance of certain discursive patterns – such as the frequent mention of the invisibility of reproductive work, female leadership in adaptation strategies, or the notion of climate justice as a central interpretive axis.

The combination of these approaches made it possible to organize the 226 coded excerpts into six major analytical themes (See figure 3), articulating previous objectives and emerging findings.

5.4.1. Construction of thematic categories

The construction of the thematic categories involved a combination of deductive coding and inductive coding (emerging from the empirical material, particularly the process conducted in Elicit Pro). As a result, six macro-categories or themes were mapped, each with its respective categories and subcategories. Figure 3 presents the hierarchical coding model generated by the MAXQDA.

Figure 3: Thematic coding map based on 226 coded segments generated by the MAXQDA focusing only on the theme and category levels.



Source: WRI Brasil.

Note: Check the codebook to see all themes, categories, and subcategories.

5.4.2. Encoding

The coding was conducted by a single coder, who applied the complete set of codes and marked the corresponding units of analysis. As a result, integrated analysis of the distribution of codes across segments and documents reveals clear patterns and significant gaps in the selected literature on the social and economic costs of climate change (see Figure 3-A-B).

In the case of Brazil, the most frequently coded categories were "Gender and climate" (27%) and "Social costs" (26%), which together make up more than half of the segments. This may reflect a trend in the studies analyzed to frame climate change through its social implications, particularly in connection with gender inequalities, access to services, health outcomes, and care responsibilities. "Economic costs" came next with 21%, suggesting that while economic impacts are present in the analyses, they can be discussed with less emphasis than social dimensions.

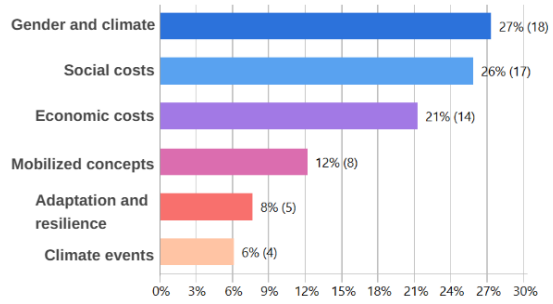
The category "Mobilized concepts" appeared in 12% of the segments, indicating some engagement with the theoretical frameworks. "Adaptation and resilience" (8%) and "Climate events" (6%) were coded less frequently, which may suggest that the selected studies focused more on the consequences of climate change than on the events themselves or responses to them.

For Zambia, a different thematic configuration was observed. "Economic costs" was the most frequent category (25%), followed closely by "Gender and climate" (24%). This points to a possible emphasis on financial impacts and the role of gender

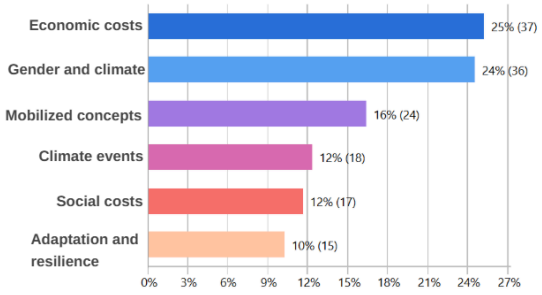
in mediating the vulnerability of families. The category "Mobilized concepts" represented 16% of the segments, indicating a relatively strong presence of conceptual or analytical references in the texts. "Climate events" and "Social costs" were present in 12% of the coded material, while "Adaptation and resilience" reached 10%, slightly above the Brazilian sample.

Figure 3: A) Presence of thematic categories in the analyzed documents and Distribution of segments coded by thematic category for Brazil; B) Presence of thematic categories in the analyzed documents and Distribution of segments coded by thematic category for Brazil to Zambia

A)



B)



Source: WRI Brasil.

6. BIBLIOMETRIC RESULTS

6.1. General standards and metadata identified for academic articles

The bibliometric analysis of the 22 documents published between 2022 and 2025 points to a dynamism and relevance of the literature dedicated to the impacts resulting from climate change on family budgets with the active participation of women[13].

According to data analyzed via Bibliometrix/Biblioshiny, the field of study has an annual growth rate of 115.4%, which indicates an accelerated expansion of the volume of publications in recent years. This significant increase reflects the growing academic and institutional interest in the topic, especially in the face of intensifying climate impacts and the demand for gender-sensitive approaches and social vulnerabilities. In addition, the average age of the articles is only 1.82 years, which reinforces the recent and emerging character of scientific production in the area. Together, these two indicators reveal that it is a field in consolidation, with production

[13] Metadata analysis was done only for academic articles.

still incipient, but at a pace of rapid expansion and conceptual and methodological updating.

From the point of view of academic influence, the studies analyzed demonstrate a high impact on the scientific community, reflected in an average of 7.27 citations per document — an indicator generally used to gauge the degree of recognition of a publication within its field. Among the highlights are the articles by Awiti A. (2022), with 42 citations, and Phiri A. T. (2022), with 25 citations that are the most cited in the corpus, signaling their role as a reference for further research.

Among the most recent studies, there is a tendency to quickly incorporate new findings into scientific production, evidenced by the high rates of normalized citation — a metric that adjusts the number of citations to the time of publication, allowing comparisons between articles published in different years. This is the case, for example, of Chitondo L. (2024) and Arunda M. (2024), which have indices of 4.29 and 3.81, respectively, even with less than two years since their publication. These data suggest that the area, although recent, is in a rapid process of consolidation, with strong circulation and absorption of new evidence.

In terms of authorship, the 22 articles analyzed involved 111 researchers, with an average of 5.05 co-authors per article—a figure that indicates a typical pattern of collaborative scientific production, often associated with interdisciplinary areas or with a strong applied component. This scenario, although it indicates a certain local consolidation of the theme. In terms of gender in authorship, an important fact is observed: 27.3% of the articles have female first authors, which may indicate female leadership in conducting research. However, women represent only 5.4% of the total number of authors identified, suggesting a possible underrepresentation of women in research teams on the topic analyzed.

Keyword analysis, performed via Bibliometrix/Biblioshiny, identified 202 unique terms in the analyzed documents. The frequency of terms such as "maize production" (13 occurrences), "crop yield" (9) and "small farmer" (7) highlights the presence of themes directly linked to subsistence agriculture and food security, especially in the context of Zambia. Words such as "multidimensional poverty" (7), "food security" (6), "floods" and "disaster management" (4 each) reflect the emphasis on complex socioeconomic impacts associated with climate change.

The Biblioshiny platform also allows the identification of terminological variation and the relative weight of central concepts. In the case of gender, the term appears in a dispersed way, with 10 variations identified — such as "gender inequality", "women", "female-headed households" — but without expressive concentration in any of them. This pattern may indicate a fragmented or transversal approach, not yet consolidated around core categories such as reproductive work, unpaid care, or emotional overload, which appear little or not at all among the most frequent terms.

Regarding institutional distribution, the analysis identified 48 institutions linked to the publications: 14 African, 7 Brazilian, 9 European, 5 North American, 3 Asian and 10 multilateral/international. Zambia leads in the number of institutional occurrences (5), followed by Brazil, Kenya, South Africa and the United Kingdom (with 2 each), indicating that the studies are territorially connected to countries in the Global South or to institutions focused on climate and social development.

Regarding the types of publication, the corpus is composed of 10 original articles, 12 systematic reviews and 1 thesis, revealing a balance between the production of new data and the critical systematization of existing knowledge — a characteristic pattern of fields in the consolidation phase, as highlighted by Aria, M., & Cuccurullo, C. (2017).

6.2. Bibliometric analysis of the selected studies

6.2.1. Publication sources and themes

The articles were published in 21 different journals, highlighting the thematic dispersion and interdisciplinary nature of the emerging literature. The only repeated source was the journal Frontiers in Sustainable Food Systems, which published two articles.

Other publications, such as the *African Journal of Food, Agriculture*, Nutrition, *and Development and the Asian Journal of Geographical Research*, appeared only once. This pattern may suggest an expanding field of inquiry, still in the consolidation phase, that crosses areas such as sustainable agriculture, health, public policy, environmental justice, and gender studies (see Table 1).

Table 1: Distribution of articles by thematic area and journal title (2022–2025)

Thematic Area	Magazine title	No. No. of items
Food security and agriculture	Frontiers in Sustainable Food Systems	2
	African Journal of Food, Agriculture, Nutrition and Development	1
	Cogent Food & Agriculture	1
	Sustainability	1
	Environmental Research: Climate	1
	CPAN Working Paper	1
Climate justice and urban adaptation	Frontiers in climate	1
	Atmosphere	1
	Climate	1
	Frontiers in Sustainable Cities	1
	Geonorte Magazine	1
Public policies and development	Brazilian Journal of Political Science	1
	Compelling Social Sciences	1
	HTS Theological Studies / Theological Studies	1
	World Journal of Advanced Research and Reviews	1

Multidisciplinary education and research	International Journal of Multidisciplinary Research	1
	International Journal of Research in Education and Social Sciences	1
	Federal University of Viçosa	1
Public health and social vulnerability	BMJ Public Health	1
	Asian Journal of Geographic Research	1
Metascience	Journal of Scientometric Research	1

Source: WRI Brasil.

6.2.2. Recurring Terms

The analysis of the most recurrent keywords in the reviewed studies deepens the understanding of the social and economic costs of climate change, particularly with regard to the impacts on women in vulnerable contexts.

As shown in Table 2, the most frequent terms belong mainly to the field of food security and agriculture, led by corn production (13 occurrences), followed by crop productivity (9) and smallholder farmers (7). These terms, along with expressions such as agricultural productivity and climate-smart agriculture, reflect how the climate crisis directly affects the income and livelihoods of women farmers, particularly in regions such as Zambia, where access to land, credit and technical assistance remains limited.

In addition, there is a predominance of expressions linked to climate justice and urban adaptation, such as climate change (4), resilience (3), adaptation (2), and climate justice (2). These terms indicate that a significant portion of the literature seeks to connect the effects of climate change with the social processes of inequality, revealing the growing centrality of climate justice in the contemporary scientific debate. Territorial references such as Zambia (2) and Sub-Saharan Africa (2) reinforce the territorial foundation of academic production.

In addition, in the field of social vulnerability and public health, terms related to gender inequality and multiple forms of vulnerability were identified. The combination of expressions such as gender inequality, intersectional inequalities, social vulnerability and invisible work totals 10 occurrences, evidencing a growing concern about the disproportionate impacts faced by women at risk.

Although less frequent, keywords related to public policy, development, and education – such as social protection (1), policy instruments (1), and gender-transformative research (1) – point to a body of literature still in development that seeks to integrate different analytical approaches to address the complexity of climate impacts. The dispersed and interdisciplinary nature of these terms, combined with the diversity of previously identified journals, suggests a field in consolidation, with the potential to strengthen as the normative frameworks of adaptation and climate justice become more robust.

Table 2: Recurring keywords grouped by topic area (2022–2025)

Thematic Area	Clustered keyword	Frequency (Sum)
Food security and agriculture	Food safety	1
	Structure of Food Systems	1
	agriculture (incl. agroecology...)	3 (2 + 1)
	Aquatic food systems	1
	Agricultural productivity	9
	maize production (maize by smallholder farmers + maize producers)	13 (8 + 5)
	Smallholder farmers	7
	climate-smart agriculture (CSA)	1
Climate justice and urban adaptation	Climate change (including "climate")	4 (3 + 1)
	Climate shocks	1
	climate vulnerability	1
	climate resilience (including resilience)	3 (1 + 2)
	adaptation (including coping strategies)	2 (1 + 1)
	mitigation	2
	Climate Justice	2
	Sub-Saharan Africa (regional)	2
	Zambia (regional)	2
Public policies and development	Development studies	1
	Technical assistance	1
Multidisciplinary education and research	agency	1
Public health and social vulnerability	gender (including all gender-related terms)	10 (4+1+1+1+1+1+1)
Metascience	inferred terms (citation, collaboration, etc.)	3

Source: WRI Brasil.

The word cloud in Figure 2 visually reinforces the consolidated findings in the table, confirming the recurring presence of core terms such as climate change, gender, climate justice, resilience, sub-Saharan Africa, food security, and agriculture. Although

it reflects the raw frequency of terms without semantic grouping, the image illustrates the thematic diversity and interconnectedness of the studies analyzed.

Figure 2: Word cloud of the most frequent keywords in the reviewed studies (2022–2025)

Source: WRI Brasil.

6.2.3. Institutional affiliations

The leadership of institutions from the Global South is evident in the sample analyzed. The University of Zambia, with three papers, and the International Institute of Water Management, with two, lead the scientific output, followed by centers such as Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA/CGIAR), which focuses on adaptation in food systems. This institutional presence reinforces the centrality of situated knowledge produced in contexts directly affected by climate change.

Table 3 highlights that Africa is home to 14 institutions, followed by Brazil with 7 centers. This reflects the strengthening of research centers committed to the themes addressed in this report. This pattern reveals not only the volume, but also the science applied to the realities of women, who face economic losses, increased expenses, and emotional burden in the face of climate instability.

By integrating academic institutions, multilateral organizations, and local networks, affiliation mapping reaffirms the importance of linking scientific production to the experiences and needs of vulnerable territories, especially with regard to the invisible costs of climate change on women's family budgets.

Table 3: Geographic distribution of research institutions in the sample

Region	Number of institutions	Names of institutions

Africa (Global South)	14	University of Zambia (3), University of Chreso, Potami International University of Management – Zambia, Ethiopian Institute of Agricultural Research, Kenyatta University, Durban University of Technology, University of Cape Town, University of the Western Cape, Institut d'Enseignement Supérieur de Ruhengeri, University of Rwanda, University of Zimbabwe, University of Abomey-Calavi, Ministry of Agriculture – Malawi, Pan-African Climate Justice Alliance
Latin America (Brazil)	7	Federal University of Bahia, Federal University of Viçosa, Federal University of Ceará, Federal Institute of Ceará, Federal University of São Carlos, State University of Campinas, FUNCEME
Asia	3	Aga Khan University (Pakistan), Chulalongkorn University (Thailand), National University of Malaysia
Europe	9	Karolinska Institutet, Karolinska Universitetssjukhuset, Stockholm Environment Institute (Sweden), Johannes Kepler University of Linz (Austria), University of Aberdeen, University of Greenwich, Institute of Development Studies (UK), Mendel University in Brno (Czech Republic)
North America	5	Columbia University, Carnegie Mellon University, New York University, Stanford University, North Carolina State University
International / Multilateral	10	International Institute of Water Management (2), AICCRA (CGIAR), CIMMYT, WHO Collaborating Centre, World Bank, UNICAF University, TANGO International, Department of Sexual and Reproductive Health, NGO Technical Assistance

Source: WRI Brasil.

In addition, the analysis of scientific production by country – based on authors' affiliations – shows that Zambia stands out with five occurrences, reflecting its leading role in research on climate change and social vulnerabilities. Brazil, Kenya, South Africa and the United Kingdom follow with two occurrences each, highlighting the active role of centers in the Global South and their contribution to debates on adaptation and climate justice.

It is important to emphasize that this indicator considers all institutional affiliations present in the articles. Thus, a single study with co-authors from different countries may be counted more than once, which explains the difference in relation to the total number of unique documents (23).

France, Sweden, Ethiopia and the United States also appear with one occurrence each, usually associated with multilateral networks or international collaborations. Overall, the data point to an engaged and territorial science, produced

from the realities of countries directly affected by the climate crisis – particularly those involving female-headed households.

6.2.4. Scientific impact and most influential articles

Analysis of the ten most influential papers in the sample reveals both the cumulative strength and relative impact of recent scientific production on the social and economic costs of climate change (see Table 4). Although the study by Umar B. B. (2022), published in Frontiers in Sustainable Food Systems, stands out in absolute terms with 51 total citations, it is important to note that more recent articles, such as those by Chitondo L. (2024) and Arunda M. (2024), had significantly high normalized citation rates (4.29 and 3.81, respectively). This may suggest that, despite their recent publication, these works are rapidly being integrated into academic debates, reflecting their relevance and topicality.

The key themes addressed by these studies – such as food security, climate justice, public health, gender, education, and systemic vulnerabilities – highlight the interdisciplinary nature of the most influential literature. These articles not only contribute robust empirical data, but also engage directly with the realities experienced by vulnerable populations, especially women and children in Global South contexts. This applied orientation and sensitivity to structural inequality help explain its accelerated academic resonance.

Thematic diversity is further reinforced by the inclusion, in the top 10, of works such as those by Gangiah (2022) and Rodrigues (2022), which, although they have lower normalized citation rates (0.17 and 0.11, respectively), expand the analytical scope when addressing urban contexts, including Brazil. The inclusion of these studies demonstrates that the scientific impact is not limited only to the volume of citations, but also considers the relevance of the empirical focus and the originality of the approaches adopted.

Together, these ten most influential articles offer insight into the main lines of inquiry into the costs of climate change for families with significant female participation. In addition, they contribute to the formulation of evidence-based policy responses that are sensitive to gender, equity, and territorial context.

Table 4: The 10 most influential articles in the sample (2022–2025)

Author, year, magazine	Total Citations	Citations by year	Standard citation
Umar B. B., 2022, Frontiers in Sustainable Food Systems	51	10.2	1.0
Awiti A., 2022, Frontiers in Climate	42	10.5	2.33
Phiri A. T., 2022, Compelling Social Sciences	25	6.25	1.39
Chitondo L., 2024, World Journal of Advanced Research and Reviews	9	4.5	4.29

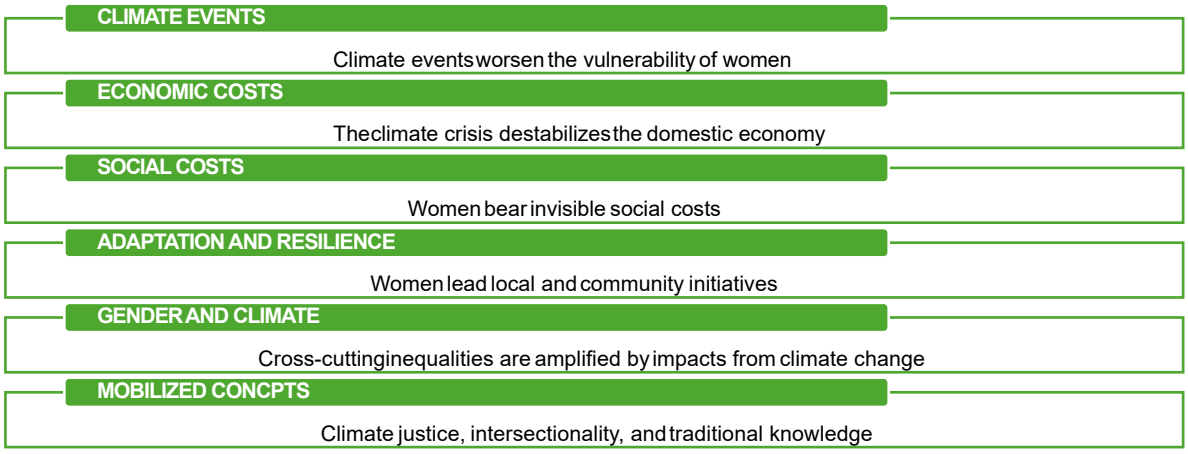
Arunda M., 2024, BMJ Public Health	8	4.0	3.81
Manyanga M., 2023, Cogent Food & Agriculture	7	2.33	3.06
Mapedza E., 2023, Sustainability	4	1.33	1.75
Mubita, 2023, Int. Journal of Research in Education and Social Sciences	3	1.0	1.31
Gangiah S., 2022, HTS Theological Studies / Theological Studies	3	0.75	0.17
Rodrigues, 2022, Geonorte Magazine	2	0.5	0.11

Source: WRI Brasil.

7. DISCUSSION

This chapter presents the patterns extracted from the analysis of the 23 selected studies. This exercise resulted in six thematic areas: relevant climate events, economic costs, social costs, adaptation and resilience, gender and climate aspects, and mobilized concepts (See Figure 3).

Figure 3: Patterns extracted from the discussion between Brazil and Zambia



Source: WRI Brasil.

7.1. Climate events: Climate events exacerbate women's vulnerability

The analysis revealed the prominent presence of extreme and slow-onset weather events as structuring elements of women's experiences in vulnerable urban and rural contexts in Brazil and Zambia. The occurrence of terms such as "floods", "droughts", "changes in rainfall patterns", "soil erosion" and "heat waves" in 20 of the 23 documents indicates that these events are drivers of socioeconomic inequalities related to factors such as gender.

The findings highlight multifaceted vulnerabilities exacerbated by extreme and slow-onset weather events. In Brazil, hydrological risk — a category of climate hazard linked to extreme events, such as heavy rainfall — is associated with expected

impacts, such as urban flooding, landslides, and waterborne diseases, which are predominant (Ottoni; English, 2022; Valêncio; Baptista, 2023).

In Zambia, the pattern revealed shows different relationships. In this case, hydrological risk is associated with the expected impacts, including prolonged droughts, water scarcity, crop losses, and soil erosion due to rainfall variability (Diwakar et al., 2024). In both Brazil and Zambia, these phenomena are not isolated, but function as multipliers of existing vulnerabilities, deepening social, economic, and gender inequalities (Ottoni; English, 2022; Fruttero et al., 2024; Valencio et al., 2023; Adam et al., 2023).

7.2. Economic costs: climate crisis destabilizes the domestic economy

The analysis revealed that economic costs appear explicitly in 18 of the 23 articles, emerging as a widely disseminated theme. The analysis reveals terms such as "crop loss", "income reduction", "household indebtedness", "increased expenses" and "credit restrictions". These terms are distinct manifestations of the economic impacts of climate change. They also indicate connections between extreme weather events and the destabilization of the family's economic base, affecting multiple dimensions – productive, domestic and financial. The studies also highlight the intersection between climate vulnerability, economic impacts, and gender-based impacts.

In Zambia, studies such as Muleya et al. (2023) indicate that the impacts of climate change — especially droughts and soil erosion — directly undermine subsistence agricultural production, with severe effects on households headed by women farmers. According to field research conducted by the authors in 2022, 70% of the women surveyed reported difficulties in accessing credit or agricultural insurance. Mweemba, Bwanya, and Sichilima (2023) support this finding, highlighting that the lack of inclusive financial mechanisms leads many women to resort to informal loan networks with exorbitant interest rates.

Diwakar, V., et al. (2024) reveal that following extreme weather events, 63% of participating women reported drastically reducing their food consumption and suspending educational or productive investments, compromising not only their immediate income but also their long-term economic autonomy.

In Brazil, the mapped economic cost appears mainly in urban areas. As a result of flooding — hydrological risk — the financial burdens related to flood impacts and chronic sanitation deficits are documented by Fialho and Alvares (2022).

7.3. Social costs: women bear the invisible social cost

Social costs affect well-being, social cohesion, rights, health, education and dignity, often disproportionately affecting the vulnerable. The reviewed articles show

that these costs are manifested in health, early childhood education, and food security. Studies such as Salvador et al. (2023) analyzed mortality from circulatory and respiratory causes during periods of drought in Brazil, highlighting pronounced effects on women. Ottoni and English (2022) also identified a significant increase in diseases exacerbated by poor sanitation in informal urban settlements in riverine communities.

In Brazil, the educational field has seen impacts such as prolonged droughts and floods correlated with increased school dropout rates, particularly among girls (Fruttero et al., 2023). Fruttero et al. (2023) found that prolonged droughts in Brazil, particularly in rural areas, are associated with lower school performance and a higher likelihood of child labor, especially among girls.

In addition, drought tends to be more harmful to girls than to boys in schools who have access to water storage facilities. Finally, another social cost directly linked to climate change is food insecurity. As highlighted by Malesu, Syrovátka and Wittmann (2024), in Zambia, women often have to travel longer distances to obtain clean water and firewood and spend more time producing and harvesting food. When food shortages occur due to climate change, women often compromise their own nutrition to ensure that their children have enough to eat.

7.4. Adaptation and resilience: women's leadership

Adaptation strategies are understood as locally-led adaptation approaches (LLA), defined as those that place people, knowledge, and local institutions at the center of decision-making on climate change adaptation, as underpinned by the World Resources Institute (2022).

Focusing on climate adaptation response strategies, the studies highlight the remarkable leadership of women. Productive diversification stands out, present in 30% of the studies analyzed. This response emerges as a concrete action to the climate variability adopted by women in subsistence farming contexts, as noted in Zambia by Manyanga et al. (2023). In a similar study, Mubita et al. (2023) emphasize that women are key players in preserving agrobiodiversity through home gardens and native seed systems, a role that increases food security in their families, thus constituting a concrete response to extreme weather events.

Another response is highlighted by Owuor, Taylor, Simushi and Mutondo (2024) for Zambia, who point out that in rural areas, women wake up earlier to secure water and food for their children during prolonged droughts, revealing how women's self-care is often sacrificed in the name of collective adaptation.

This collective adaptation is linked to another important aspect highlighted in the analysis of the article, which concerns the formation of support networks for women, observed in eight studies. Alonso-Población and Siar (2023), in their analysis of networks of fishing communities in Brazil and on the African continent, point out that

women's collective action increases their ability to claim rights and engage in local decision-making, in addition to producing positive effects on family food security.

Chisanga and Zulu-Mbata (2018) warn that the absence of public policies aimed at strengthening women's autonomy can transform these strategies into mere forms of precarious survival and not into mechanisms of social transformation.

7.5. Gender and climate: intersectional inequalities are amplified by climate

The analysis highlights the intersections between gender, class, race, age, and territory. In both rural and urban Zambia, women face difficulties in accessing resources, services and rights. Terms such as "multidimensional poverty", "families headed by women", "wealth inequality", "lack of public policies" and "territorial exclusion" are recurrent in the documents - identified in 19 of the 23 studies analyzed.

In Brazil, the effects of the climate crisis deepen pre-existing inequalities in the sexual division of labor. Ferreira de Lima, Barbosa, Benevides, and Mayorga (2024) show that, in 2020, women spent 10.4 hours more per week on care tasks than men, a burden that worsens during extreme events such as floods.

A similar situation exists in rural Zambia, where gender inequalities worsen due to resource scarcity and institutional exclusion. Studies indicate that more than 70% of women affected by drought do not access agricultural extension services and about 68% do not have formal land titles, making it difficult for them to access credit and public policies (Wang; Konar; Anderson; Hadunka; Mulenga, 2025).

In rural Zambia, women with low educational attainment and multiple children are particularly affected by the lack of context-sensitive public policies (Gicheru, Mwenda, & Omwami, 2024). During prolonged droughts, as Nkurunziza, Kabanda, and McSharry (2024) show, male migration exacerbates this burden, transferring productive roles only to women.

In Brazil's urban centers, such as Recife, 68% of female-headed households in high-risk areas report material losses, and 44% report increased health and transportation-related expenses, compounded by inadequate infrastructure and informal labor markets (Ottoni; English, 2022).

7.6. Mobilized concepts: notions that guide the debate

Finally, the mobilization of concepts was also the focus of this scoping review. Among the main concepts mobilized are: climate justice, intersectionality, adaptive capacity, empowerment and appreciation of local knowledge.

The concept of climate justice emerged as a cross-cutting theme, highlighting the unequal distribution of risks and response capacities (Ottoni; English, 2022). Another concept mobilized was intersectionality, which is notably central to this debate

in understanding how gender, race, territory, and assets shape overlapping vulnerabilities (Batista; Lelis;Neves, 2023; Gicheru et al., 2024).

Although women farmers lead strategies such as crop diversification and the use of adapted seeds, as noted by Malesu, Syrovátka, and Wittmann (2024), they face structural barriers that limit their adaptation. The concept of female empowerment – understood as the strengthening of women's autonomy in decision-making and access to resources – emerges as fundamental for food resilience. This knowledge reinforces the strategic role of women in the adaptation agenda, especially at the local level (Mubita et al., 2023).

8. PATTERNS EXTRACTED FROM THE DISCUSSION BETWEEN BRAZIL AND ZAMBIA

Table 5 presents a summary of the main social and economic costs identified in the studies analyzed, organized by thematic category. It highlights the way in which the impacts on households with a significant presence of women in Brazil and Zambia appear.

Table 5: Synthesis of climate impacts on households with a significant female presence in Brazil and Zambia (2022–2025)

Country	Climate event	Nature	Cost Type	Possible domestic impacts	Associated code	Reference
Brazil	Increase in average temperature	Slow Slow	Social	Higher incidence of respiratory diseases and impacts on the well-being of children and the elderly in female-headed households	Health and well-being	Fruttero, A., et. al., 2023
Brazil	Heavy rains and flooding	Extreme		Decline in girls' school performance and dropping out of school for domestic work	Education and daycare	Fruttero, A., et. al., 2023
Zambia	Irregular rainfall	Slow Slow	Economic	Forced adaptation to the use of commercial seeds without technical support, compromising food sovereignty	Income and livelihoods	Malesu, L. M., Syrovátka, P., & Wittmann, V. (2024)
Brazil	Flooding Extreme	Extreme	Economic / Social	Purchase of water via water trucks; replacement of household appliances; Burden of family care	Increased expenses	Zape, K. L. (2023).
		Extreme	Social	Water contamination and increase in infectious diseases in areas lacking basic sanitation	Health and well-being	Ottoni, M. L., & English, E. C (2022)
		Extreme	Economic	Climate-related economic shocks tend to have a disproportionately	Economic asset losses	Fruttero, A., et. al., 2023

				negative impact on women's agency due to several factors, including their lower decision-making power in the household, limited representation in policymaking, and greater exposure to gender-based violence.		
		Social	Social	Water contamination and increase in infectious diseases in areas lacking basic sanitation	Health and well-being	Valencio, N., Valencio, A., & Baptista, M. S. (2023)
	Heat waves and erratic rainfall Mixed	Mix		Respiratory diseases, water insecurity, school dropout, household burden	Health and well-being	Zape, K. L. (2023).
Zambia	Shortened rainy season	Slow	Economic	Forced adoption of commercial seeds; Drop in productivity and increase in food vulnerability	Income and livelihoods	Malesu, L. M., Syrovátka, P., & Wittmann, V. (2024)
	Prolonged droughts	Slow	Economic / Social	Women, rural dwellers, and marginalized communities make up the majority of people without digital connectivity due to systemic barriers, including accessibility, access to digital skills and education, language and literacy barriers, and perceived relevance and social norms." Women farmers often tend to have limited access to		Mapedza, E. et. Al.. (2022)

				agricultural extension information. Some extension workers further reinforce these patriarchal views, as they also see men as the farmers who should be called to agricultural extension meetings.		
		Infrastructure	Economic	20% increase in electricity costs; use of generators and solar panels by female-headed households	Increased expenses	Bwali, H., & Mubuyaeta, C. (2024)
		Slow		In Zambia, disasters exacerbate existing socio-economic vulnerabilities and inequalities in Zambia, disproportionately affecting marginalized communities, women, children, and people with disabilities [...] The increased frequency and intensity of extreme weather events, such as storms, heat waves, and droughts, increases the risk of disasters.	Income and livelihoods	Chitondo, L., Thelma, C. C., Mpolomoka, D. L., & Ngulube, L. (2024).
		Slow	Social	Voluntary seasonal migration among male family members seeking off-farm work is putting more pressure on women, who must take on expanded domestic	Home Cargo	Awiti, A. O. (2022).

				roles in the absence of male family members		

Source: WRI Brasil.

9. FINAL CONSIDERATIONS

The results compared between Brazil and Zambia indicate that, despite the historical, political, and economic disparities that characterize the two countries, consistent and cross-cutting patterns emerge in the way climate change intensifies structural inequalities — especially in the lives of families with a significant presence of women.

Far from being random shocks or neutral effects, climate impacts function as amplifiers of historical processes of exclusion and vulnerability (Zape, 2023). The results presented here offer the possibility of a reinterpretation of the climate crisis: as an expression and catalyst of already existing social injustices. Among the most evident impacts is the worsening of economic inequalities.

The combination of loss of income, increased expenses and lack of social protection imposes concrete limits on the daily reproduction of these families. The case of Zambian women farmers who, in the face of drought and lack of access to formal credit, resort to informal loans with high interest rates, reveals a circuit of indebtedness and financial insecurity that compromises the present and the future (Mweemba; Bwanya; Sichilima, 2023). In Brazil, the cost of extreme events — often hidden in family budgets — translates into expenses with health, transportation, energy, and loss of assets, disproportionately affecting urban households with relevant participation of women, according to Fialho and Alvares (2022).

These findings reinforce the urgency of public policies for economic protection that are territorial, gender-sensitive, and aimed at reducing exposure to climate risks with a decrease in vulnerability and an increase in adaptive capacity IPCC (2023, p.43). The social costs, although less measurable, are equally critical. The overload of care work, the dropping out of school of girls, and the use of extreme coping strategies (such as food reduction or early marriage) indicate that the effects of the climate crisis go beyond the material sphere and directly affect fundamental rights (Fruttero et al., 2023). Such effects redefine social roles, perpetuate gender inequalities, and widen the exclusion of women and girls from decision-making and opportunity spaces. This points to the need for a climate adaptation approach that incorporates subjective and relational dimensions of impact—such as time, care, autonomy, and access to dignity (Mubita et al., 2023).

As for emerging themes, studies also reveal an emerging dimension: the active role of women as agents of adaptation and resilience (Manyanga et al., 2023). Its performance in collective initiatives, sustainable resource management, solidarity networks, and productive innovation demonstrates a strategic capacity that remains invisible or undervalued by climate policies. Recognizing, supporting, and financing this role can be an essential condition for any adaptation response that is

transformational in relation to the ongoing and future impacts of the climate crisis — not as a compensatory gesture, but as part of a just and truly inclusive transition.

The climate bills lens therefore emerges as a promising analytical approach to interpret this complexity. The possibility of mapping economic and social costs allows us to point out that this approach can support the better qualification of costs under those who bear the most impacts of climate events. It is also worth mentioning that this approach is directly associated with the climate justice agenda — a concept that articulates themes such as race, gender, territory, human rights, and traditional knowledge. In view of this, the following are three strategic questions for future research agendas:

- How to incorporate climate bills — especially those that fall on women in vulnerable contexts — into budget planning and execution instruments, ensuring their visibility in public accounts?
- What data collection, systematization, and monitoring mechanisms would be needed to more accurately map the economic and social costs of the climate crisis on different groups of women, considering territorial, racial, and generational cuts?
- How can the "climate bills" approach be scaled up to capture the impacts of the crisis on other marginalized groups — such as Black people, Indigenous peoples, peripheral communities, and informal workers — guiding climate justice action?

Recognizing climate bills can result in proposing transformative pathways to climate justice action.

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ANNEX

CODE BOOK

1. Gender and climate

Women, especially those in vulnerable situations, are disproportionately affected by the impacts of climate change. They tend to face higher probabilities of poverty and multidimensional deprivation, with Black women and single mothers being the most affected. This is due to a number of factors, including the feminization of poverty, the burden of unpaid domestic and care work, male migration, lack of access to resources and knowledge, and the limited decision-making power of families. In addition, women play central roles in fisheries and agriculture value chains, but often occupy the most unstable and lowest-paid positions. As such, women bear a disproportionate burden of environmental crises such as droughts, floods, and food insecurity, which deepens their vulnerability.

1.1 Condition of women in vulnerable contexts

1.1.1 Women as primary providers

As primary providers in vulnerable contexts, women face disproportionate challenges due to climate change. They take on additional domestic and care responsibilities when men migrate or are absent and are more affected by food insecurity and poverty. Female-headed households, particularly Black women and single mothers, are especially affected by income variability caused by climate shocks. Despite their central role in fisheries and agriculture value chains, women often occupy precarious and low-paid positions with little recognition. Thus, women in vulnerable contexts bear a disproportionate burden of climate change impacts.

1.1.2 Women as financial decision-makers

Women as responsible for managing family budgets in conditions of climate stress.

1.2. Intersectionality

1.2.1 Asset Ownership + Gender

Owning assets such as land and livestock can offer protection against climate shocks, but there is a pronounced bias against women in accessing these properties. Men typically have more assets, which exacerbates women's vulnerability to these shocks. Asset ownership plays a crucial role in providing protection, serving as alternative coping mechanisms where insurance markets are absent. However, the effectiveness of these strategies depends on the distribution of pre-existing assets and the family's ability to access other sources of income.

1.2.2 Gender + Food Insecurity

Women play a critical role in food security, especially in livestock production, where they contribute to climate-adapted production practices. However, food insecurity can exacerbate existing nutritional vulnerabilities, such as iron deficiency in pregnant or breastfeeding women. Integrated aquaculture and cultivation projects have led to increased household incomes and reduced malnutrition in Zambia and Vietnam. Climate change negatively affects women, whose livelihoods depend on natural resources for food, firewood, and water – leading to household food insecurity and water scarcity. During droughts, women often reduce the frequency of meals and compromise their own nutrition to ensure that their children have enough to eat.

1.2.3 Gender + Unequal Access to Credit

Women face significant barriers in accessing credit and loans to invest in climate-adaptive practices. They are often viewed as high-risk borrowers by financial institutions due to their limited ownership of land and assets. This situation is reflected in smallholder farming and aquaculture, where women struggle to access formal financial services. Food insecurity, in this case, aggravates other structural vulnerabilities and reduces women's ability to adapt.

1.3. Invisible Work

1.3.1 Domestic Water Crisis Management

Women and children in rural communities must walk long distances to collect water for daily household needs, especially in arid areas where water scarcity forces them to travel further to find perennial springs. One community strategy to reduce workload and vulnerability has been the use of donkeys and camels to transport water.

1.3.2 Emotional Burden and Mental Health

Women face a disproportionate emotional and domestic workload, especially when caring for dependents and dealing with household chores. This burden is compounded by the fact that women tend to use more of their income to support their families, while men have more financial resources to address climate impacts in agriculture. In addition, women who work in activities related to fishing outside the home often face social sanctions due to gender norms that see them primarily as housewives. This workload and gender norms harm women's mental health and well-being, increasing the vulnerability of their families.

1.4 Participation and Agency

1.4.1 Women as local leaders

As local leaders, women play a critical role in climate mitigation and adaptation. They require access to productive resources, participation in community groups, and a voice in household decisions to act as effective agents of change. When given the opportunity, women demonstrate leadership in adaptation initiatives, such as building flood protection infrastructure. However, they still face barriers, including underrepresentation on natural resource management committees due to gender norms that privilege male voices. Recognizing and supporting women's leadership is essential to building climate resilience at the household and community levels.

1.4.2 Women in Informal Support Networks

Formation of solidarity and care groups among women.

2. Economic costs

Women in low- and middle-income countries (LMICs) are particularly vulnerable to the impacts of climate change due to their dependence on climate-sensitive sectors such as agriculture, fisheries/aquaculture, and tourism, as well as their lower capacity to adapt. They face significant barriers in accessing financial resources, such as credit and loans, to invest in sustainable agricultural technologies and practices. In addition, women have less decision-making power in households and are underrepresented in policy-making processes, which exacerbates the negative effects of climate-related economic shocks. These vulnerabilities are reflected in declines in agricultural production, household incomes, and the overall well-being of women and girls. Therefore, it is crucial to ensure women's land tenure rights and access to agricultural resources in order to advance local and global mitigation and adaptation goals.

2.1 Income and means of subsistence

2.1.1 Loss of access to resources and income generation

Loss of crops, fishing or other productive sources.

2.1.2 Indebtedness due to weather events

Access to credit is a significant challenge for women and smallholder farmers. Women involved in small-scale aquaculture and fisheries struggle to secure loans for their businesses, as financial institutions often perceive them as high-risk borrowers due to limited ownership of land and assets. Similarly, smallholder maize farmers in Zambia face substantial barriers to formal financial services, such as savings and credit. Limited access to finance is a key obstacle to adopting more sustainable farming and fishing practices.

2.1.3 Income gains

Increased rainfall improves agricultural productivity, increasing household incomes, and improving girls' health. It also benefits the socioeconomic status of adult women, mediated by increased access to education.

2.1.4 Access to credit

As noted above, access to credit is a major barrier, particularly for women and smallholder farmers, due to institutional biases and asset limitations, hindering sustainable development.

2.2 Growing expenses

2.2.1 Additional energy and water expenses

Operating costs increase due to reliance on alternative energy sources, such as diesel generators and solar panels, during power outages. Additionally, the financial cost can be a barrier to accessing clean cooking fuels such as LPG. While the free distribution of LPG cylinders and stoves in rural areas can help, it can also lead to disuse or accumulation of unused equipment if residents cannot afford fuel.

2.2.2 Emergency transport or healthcare expenditure

Emergency economic costs related to transportation and health increase due to several factors: women often have to travel long distances to access essential services in remote areas; there is a lack of patient transport strategies in health units; and climate change-related floods displace communities and disrupt sexual and reproductive health services.

2.2.3 Increasing food expenditure

It includes rising prices, local scarcity, and impacts on food security.

2.2.4 Unequal access to information technologies

Unequal access to tools such as mobile phones and radios poses a major challenge to climate information communication, particularly for women farmers. Although

mobile phone ownership is higher in urban areas compared to rural Zambia, female-headed households are less likely to own a telephone than male-headed households. In addition, women face greater technical difficulties in using these tools due to low literacy levels. Therefore, gender-responsive design of climate information services – such as those from AICCRA – is critical to reaching women and men farmers effectively.

2.2.5 Displacement and access to resources

Adverse weather events – such as saltwater intrusion, destructive flooding, and extreme weather change – impose significant financial burdens on poorer residents. These events force people to travel longer distances to access essential resources such as clean water. Changes in temporary migration patterns especially affect urban areas, exacerbating the already interconnected housing and water crises.

2.3 Damage to Productive Assets

2.3.1 Loss of equipment or supplies

Destruction of assets such as tractors, nets, seeds and houses.

2.3.2 Loss of equipment or supplies

Emergency economic costs related to transportation and health increase due to several factors, such as the need for women to access essential services in remote areas, the lack of patient transportation strategies in health facilities, and the impacts of climate change-induced flooding, which displace populations and disrupt the provision of sexual and reproductive health services.

3. Social Costs

3.1 Health and well-being

3.1.1 Climate-related diseases

Older adults (60+) and infants (0–12 months) are the most affected by hospitalizations related to climate-induced diseases. Communities in informal settlements along riverbanks in impoverished peripheral areas of Brazil have increasingly suffered from more intense annual urban flooding, such as those in the Roncador River region of Duque de Caxias. The growing housing crisis, lack of public investment in urban planning and housing policies, and growing real estate speculation have exacerbated social inequalities and significantly increased the number of informal settlements in recent decades. Consequently, these communities have faced numerous financial and health burdens related to flooding and chronic sanitation deficits. Women suffer the most during droughts, often needing to take their children to hospitals more often. Droughts also affect smallholder rural farmers, leading to changes in eating habits with potential long-term health consequences.

3.1.2 Psychologicaland emotional impacts

The consequences of climate change and natural disasters disproportionately affect women's health and well-being. Theyare at higher risk of waterborne diseases such as malaria, particularly as primary caregivers. The psychological and emotional impacts—including anxiety, depression, post-traumatic stress disorder (PTSD),and suicide—can be exacerbated by economic losses and forced displacement. Other health problems, such as pneumonia, respiratory infections, tuberculosis, and asthma, can worsen due to air pollution. In addition, women may face violence and loss of autonomy, such as being subjected to polygamous marriages after climate shocks. While there may not be clear gender differences in some areas, such as direct mortality or cognitive and socio-emotional development, women's health in Africa is complex and requires special attention.

3.1.2 Physical or respiratory impacts

It includes illnesses aggravatedby extreme heat, smoke, dust, or flooding.

3.1.3 Reproductiveand neonatal impacts

Indoor air pollution can negativelyaffect neonatal health, includingintrauterine growth restriction, impaired neurodevelopment, fetal thrombotic vasculopathy, premature mortality, low birth weight, and perinatal death. Studies and experimental reviews have shown that extreme temperatures, floods, and droughts directly affect sexual and reproductive health and rights (SRHR)through various mechanisms. In addition, women who give birth during or shortly after a natural disaster are at increased risk of adverse reproductive outcomes, including preeclampsia, hemorrhage, preterm birth, and birth complications.

3.1.4 Social cost of exposure to recurrent environmental risks

(Includes cumulative, long-term health and social charges.)

3.1.5 Violence against women

Gender-based violence (GBV)against women in food resettlement camps included emotional and physical violence committed by partners and strangers during and after climate-induced natural disasters.

3.2 Education and Child Care

3.2.1 Droppingout of school due to the climate crisis

Research indicates that climate shocks, such as long periods of heavy rainfall, can lead to higher mortality rates among girls, poorer health outcomes, increased school dropout rates, or early marriage. Adolescent girls – often with more domestic skills – are typically withdrawn from school during these periods, unlike very young boys and

girls. In Brazil, extreme weather shocks negatively affect performance in subjects such as mathematics and language, especially among girls.

3.2.2 Nutritional insecurity

Reduction in infant feeding due to loss of income or crop failure.

3.3 Family overload

3.3.1 Redistribution of domestic responsibilities

Brazilian women spend, on average, 10.4 hours more per week than men on household chores and care. When men migrate, their responsibilities are added to women's workload, which can prevent women from securing food for their families and lead to children leaving school to replace the absent caregiver. This dynamic also causes families to forgo or abandon labor-intensive agricultural technologies. Women play a key role in unpaid activities such as post-harvest processing, fishing, and household maintenance. The adoption of crop diversification and agricultural technology increases the demand for female labor, potentially with negative consequences as girls are taken out of school to replace their mothers. During droughts, the demand for agricultural labor decreases, leading women to withdraw from paid work and focus more on household chores and motherhood. While men recognize that women take on more domestic responsibilities during droughts, women themselves perceive their workload as heavier due to their multiple roles.

4. Weather events

4.1 Extreme events

Extreme weather events – such as floods, locust invasions, heat waves, droughts and storms – have severe impacts on vulnerable communities, particularly in rural areas. These events affect agriculture, livestock, and livelihoods, leading to food insecurity, water scarcity, and economic losses. Women and the most socioeconomically vulnerable groups are disproportionately affected by these disasters. Adopting sustainable farming practices and subsidy programs can help mitigate the effects of these extreme weather events. In addition, improvements to urban infrastructure – such as drainage systems and waste management – are crucial to addressing the impacts of heavy rainfall and prolonged droughts.

4.1.1 Floods and storms

Destruction of housing and infrastructure.

4.1.2 Prolonged droughts and dry spells

It impacts agricultural production, livestock and water availability.

4.2 Slow Start Events

4.2.1 Change in Precipitation Patterns

Reduction, delay or irregularity in rainfall.

4.2.2 Rising temperatures

Gradual increase in temperature and its effects.

5. Adaptation and Resilience

Adaptation and resilience to climate change requires the active involvement of women and gender experts, as they are powerful agents of change and their participation is essential. Women play a central role in preserving agrobiodiversity and family resilience by cultivating vegetable gardens and maintaining traditional knowledge of crop varieties and diversity. Crop diversification and livestock integration also increase resilience and productivity. However, women face barriers to accessing essential services, assets, adaptive capacity, information, training, and technology related to climate adaptation. Policies and programs should prioritize strengthening the role of women, such as ensuring access to productive resources, participation in producer groups, and a voice in household decision-making. Interventions to strengthen women's collective action – such as networks, associations and cooperatives – are also important.

5.1 Domestic Strategies

5.1.1 Productive diversification

Gardening, new crops and integration of activities.

5.1.2 Routine adjustments and self-care

Changes in everyday habits and technologies to reduce risks.

5.2 Public Policies and Support

5.2.1 Lack of access to social programs, infrastructure, or technologies

Absence or inadequacy of institutional responses.

5.2.2 Lack of training and technical assistance

Lack of technical support for vulnerable families.

5.3 Women's Support Networks

5.3.1 Informal exchange groups or cooperatives

Women organizing to ensure survival and resilience.

6. Concepts mobilized

Gender inequality exacerbates the impacts of climate change, as women are disproportionately affected due to harmful socio-cultural norms, unequal access to resources and services, and subordinate positions in the social hierarchy. However, women also possess strong adaptive capacities and can play an active role in mitigating impacts. Gender-responsive climate information services have the potential to transform agricultural production and rural communities by empowering women. In addition, the inclusion of women in clean energy supply chains and decision-making spaces can contribute to a more equitable transition.

6.1 Climate justice

6.1.1 Unequal distribution of risks and responses

Recognition of the unequal burden of impacts and inequality in solutions.

6.2 Intersectionality

6.2.1 Overlapping Inequalities

Multiple forms of oppression and exclusion (race, gender, territory).

6.3 Adaptive Capacity

6.3.1 Differentiated response measures

Different levels of access to resources and institutional support.

6.4 Empowerment

6.4.1 Women's autonomy and leadership

Female leadership and decision-making capacity in crisis contexts.

6.5 Local knowledge

6.5.1 Traditional knowledge and practices

Use of ancestral knowledge for adaptation and resilience.

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