Gender dimensions in climate change in the Amazon

Vulnerability and resilience among rural women in Pará

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WORKING PAPER 57

Working Paper 57

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Working Paper 57

DOI: 10.17528/cifor-icraf/009402

Mello D, Tournes D, Morais R, Splendore J, Lacerda L, Marques E, Schmink M, Sobreiro T, Cortinhas L, Miccolis A. 2025. *Gender dimensions in climate change in the Amazon: Vulnerability and resilience among rural women in Pará*. Working Paper 57. Bogor, Indonesia: CIFOR; Nairobi, Kenya: ICRAF.

Translation of:
Mello D, Tournes D, Morais R, Splendore J, Lacerda L, Marques E, Schmink M, Sobreiro T, Cortinhas L, Miccolis A. 2025. *Dimensões de Gênero nas Mudanças Climáticas na Amazônia: Vulnerabilidade e Resiliência entre Mulheres Rurais Paraenses.* Documento de Trabalho n.º 56. Bogor, Indonésia: CIFOR; Nairobi, Quênia: World Agroforestry. https://doi.org/10.17528/cifor-icraf/9401

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Acknowledgement

This research is part of the ARCA Programme, conducted by the Centre for International Forestry Research and the World Agroforestry (CIFOR-ICRAF Brazil), with the collaboration of Ricardo Mello (Technical Advisor to the Chico Mendes Memorial), Denise Oliveira (Communications Coordinator at CIFOR-ICRAF Brazil) in reviewing the article, as well as Vitória Alves and Lucas Cortinhas (CIFOR-ICRAF Brazil) and Amanda Araújo (Partners for the Amazon Platform – PPA) in photographing the workshops on Gender and Climate Change. The contributions of these professionals, through technical reviews and the provision of images, were fundamental to the preparation of this article.

Summary

The Amazon region of Pará represents a complex mosaic of ecosystems and socio-productive systems in which rural women play strategic roles in promoting food security, sustainable biodiversity management and the consolidation of low-carbon economies. In the context of the state of Pará, characterized by high socio-cultural diversity, ecological vulnerability and intense anthropogenic pressures, the effects of climate change disproportionately affect historically marginalized populations – especially women, youth, Indigenous Peoples and traditional communities. Despite the central role of women, persistent gender disparities restrict their access to resources, decision-making arenas and technologies, thereby exacerbating inequalities and prompting resilience strategies in the face of the climate crisis.

This publication, linked to CIFOR-ICRAF's Gender and Social Inclusion research line in Brazil and developed under the Amazon Regenerative Agriculture and Conservation (ARCA) Program, seeks to contribute to filling this gap by analysing the impacts of extreme weather events on the livelihoods and productive activities of rural women in Pará, as well as the adaptive strategies they have mobilized in the face of the challenges posed by the climate crisis.

Our methodological approach combined a review of scientific and grey literature published between 2019 and 2025, the application of the Forest and Forest-Dependent People Vulnerability Assessment Framework (FAO/CIFOR 2019), and the holding of a dialogue and discussion workshop in focus groups with 57 female leaders from 27 municipalities in Pará, covering identity diversity (Indigenous, *quilombolas*, riverine, farmers, fisherwomen) and productive diversity (agriculture, extractivism, fishing, handicrafts, community agroindustry).

From the women's perspective, the following were identified: a) the main climatic events affecting different agro-ecosystems in Pará (prolonged droughts, flash floods, changes in rainfall patterns and rising temperatures); b) the differentiated environmental and socio-economic impacts on women, including loss of biodiversity, reduced income, and overload of productive and reproductive work; c) adaptation strategies already implemented, based on traditional knowledge, social innovation and agro-ecological practices (agroforestry systems, community water management, solidarity marketing); and d) structural, institutional and cultural barriers that restrict the full participation of women and young people in climate governance (unequal access to land, credit, technology and information).

Results of the analysis show that climate justice requires public policies that are sensitive to gender, territory and Amazonian socio-cultural diversity. At the same time, they reveal the potential of women as agents of transformation, capable of articulating cooperation networks, innovating in productive systems, and influencing mitigation and adaptation agendas.

The article is organized into five sections.

1. Section 1 introduces a theoretical contextualization of the intersections between gender and climate.
2. Section 2 covers the methodology used and describes the research design, data collection instruments and analytical procedures.
3. Results are discussed in Section 3, presenting climate events, their impacts, resilience practices and the barriers identified.
4. Section 4 provides conclusions and recommendations offers guidelines for policymakers, academia, civil society organizations and social movements interested in promoting gender equity and sustainability in the Amazon.
5. Section 5 provides final considerations.

By offering empirical evidence and policy proposals aligned with the Sustainable Development Goals (SDGs 5, 10, 13 and 18)[1], this work aims to strengthen the inclusion of Amazonian women in climate governance debates and practices, contributing to a more just, resilient and regenerative future.

This work was carried out in 2025, in Belém, capital of the state of Pará, where the 30th United Nations Climate Change Conference will be held. It is hoped that it will bring insights, evidence, reports and actions from a small group representing thousands of female voices who work daily to conserve the forest and maintain Amazonian culture and well-being.

1 SDG 5 – Gender Equality; SDG 10 – Reduced Inequalities; SDG 13 – Climate Action; SDG 18 – Ethnic and Racial Equality).

1 Introduction

Climate change represents one of the most pressing and complex challenges of the 21st century, whose effects are manifested in a profoundly asymmetrical manner among different global populations. The climate crisis poses a multifaceted threat to human life, ecosystems and the guarantee of fundamental rights, requiring urgent and integrated responses. Its adverse impacts are unevenly distributed, falling most heavily on vulnerable populations and communities – especially in low-income countries – and disproportionately affecting women, youth, children, traditional communities and Indigenous Peoples (Roy et al. 2022; UN Women 2023; Andrijevic et al. 2025). In Latin America, and particularly in rural areas of Brazil, women are disproportionately affected by climate risks and impacts, as environmental changes exacerbate pre-existing gender inequalities; girls and women experience higher poverty and lower access to resources, which increases their vulnerability to environmental risks (UN Women 2021, 2023; Sinalo et al., 2025).

On the other hand, the agency of women and young people has been essential both in local and national mobilization and in global climate negotiations (James et al. 2021; UNICEF Brazil 2022; UN Women 2023; Sorge et al. 2025). Thus, the inclusion of these groups becomes a key element in environmental governance, not only as a normative issue of rights, but also because it enriches climate solutions with diverse perspectives. Despite being most affected by climate change, women and young people have low participation in the discussion processes of adaptation and mitigation programmes and policies (Danilenko et al. 2024).

In the Amazon, climate change has had a significant impact on rural areas, altering ecological, economic and social dynamics. Within this scenario, rural women face complex challenges in their productive activities, experiencing risks ranging from climate instability to exclusion from decision-making and planning processes. The purpose of this study is to analyse the risks and impacts faced by these women in their productive and economic contexts, understanding how they have responded to such adversities through practices that seek to increase their capacity for adaptation and resilience.

The research is based on the premise that rural women play a strategic role in maintaining agro-ecological systems, food security and environmental conservation. Therefore, understanding their adaptive practices is fundamental to strengthening public policies and actions to combat climate change.

The state of Pará, marked by vast socio-ecological diversity, epitomizes the paradoxes of the contemporary Amazon: an abundance of natural resources and, simultaneously, socio-environmental pressures derived from deforestation, burning, agricultural expansion and large-scale infrastructure projects. Changes in rainfall patterns, prolonged droughts, fires, flash floods and temperature anomalies are redefining regional production dynamics, compromising food security and the income of communities that depend directly on local ecosystems (Peters et al. 2024).

Specifically, the objective of the research was:

- to identify the main climatic events that affect rural areas – such as floods, droughts and changes in rainfall patterns – and understand their causes, effects and direct impacts on women's production and livelihoods.
- to map the practical actions (traditional and innovative) and organizational strategies adopted by women to deal with climatic and socio-environmental challenges, highlighting local knowledge and experiences of resistance.
- to identify institutional and community mechanisms that enable (or hinder) the active participation of women and young people in environmental governance and in the development of collective strategies to address climate change.

2 Methodology

2.1 Research method

The study adopted mixed methods involving an exploratory descriptive qualitative survey and analysis, aligned with the Forest and Forest-Dependent Peoples Vulnerability Assessment Framework (FAO and CIFOR 2019), as well as a quantitative analysis of women's discourse by immediate and intermediate geographic regions of the state of Pará (IBGE 2017), more commonly known as mesoregions.[2] The methodological strategy combined three main sources of evidence: systematic review of scientific and grey literature (2019–2025), analysis of public policies and socio-environmental databases, and generation of primary data through workshops and focus groups with rural women in the state of Pará. The triangulation of these methods sought to ensure analytical robustness and internal validity of the findings (Creswell and Plano-Clark 2018).

The systematic literature review was conducted in the Web of Science, Scopus, SciELO and Google Scholar databases, and the CIFOR-ICRAF digital library. The keywords combined descriptors in Portuguese, English and Spanish: "gender AND climate change", "women AND rural AND Amazon", "feminist climate resilience" and "Pará AND family farming", among others. Period filters (2019–2025) were applied. Reports from multilateral organizations (IPCC, FAO, UN Women, World Bank) and classic studies prior to 2019 were included for thematic relevance. In total, 162 documents comprised the body of the study.

The spatial scope covered the six mesoregions of Pará (Lower Amazon, Marajó, Northeast Pará, Belém Metropolitan region, Southeast Pará and Southwest Pará), representative of floodplain, terra firme, mangrove and floodable forest ecosystems. The selection of key informants followed intentional quota sampling to ensure identity diversity (quilombolas,[3] Indigenous Peoples, riverine communities, farmers, fisherwomen, extractivists), territorial coverage (number of municipalities), productive diversity (agriculture, plant and animal extractivism, fishing, artisanal agroindustry) and community leadership (formal or recognized leaders). Fifty-seven women participated, which is higher than the minimum recommended for thematic saturation in focal studies (Guest et al. 2017).

Participants were mobilized through collaborative strategies that were sensitive to the territorial, socio-cultural and logistical realities of the women involved. Territorial and institutional mapping was carried out, based on coordination with local and regional networks – such as the Jirau Agroecology Network (Santos, 2019) – and in partnership with unions, associations, social movements and rural women's networks. The process respected the specificities of access to information, travel conditions and forms of community coordination, ensuring representativeness and inclusion. The criteria defined for identifying key informants were structured around four fundamental pillars:

a. **Identity representativeness:** Women who express the diversity of identity categories present in rural communities in the state of Pará, such as quilombolas, Indigenous women, fisherwomen, farmers, riverine women, residents of peri-urban areas, among others.
b. **Territorial coverage:** Women from all mesoregions of the state, covering the variety of agro-ecosystems characteristic of the region, such as floodplains, terra firme, mangroves, terra firme forest, floodplain forest, extractive reserves, among others.

2 This term was adopted in the research, due to the fact that rural women are easily identified/located by mesoregions in the state.

3 Quilombolas are the descendants and remnants of communities formed by fugitive slaves (the quilombos) between the 16th century and 1888 (when slavery was abolished) in Brazil (Brasil Escola n.d.).

c. **Productive diversity:** Active participation in different productive economic activities, with an emphasis on local biodiversity products, such as agriculture, agroextractivism and various forms of extractivism (açaí, oils, seeds, handicrafts, crab gathering, beekeeping, etc.).
d. **Protagonism and leadership:** Women who play leadership roles in their communities and/or act as representatives of organizations or social movements.

The primary data collection workshops took place on 25–27 June 2025, in Belém, Pará, using participatory methods adapted from the Community Climate Vulnerability Assessment (Reed et al. 2013). The techniques included a climate timeline to reconstruct extreme events over the last two decades, social cartography to map local risks and resources on cartographic panels, an impact matrix and strategies to assess productive, environmental and social effects, and an analysis of barriers to identify institutional, technological and cultural limitations. All meetings were conducted by researchers trained in gender-sensitive and intercultural facilitation. Discussions were audio recorded with the free and informed consent of the participants and transcribed in full. The key stages of data and information collection are summarized in Figure 1.

Figure 1. Key stages of data collection for the study (2025)

2.2 Characterization of key informants

The women (57 participants) in this study predominantly identified themselves as representatives of different categories of rural women, distributed as follows: farmers (38%), quilombolas (31%), riverine women (21%), and Indigenous women and fisherwomen (10%) (Figure 2).[4] Among the social and economic entities that rural women represent in the study, 38% were associations, followed by unions (18%), organizational networks focused on production and/or socio-community activities such as cooperatives (11%) and collectives (15%), among others (Figure 3), including those composed exclusively of women or of a mixed organization (composed by men and women).

4 Informal groups that work on social and/or economic activities in the community.

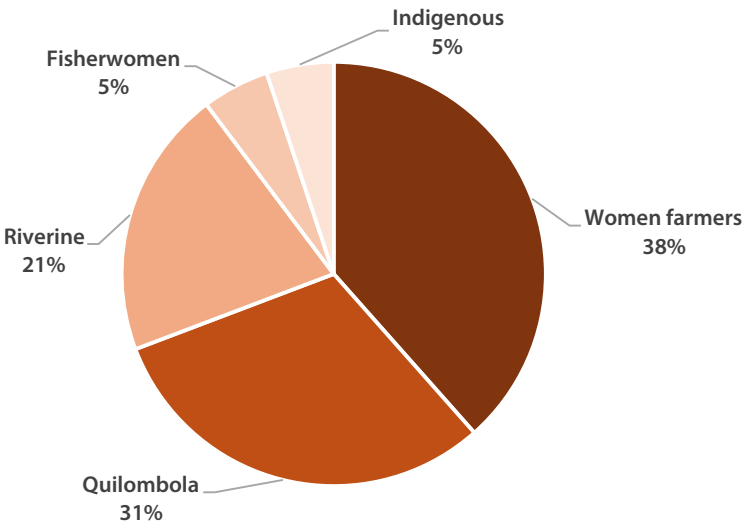

Figure 2. Representative categories of survey participants

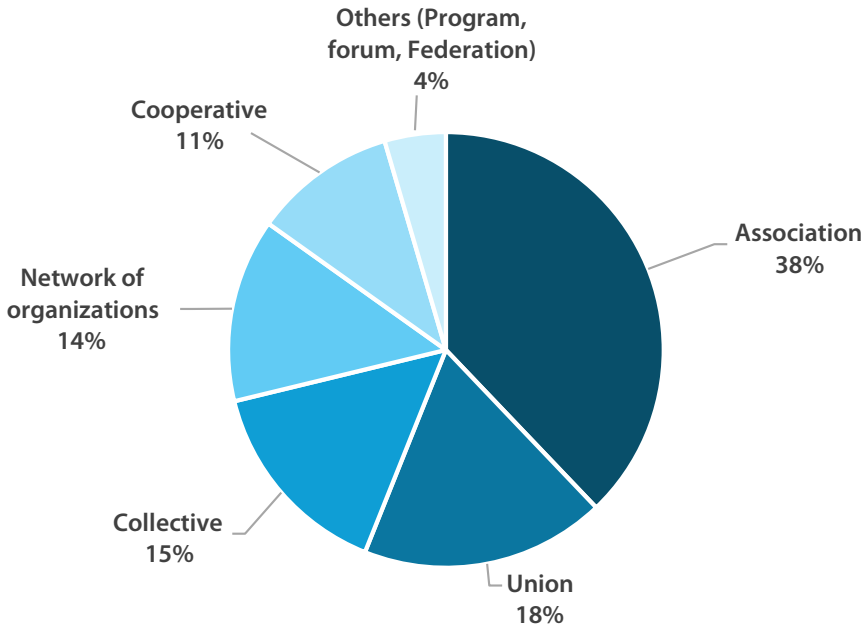

Figure 3. Types of organizations in which rural women participate (2025)

Women play a significant role in leadership and management positions in social and economic organizations. Almost half (47%) hold the position of president. This direct involvement in decision-making and administration – which also includes roles such as secretary, vice president, treasurer and advisor – reveals a process of institutional appropriation by women who have historically been underrepresented in these spaces. This is a movement that redefines the role of women in organizational and community dynamics (Figure 4).

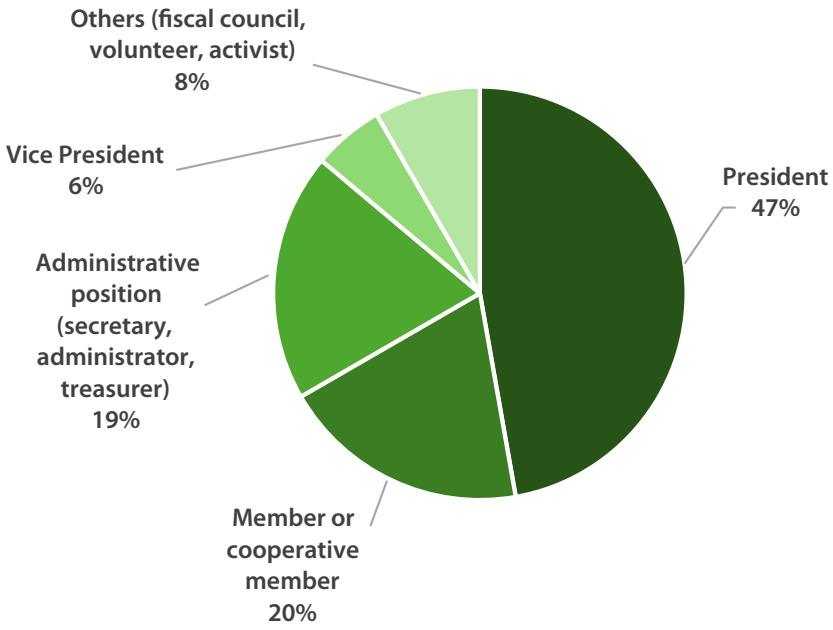

Figure 4. Positions held by women in organizations (2025)

The participants' responses highlight the wide diversity of productive practices carried out by women in order to ensure their subsistence and generate income. Among these activities, the following stand out:

a. **Agriculture and agroforestry:** cultivation in fields and agroforestry systems, including production of cassava and its derivatives (flour, beiju, tapioca gum), vegetables (such as chili pepper (*Capsicum chinense*) and pumpkin (*Cucurbita moschata)*), fruit growing (papaya (*Carica Papaya* L.), banana (*Musa saplentum)*, cupuaçu (*Theobroma grandiflorum)*, cocoa (*Theobroma cacao)*, açaí (*Euterpe oleracea))*, and agro-ecological management of cultivated areas.
b. **Animal husbandry:** raising small animals such as poultry (chickens, ducks) and pigs, as well as poultry farming for egg production, meliponiculture, beekeeping and fish farming.
c. **Plant and animal extraction:** collection of seeds and forest products (Brazil nuts, honey, copaiba oils (*Copaifera langsdorffii)* and andiroba (*Carapa guianensis Aubl)*, pracaxi (*Pentaclethra macroloba Willd Kuntze)*, native seeds), açaí management, crab and shrimp collection, and artisanal fishing.
d. **Artisanal and agro-industrial production:** manufacture of bio-jewellery and artisanal ceramics, food processing (fruit pulps, jams, compotes, liqueurs, propolis, vegetables, cassava derivatives) and production of herbal medicine and personal hygiene items (soaps, moisturizers, herbal and aromatic essences and creams), with raw materials sourced from small-scale natural resources.

These practices reveal not only strategies for economic survival, but also the use of traditional knowledge, forms of productive resistance and appreciation of local biodiversity. The multiplicity of initiatives reflects the adaptive capacity and leadership of women in the socio-economic dynamics of their territories.

The productive activities carried out by women take place in various territorial spaces, highlighting the plurality of land and community arrangements. They are predominantly implemented in their family units, in areas of collective use by communities, on land belonging to close relatives (such as parents and in-laws), and in private spaces belonging to third parties, and/or public areas. This diversity of locations reveals both strategies for accessing land and collaborative dynamics that sustain productive practices in rural areas (Figure 5).

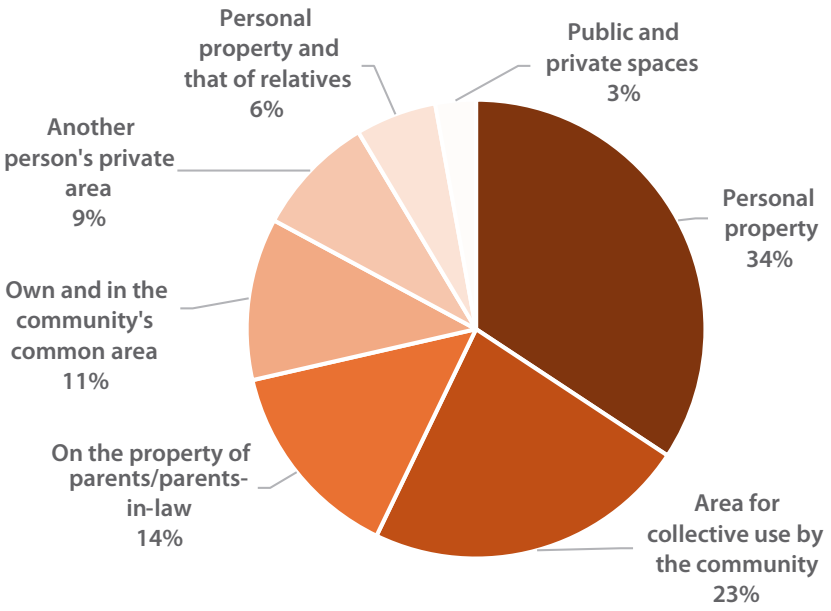

Figure 5. Areas where women's productive activities are implemented (2025)

This context highlights the need for agrarian reform as a public policy to democratize access to land and increase women's productive autonomy. The existence of areas exclusively for women – even if in partnership or as shared use – favours processes of economic emancipation, strengthening of territorial identities and expansion of food sovereignty.

The productive activities carried out by women occur in a wide variety of agro-ecosystems, such as dry land, floodplains, *igapó* (flooded forests) and mangroves. These environments are home to different types of vegetation, including primary forests, secondary forests, degraded areas in the process of recovery, pastures, mangroves and agroforestry systems. This ecological diversity highlights women's deep knowledge of the land and their ability to adapt productive practices to local contexts. In addition to their biological and socio-cultural richness, these agro-ecosystems are highly sensitive to climate change, especially mangroves, igapós, and wetlands near rivers, streams and springs. These territories face pressures such as salinization, flooding, erosion, water scarcity and loss of vegetation cover. Women's work in these spaces reveals not only technical skills in sustainable management, but also resilience strategies that contribute to environmental regeneration and the protection of common goods.

3 Results

3.1 Climate events faced by rural women

In recent years, women in Pará have experienced an intensification of extreme weather events in their territories. Prolonged periods of drought, rising average temperatures, a significant reduction in rainfall, less intense precipitation and sudden floods were the events most frequently cited by them. These phenomena degrade forests, change rainfall patterns, alter plant physiology, compromise agricultural systems, destroy basic infrastructure, disrupt social support networks and overload health services.

Such events are linked to anthropogenic factors (Figure 6), deforestation, burning, soil contamination (by pesticides), water contamination (by mercury and ship oils), predatory exploitation of natural resources and expansion of monocultures. In addition, these items, plus the implementation of large projects – such as hydroelectric plants – significantly alter local socio-environmental dynamics, as does the increase in greenhouse gas emissions that are related to the fossil fuel-based energy system.

The analysis shows that the impacts of climate change on rural women's productive practices and living conditions manifest themselves in multifaceted ways, encompassing productive, environmental and socio-economic aspects.

From an environmental perspective, women in rural areas have observed an intensification of impacts that directly compromise their productive practices and ways of life. The growing proliferation of pests and diseases in crops and livestock has become recurrent, requiring greater effort and more resources from women to maintain production.

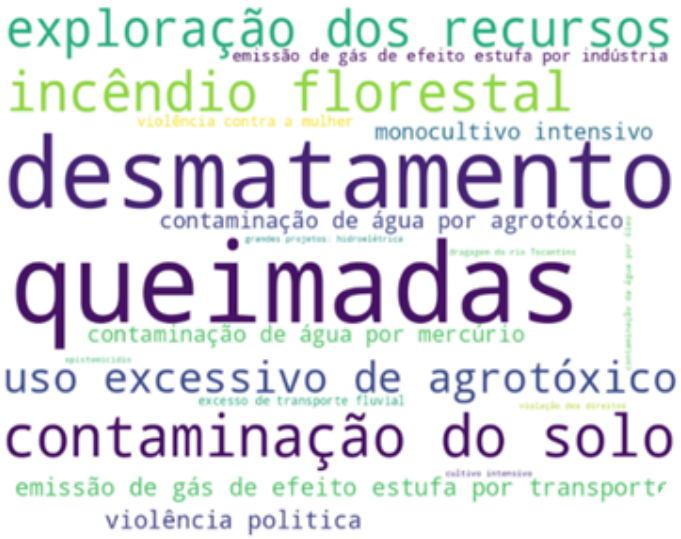

Figure 6. Word clouds on the causes and effects of climate events (2025)

Changes in rainfall patterns have destabilized traditional women's practices, compromising the predictability of harvests (e.g., açaí), which are often lost due to prolonged droughts or sudden floods. The loss, aging and devaluation of native seeds, in addition to reducing the raw material for their handicrafts, are causing genetic impoverishment, but also the erosion of ancestral knowledge that sustains family farming.

The significant reduction in fish stocks and the scarcity of shellfish, such as crabs, highlight the collapse of food systems based on local biodiversity. The disappearance of pollinators due to changes in seasonality and the shortening of seasons are also aggravating ecological imbalances, directly affecting agricultural productivity and ecosystem regeneration.

In the context of livestock farming, women report a decrease in the body weight of poultry and an increase in animal mortality, reflecting changes in temperature, food availability and water quality. Warming waters, prolonged absence of rainfall, and silting of rivers and streams have compromised hydrological cycles and the supply of essential water resources, deepening the socio-environmental vulnerability of communities.

From a socio-economic and productive standpoint, participants highlight a scenario of intense transformations that directly impact the communities' ways of life and livelihoods. The disappearance of traditional crops and the reduction of cultivated areas reveal a process of cultural and territorial erosion.

The loss of raw materials and biodiversity, with the disappearance of native species, compromises not only environmental sustainability but also the local productive base.

Water scarcity and reduced harvests intensify food insecurity, while the decline in production for self-consumption and commercialization aggravates the economic vulnerability of families.

Added to this are logistical precariousness and increased physical and emotional effort to maintain productive practices, creating a situation of structural fragility that requires attention and integrated public policies.

3.1.1 Analysis of these effects by geographic region

The climatic effects reported by women were also analysed by geographic region in order to identify particularities in the discourses. The number of women per mesoregion and the total number of effects reported are shown in Table 1. Although the number of women was higher in the Northeast region of Pará (29), the only representative from the Southwest region contributed 8 effects (Figure 7). Therefore, to understand the frequency of the effects cited by women, the weighted average per woman was calculated, and the average per mesoregion was found to be: 2.5 (Northeast) and 8 (Southwest). It is also worth noting that in Marajó there was little variation in the effects cited by women (7.4).

Table 1. Number of women per mesoregion and total effects reported

Regions	Total Effects	Total Women	Effects/Woman
Lower Amazon	23	4	5.75
Marajó	67	9	7.44
Northeast Pará	74	29	2.55
Belém Metropolitan Region	10	5	2
Southeastern Pará	22	5	4.4
Southwest Pará	8	1	8

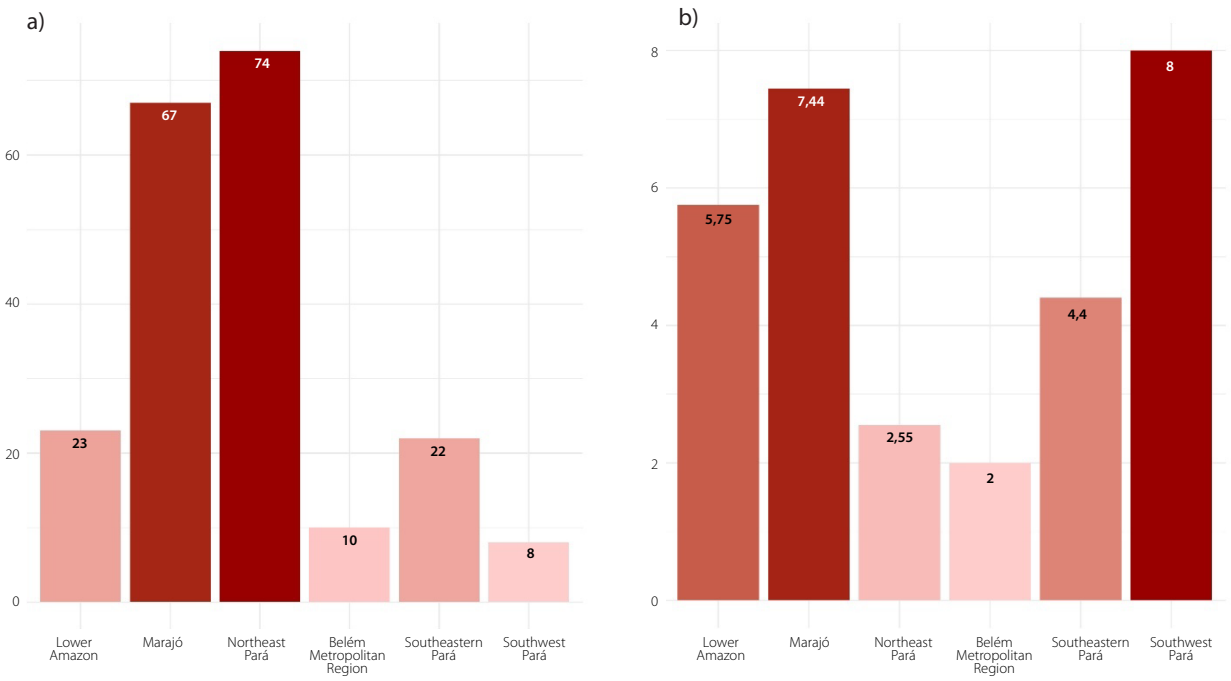

Figure 7. Frequency of effects by geographic region with and without weighting

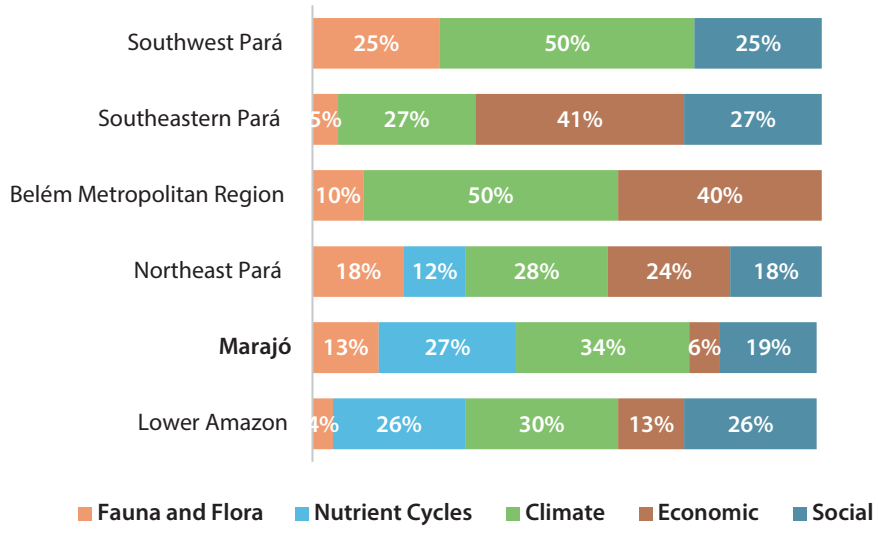

Figure 8. Relative distribution of observed effects by category and geographic region

Figure 8 shows the relative distribution of the effects observed in five categories (Fauna and Flora, Climate, Economic, Natural and Production Cycles, Social) by geographic region. Here, Fauna and Flora reflect the effects on biodiversity; Climate shows effects on a global scale; Economic shows interference with family income; Natural and Production Cycles are effects that produce changes in the production system and changes in the quality of raw materials; And Social represents consequences that generate changes in social, psychological, moral, educational and migratory elements.

The effects on climate were cited in all mesoregions in high proportions (>40%), except for Southeast Pará, which showed greater effects on the N and P cycles (41%). This corroborates the characteristics of this landscape, which has high rates of burning, reduced rainfall, and expansion of agriculture and livestock farming. Another factor observed was the loss of biodiversity related to fauna and flora, cited by all regions except Belém metropolitan region, and its impact on the economic sector. In the Lower Amazon, for example, the economic effects are noticeable in income (26%), due to the decrease in the supply of fish, seeds and pollinators for honey production, and difficulties in investing in other productive activities. In Marajó, of the 67 effects mentioned by the 9 women, 13% were social effects and only 6% were N and P cycles. This shows that the effects on the economy may be directly associated with social factors such as rural exodus, epistemicide and disease, and not necessarily with production cycles.

3.2 Women's vulnerability to climate change

Recurring extreme weather events in the Amazon, such as floods, rising temperatures, prolonged droughts and forest fires, have had a substantial impact on the living and working conditions of rural women. These phenomena not only compromise traditional production systems but also intensify gender inequalities, highlighting a disproportionate relationship between environmental effects and the most vulnerable groups. Women pointed to reduced family income as one of the main factors generating economic instability, social vulnerability, food insecurity and the perpetuation of extreme poverty. This instability triggers processes of reorganization of productive activities and intensifies financial losses, including the loss of local customers.

Women highlighted the loss of vegetation cover, which reduced the availability of firewood, fruits and medicinal plants, where these are essential resources for traditionally female activities, such as gathering native fruits and managing small agroforestry plots. They also mentioned the destruction of flowers and non-timber forest products, the emergence of pests and diseases, the loss of seeds, and the decline in productivity with the disappearance of native species. These impacts compromise not only the supply of raw materials for rural women's productive activities, but also the food security of families and the socio-cultural practices that sustain local ways of life.

Other effects include the devaluation of native seeds due to their low quality and reduced working hours due to extreme heat, which makes it difficult to work in the fields during the hottest part of the day.

The degradation of natural resources also increases the workload of women, who must travel longer distances in search of water, firewood and food. Exposure to fires increases physical exhaustion and reduces the time available for education, community participation and paid activities. The reports point to significant implications for public health. Changes in the nutritional composition of food, an increase in the incidence of diseases such as malaria and a rise in infant mortality rates were mentioned, with a reduction in life expectancy in the affected communities.

From the perspective of female mobility, lower river levels caused by drought directly impact river transport, hindering the navigation of ferries and boats, resulting in periods of temporary isolation, rural exodus and migration to urban centres. Water transport logistics are severely impaired, compromising supply, production distribution, and access to markets and basic services, imposing logistical challenges that further aggravate the situational vulnerability.

Reduced water availability also compromises subsistence crops and small animal husbandry managed by women, leading to decreased dietary diversity and greater food insecurity. At the same time, water scarcity impacts women's mental health and physical integrity through psychosocial stress and gender-based violence. The culturally assigned responsibility of ensuring domestic water supply precipitates high levels of anxiety and depression when reserves run out, especially in female-headed households that lack male support to share tasks (Losekann et al. 2025).

Water scarcity also impacts cultural and spiritual practices. Among Amazonian Indigenous Peoples, the lack of fresh water for rituals and traditional food preparation threatens collective identities and increases psychological stress among women (Ravera et al. 2016).

The additional risk faced by female environmental defenders was also highlighted as a vulnerability. By leading the protection of territories against deforestation and burning, they become targets of threats, physical violence, murder and judicial harassment, in a combination of environmental and socio-political risks that reinforces the intersectional nature of women's vulnerability to forest fires.

The data show that the effects of climate change in the region not only compromise productive activities and threaten the food and water security of communities, but also jeopardize the way of life, traditional knowledge and autonomy of rural women. Given this scenario, it is urgent to implement integrated and intersectoral public policies based on gender, territory and climate justice. In addition, private sector programmes and investments can play a strategic role in accelerating the support and transformations necessary to empower rural women.

3.3 Resilience practices of rural women

Women reported various strategic practices being implemented in pursuit of resilience in the face of climate change. These strategies encompass reconciling sustainability, traditional knowledge and innovation. From a socio-economic perspective, the transition from subsistence agriculture to diversified market-oriented production has established itself as an essential adaptive strategy in the face of socio-environmental challenges. Rural women, historically linked to family farming, have been taking on an increasingly active role in adopting innovative practices that add value to production and strengthen the economic resilience of communities (Table 2).

Table 2. Productive practices carried out by rural women in Pará

Practices	Descriptions
Agro-ecological production	• Production of organic insecticides • Beekeeping in forest areas for pollination and environmental recovery • Implementation of agroforestry systems and fish farming • Establishment of productive backyards and fields without burning, with guidance, to prevent fires • Use of biofertilizers and resilient plant species • Use of gliricidia (*Gliricidia sepium*) and other plants for shade, ground cover and biomass production • Shading and vegetation cover for cocoa cultivation • Reuse of water from other activities and storage of rainwater • Reforestation and organic fertilization • Hydroponics with homemade resources • Agroforestry management and planting of species adapted to climate change • Combating predatory extractivism, such as crab harvesting during the closed season • Productive exchanges, such as trading crabs for fish
Strengthening traditional productive activities	• Encouraging artisanal fishing and family farming • Installation of cold storage rooms for food storage • Use of cisterns to ensure access to water during periods of scarcity

continue to the next page

Table 2. Continued

Practices	Descriptions
Solidarity-based marketing and community integration	• Exchanges and sales between neighbouring communities • Participation in short marketing circuits and local events • Adaptation to ecotourism as an alternative source of income
Water resource management and adaptation to climate change	• Purchase of products in other regions as a supply strategy • Collection of water from distant rivers using hoses • Rainwater storage and reuse of water from other activities
Economic diversification and income generation	• Replacement of productive activities with alternatives such as informal trade or access to social programmes • Change of activity, such as selling clothes or other products
Strategic use of technology and knowledge	• Access to information through digital tools • Exchange of knowledge and replication of good practices between communities • Seeking training and technical knowledge, especially for young people
Political and environmental engagement	• Active participation in environmental councils • Organization of community events • Establishment of partnerships for forest recovery, enrichment of secondary forests and resistance to the actions of large businesses

These actions demonstrate how women are leading processes of social and economic transformation, and promoting sustainability, autonomy and climate justice in their territories (Mello,2025).

3.4 Barriers to women's resilience in the face of climate change

Women face multiple barriers in various areas that compromise their full participation in society and their ability to address climate challenges.

From an organizational perspective, women's resilience to climate crises is affected by several factors that limit their effective participation in decision-making and public policy formulation processes. The low representation of women in governance bodies, combined with the scarcity of technical support mechanisms, compromises the formulation of inclusive policies, just as the limited dissemination of public notices and opportunities compromises access to resources and training programmes. In addition, the weakening of social organizations and the absence of collaborative networks hinder collective articulation, especially in contexts marked by a reduction in active leadership and low generational renewal. The lack of access to institutional spaces dedicated to climate debate, coupled with limited government transparency and low levels of structured political support, restrict the incorporation of gender perspectives into adaptation strategies. The scarcity of initiatives aimed at generating decent work and technical training on climate change creates an organizational environment that is not conducive to strengthening women's resilience.

On the economic front, women highlight a number of structural barriers that limit their autonomy and ability to cope with crises. Inefficient and bureaucratic public policies hinder women's and young people's access to productive inclusion and social protection programmes. The persistent devaluation of women's work, combined with wage inequality, perpetuate precariousness and restrict capital accumulation and financial security, especially in rural and coastal areas, where family farming lacks

direct support. Here, workers such as fisherwomen and shellfish gatherers remain unprotected by the absence of unemployment insurance, exposing rural and coastal workers to cycles of vulnerability. The lack of a state climate plan with a gender perspective and insufficient budget to address environmental impacts further aggravate this scenario, especially given the scarcity of accessible credit, which prevents investment in adaptation and innovation. These economic barriers not only limit women's leadership but also weaken the collective capacity to respond to climate change.

From a structural point of view, there is a lack of formal recognition of women's professional activities in the sectors of agriculture, extractivism, agroforestry systems and fishing, which contributes to their marginalization in public policies and rural development programmes. This gap is exacerbated by the difficulty of accessing specific credit, comprehensive health services, including mental health care, and land regularization, especially among traditional peoples and communities. Digital and linguistic exclusion represents an additional obstacle, limiting rural women's access to adaptive technologies and relevant climate information. At the political–institutional level, factors such as climate denialism, low female representation in councils and decision-making bodies, persistent gender stereotypes, structural violence and the discontinuity of public policies, compromise the effective inclusion of women in climate change planning and response processes, perpetuating their socio-economic vulnerability.

Socio-cultural factors also play a central role in limiting women's resilience. Traditional knowledge and occupations such as crab picking remain undervalued and are without formal recognition in social security, restricting the labour protection of these workers. The lack of technical assistance, care policies and adequate public transportation, coupled with the incidence of prejudice, environmental racism, religious violence and harassment, compromise the well-being and safety of women in their territories. The fragility of social organizations and the lack of affirmative action, such as specific quotas for women in access to higher education in programmes focused on the countryside, limit educational training and political participation.

In the family context, women face maternal overload, socio-emotional abandonment, resistance to the adoption of agro-ecological practices, lack of support from partners and lack of incentives for rural succession. Solo motherhood, external demands and the sexual division of labour impose a disproportionate burden on women, aggravated by extreme weather events that disrupt essential services and intensify so-called 'time poverty', restricting their participation in training and decision-making processes.

4 Recommendations

The following recommendations derive both from the challenges mapped out above and from the concrete experiences of resilience built by rural women, serving as a guide for public policies, government programmes and community strengthening initiatives.

1. Strengthen local knowledge and community education

- Expand training programmes such as the Sustainable Amazonian Leaders (LIAS) Program,[5] which train women in public policy, climate change and communication, increasing the presence of women in environmental decision-making bodies.
- Integrate content and teaching methods adapted to women's realities, such as in the Proteger Program, encouraging the adoption of sustainable management practices, vegetable gardens and rational use of water resources.
- Promote the intergenerational multiplication of knowledge, encouraging experienced women farmers to share strategies with young rural people and new leaders, strengthening community networks and local resilience.

2. Implement adaptive social technologies and resilient infrastructure

- Invest in the implementation of cisterns, community gardens and sustainable irrigation systems, promoting water and food security in the face of extreme weather events.
- Implement diversified agro-ecological systems that are more resistant to drought, soil salinization and erosion.
- Support women's associations and cooperatives in accessing low-cost technologies and adding value to local production chains, valuing extractive and agricultural knowledge.
- Facilitate access to credit and specific government incentives for the acquisition of these technologies and essential infrastructure.

3. Promote inclusive governance and gender-sensitive public policies

- Include rural women in policy decisions on climate, land and production, guaranteeing seats on management councils and environmental planning forums.
- Finance integrated community projects, such as Marajó Resiliente, which combine climate adaptation, health, food security and productive organization.
- Create government incentives – green credit lines, targeted technical assistance, and exclusive calls for proposals – for innovative practices led by rural women.
- Integrate public policies on social protection, health, education and combating violence with climate adaptation and mitigation agendas.

4. Foster communication, visibility and autonomy

- Promote awareness campaigns on the importance of climate resilience led by women, highlighting their solutions and experiences in local and national media.
- Support the production of audiovisual content, podcasts, articles and other informational materials by women, strengthening their visibility and advocacy capacity.
- Encourage networking and the exchange of experiences among groups of women farmers, extractivists, riverine communities and traditional communities.

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5 Promoted by Imazon, the Amazon Institute of Man and Environment. The initiative is aimed at specialists over 30 years of age with at least 5 years of professional experience who have lived in Pará for a decade or more. Launched in 2024, the programme involves classes on climate change, the Amazon, public policies in the executive and legislative branches, women's participation in public debate, relations with the press and digital content production (Imazon n.d.).

5. Expand climate finance and encourage female leadership

- Create and expand funds to support technological innovations, dedicated especially to projects and initiatives led by women.
- Encourage the training of women leaders in public policy, innovation, *advocacy*, communication and the protection of environmental defenders, following the example of the LIAS Program.

6. Guarantee access to rights and essential services

- Expand access to comprehensive healthcare, land regularization and digital inclusion for rural women, overcoming structural barriers that perpetuate gender inequalities.
- Implement specific unemployment insurance policies for rural and coastal women workers, protecting them from climate shocks.
- Adopt quotas for women in rural extension programmes, land regularization and agricultural credit.

7. Strengthen economic autonomy and fair value chains

- Create solidarity-based marketing mechanisms, such as community fairs and short supply chains that reduce intermediaries.
- Expand women's participation in the Food Acquisition Program (PAA) and National School Feeding Program (PNAE).
- Encourage participatory certifications and fair-trade labels with a gender focus, valuing women's work in the production of açaí, nuts, cocoa, vegetable oils, handicrafts, etc.
- Invest in training for the management of women's cooperatives.

5 Final considerations

This study highlighted the central role of women in the Brazilian Amazon as protagonists in the daily struggles against the climate crisis. The analysis of the challenges faced by Indigenous Peoples, quilombolas, extractivists, women farmers and riverine communities exposed not only the multiple vulnerabilities to which they are subject, marked by work overload, isolation, and difficulty in accessing public policies and resources, but also, and above all, highlighted their remarkable capacity for resistance, social innovation and the creation of adaptive solutions in territories rooted in local knowledge.

The experience of Amazonian women demonstrates that climate change adaptation and mitigation strategies are inseparable from gender justice. The valorization of traditional knowledge, the formation of solidarity networks, community leadership, agro-ecological practices, and the proposal of new forms of social organization constitute repertoires of resilience that transcend the response to the climate emergency, pointing to the construction of more sustainable, equitable and territorially rooted ways of life.

However, structural challenges remain that require urgent and coordinated action: the exclusion of women from decision-making spaces, restricted access to green credit and technologies, and the invisibility of their productive and caregiving roles. Such obstacles will not be overcome by palliative measures, but require intersectoral, democratic public policies committed to transforming historical inequalities.

This study also sought to demonstrate, through concrete examples and practices already underway in Pará, that transformation is possible when it respects local realities, values listening to those who feel the effects of climate change most acutely and invests in strengthening women's autonomy. There are countless inspiring initiatives – from political training to social technologies, from agro-ecology to the protection of environmental defenders – that can be expanded, replicated and reinvented in different parts of the country.

Researchers are encouraged to adopt participatory methodologies that recognize women as producers of knowledge and agents of change. Rural extension workers are encouraged to act with empathy and creativity, ensuring that each technical action is also a gesture of affirmation of women's rights and knowledge. To rural women themselves, this analysis recognizes and reveres the leading role they play on a daily basis, bringing their voices as a legitimate source of inspiration for a more humane, inclusive science and extension that is connected to contemporary challenges.

Finally, to government officials and public policy makers, this message: ***there is no climate justice without gender justice***. May every piece of legislation, incentive, funding and decision place women from the countryside, the forest and the waters at the centre of adaptation and resilience strategies. It is urgent to increase investment in education, health, agro-ecology, governance and the protection of rights, recognizing that without autonomous and organized women, no model of territorial development will be environmentally sustainable or socially just.

References

Andrijevic M et al., 2025. Representing gender inequality in scenarios improves understanding of climate challenges. *Nat. Clim. Chang.* , 138–146 (2025). https://doi.org/10.1038/s41558-024-02242-5

Santos, A. et al. 2019. Rede jirau de agroecologia: uma inovação estratégica para mobilização social no Baixo Tocantins. Revista Tecnologia e Sociedade. 15. DOI:10.3895/rts.v15n38.8900 Revista Tecnologia e Sociedade

Brasil Escola. n.d. Quilombolas. Accessed 3 October 2025. https://brasilescola.uol.com.br/sociologia/quilombolas.htm

Creswell JW et al., 2018. Designing and conducting mixed methods research. 3rd edition. Thousand Oaks, CA: SAGE Publications, Inc. https://www.scirp.org/reference/referencespapers?referenceid=2697821

Danilenko D et al., 2024. Women are under-represented in adaptation policy research and are more likely to emphasise justice topics. Global Environmental Change 83:102700. https://iopscience.iop.org/article/10.1088/2752-5295/ad6f3b/meta

FAO and CIFOR (Food and Agriculture Organization of the United Nations and Center for International Forestry Research). 2019. FAO Framework methodology for climate change vulnerability assessments of forests and forest dependent people. Rome: FAO. https://openknowledge.fao.org/server/api/core/bitstreams/ab0dfffe-9f36-4a4e-9bb7-efa72d236622/content

Favilla V. 2006. *Gender assessment report of the PPG7 Pilot Program – Protect and ProVárzea*. Brasília: Ministério do Meio Ambiente Programa de Proteção das Florestas Tropicais do Brasil (MMA/PPG7).

Guest G et al.2017. How many focus groups are enough? Building an evidence base for nonprobability sample sizes Field Methods 29: pp. 3–22. https://doi.org/10.1177%2F1525822X16639015 https://www.researchgate.net/publication/301719869_How_Many_Focus_Groups_Are_Enough_Building_an_Evidence_Base_for_Nonprobability_Sample_Sizes

IBGE (Brazilian Institute of Geography and Statistics) 2017. Regional divisions of Brazil. Rio de Janeiro, Brazil: IBGE. Accessed 3 October 2025. https://www.ibge.gov.br/geociencias/cartas-e-mapas/redes-geograficas/15778-divisoes-regionais-do-brasil.html

Imazon. n.d. Women leaders in Pará to broaden debate on climate change, gender, and territory. Belém, Brazil: Imazon. Accessed 3 October 2024. https://imazon.org.br/imprensa/mulheres-lideres-do-para-ampliarao-debate-sobre-mudancas-climaticas-genero-e-territorio/

James R. et al. 2021. Conservation and natural resource management: where are all the women? Oryx 55(6):860–867. https://doi.org/10.1017/S0030605320001349

https://www.cambridge.org/core/journals/oryx/article/conservation-and-natural-resource-management-where-are-all-the-women/D6C52EA0E86D4CCD139AF02663DC9C97

Losekann R. 2010. *Being a poor female head of household: Challenges, achievements, and difficulties*. [PhD thesis]. Universidade Federal do Rio de Janeiro (UFRJ). https://minerva.ufrj.br/F/?func=direct&doc_number=000768128&local_base=UFR01

Mello, D. et al. 2025. Empowering women, enriching forests in the Amazon: The role of collective microenterprises. In: Rogelja, T. and Kroese, L. (Eds.). 2025 Women as stewards of forests. Tropical Forest. Issues 63, 2025 https://www.tropenbos.org/resources/tfi63-women-as stewards-of-forests/3-2-empowering-women-enriching forests-in-the-amazon-tfi63/

Peters SAE et al.2024. Effects of environmental change on health and the critical need for sex- and gender-disaggregated data. *npj Womens Health* **2**, 27 (2024). https://doi.org/10.1038/s44294-024-00029-9. https://www.nature.com/articles/s44294-024-00029-9

Roy J. et al. 2022. Synergies and trade-offs between climate change adaptation options and gender equality: A review. Global Environmental Change 72:102367. https://doi.org/10.1057/s41599-022-01266-6

Reed M, et al. 2013. Combining analytical frameworks to assess livelihood vulnerability to climate change and analyze adaptation options. Ecological Economics 94:66–77. https://doi.org/10.1016/j.ecolecon.2013.07.007

Schmink M et al. 2015. *Under the canopy: Gender and forest governance in the Amazon*. Bogor, Indonesia: Center for International Forestry Research (CIFOR). https://www.cifor-icraf.org/knowledge/publication/5505/

Sinalo X et al., 2025, April 29. The interplay of climate change, food security and women land ownership. 43rd PARIS International Conference on "Agricultural, Biological and Environmental Sciences" (PABES-25) 29 April to 1 May 2025 https://www.researchgate.net/publication/391765504_The_Interplay_of_Climate_Change_Food_Security_and_Women_Land_Ownership

Sorge J et al., 2025.. Piangüeras: Guardians of the mangrove in the Colombian Pacific. In: Rogelja, T. and Kroese, L. (Eds.). 2025 Women as stewards of forests. Tropical Forest. Issues 63 (pp. 3-10). Tropenbos International. https://www.tropenbos.org/app/data/uploads/sites/2/1.1-

UN Women. 2023a. Feminist climate justice: A framework for action. United Nations Entity for Gender Equality and the Empowerment of Women. https://www.unwomen.org/en/digital-library/publications/2023/11/feminist-climate-justice-a-framework-for-action

UN Women. 2023b. *Gendered Impacts of Climate Change - Women's Resilience to Disasters Concept Note (WRD)*. https://wrd.unwomen.org/practice/resources/womens-resilience-disasters-concept-note-0

UN Women. 2019. *Gender and age inequality of disaster risk*: Summary and policy recommendations. https://www.unwomen.org/sites/default/files/2021-11/Policy-brief-Gender-and-age-inequality-of-disaster-risk-en.pdf

UNICEF Brazil. 2022. Children, adolescents, and climate change in Brazil. United Nations Children's Fund. https://www.unicef.org/brazil/media/21346/file/criancas-adolescentes-e-mudancas-climaticas-brasil-2022.pdf

DOI: 10.17528/cifor-icraf/009402

In the Amazon, the effects of climate change have caused significant transformations in rural areas, altering ecological, economic and social dynamics. In this context, rural women face complex challenges in their productive activities, dealing with risks ranging from climate instability to exclusion from decision-making and planning processes. This research aimed to analyse the risks and impacts experienced by these women in their productive and economic contexts, as well as to understand the strategies that have been mobilised to increase their capacity for adaptation and resilience. The results highlight the leading role of Amazonian women in responding to the climate crisis, emphasising their resilience, social innovation and creation of adaptive solutions rooted in traditional knowledge. Indigenous women, *quilombolas*, extractivists, farmers and riverine women have developed resilient practices, despite structural vulnerabilities such as work overload, political exclusion and restricted access to resources. Based on concrete experiences in the state of Pará, Brazil, the study reinforces that climate justice is intrinsically linked to gender justice and proposes the formulation of intersectoral public policies and participatory methodologies that recognise women as central agents in the construction of sustainable and resilient territories.