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UNIVERSITÄT FÜR BODENKULTUR WIEN  
University of Natural Resources  
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# Master Thesis

## Gender vulnerability to climate change: a systematic review and insights of a Latin American case study

submitted by

Student LETICIA CAROLINA ZAVALA, BSc

in the framework of the international Master programme

**Environmental Sciences – Soil, Water and Biodiversity**

in partial fulfilment of the requirements for the academic degree

**Master of Science**

Vienna, March 2022

Co-Supervisor(s):

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## Affidavit

I hereby declare that I am the sole author of this work. No assistance other than that which is permitted has been used. Ideas and quotes taken directly or indirectly from other sources are identified as such.

This written work has not yet been submitted in any part.

I hereby confirm that I am familiar with the standards of Scientific Integrity and with the guidelines of Good Scientific Practice, and that this work fully complies with these standards and guidelines.

Copenhagen, 23.03.2022  
City, date

A handwritten signature in black ink that reads "Leticia Zavala". The script is cursive and elegant.

Leticia Carolina ZAVALA

## Acknowledgements

Firstly, i would like to express special thanks and gratitude to my supervisors, Doris Damyanovic, Anne Gravsholt Busck and. Maria Papathoma-Köhle for their help, inspiration, and guidance though all the process of this thesis, without their direction this research wouldn't have been possible. Secondly, i would also like to thank my parents, family, partner and friends who played a crucial role in inspiring me and supporting me through these last years, for their patience and love, thank you.

## Abstract

The impact of climate change is not gender-neutral; it affects genders differently due to socially constructed gender roles. Gender inequality is argued to exacerbate women vulnerability under climate change due to the unequal distribution of rights, power, opportunities, and resources. This research aims to further understand vulnerability to climate change in urban areas of the Global South with an intersectional gender perspective and to answer two research questions: “what factors are associated with gender vulnerability to climate change in urban environments in the Global South” and “how does gender vulnerability is experienced in Latin America.” The method applied is the triangulation of literature review from the Global South with questionnaires and semi-structured interviews from a representative case study of Latin America, namely, the mega city of Buenos Aires, Argentina. The analysis of the three data sources is organized in five thematic topics: “gender roles”, “lack of participation”, “gender violence”, “inequality” and “empowerment”. Findings of this thesis suggest that these factors are associated with gender vulnerability to climate change in the Latin America and the Global South. Moreover, there is a prominence of the “gender role” factor in Global South as in Latin America, suggesting similarities in this aspect. Also, in Latin America the positive influence of “empowerment” is prominent as the negative influence of “lack of participation”. Furthermore, another finding is the low amount of literature on this subject in the Global South and in Latin America. This suggests a need for further research due to the relevance of the topic for urban environments in the context of climate change.

## Kurzfassung

Die Auswirkungen der Klimakrise sind nicht geschlechtsneutral, sondern betreffen die Geschlechter aufgrund der gängigen Geschlechterrollen und der ungleichen Verteilung von Macht, Rechten, Teilhabe und Zugang zu Ressourcen unterschiedlich. Diese Ungleichheit verschärft die Vulnerabilität von Frauen in Bezug zu den Klimafolgen.

Diese Forschung aus einer intersektionalen Gender-Perspektive zielt darauf ab, die Vulnerabilität in städtischen Gebieten des globalen Südens besser zu verstehen und anhand von zwei Forschungsfragen zu beantworten: "Welche Faktoren sind mit der geschlechtsspezifischen Vulnerabilität bezogen auf den Klimawandel in Städten des globalen Südens relevant?" „Wie wird mit dieser geschlechtsspezifischen Vulnerabilität umgegangen bzw. gelebt?"

Der methodische Zugang beruht auf einer Triangulation von Literaturrecherche, Befragungen und Interviews anhand der Fallstudie Buenos Aires, Argentinien.

Die Analyse der Daten untergliedert sich in fünf Themenschwerpunkte: "Geschlechterrollen", "mangelnde Beteiligung", "geschlechtsspezifische Gewalt", "Ungleichheit" und "Empowerment". Die Ergebnisse dieser Arbeit deuten darauf hin, dass diese fünf Faktoren die Vulnerabilität von Frauen bezogen auf den Klimawandel in Lateinamerika und generell im globalen Süden beeinflussen. Darüber hinaus ist der Faktor "Geschlechterrolle" generell im globalen Süden stärker ausgeprägt als in den Ländern Lateinamerikas. Auch ist in Lateinamerika der positive Einfluss von "Empowerment" stärker ausgeprägt als der negative Einfluss von "mangelnder Beteiligung".

Ein weiteres Ergebnis dieser Untersuchung ist die geringe Anzahl von Publikationen zu diesem Thema im globalen Süden und in Lateinamerika. Dies deutet darauf hin, dass aufgrund der Relevanz des Themas für eine klimaangepasste Entwicklung von urbanen Regionen weiterer Forschungsbedarf besteht.

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## 1. Introduction

### 1.1. Relevance of the study

Climate change does not affect people's safety, security, health, and well-being in the same way. The IPCC projects that climate change will have a different impact between regions, generations, classes, income groups, and genders, leaving the poor as the most affected (IPCC, 2014a; World Bank, 2010). Moreover, urban populations are growing and projected to increase from 53% to 70% by 2050 (IDMC and NRC, 2014; UNISDR, 2014). Moreover, it is estimated that approximately one billion people are currently living in slums (Lall and Deichmann, 2012). Challenges already present as a result of socioeconomic inequalities are likely to increase due to unplanned development, environmental degradation, and precarious livelihoods (Gutierrez and Gibbons, 2020). Vulnerability to climate change intersects with existing vulnerabilities and inequalities, generating even worse impacts on the most exposed populations (Allen et al., 2018) having a differential impact in the Global South (Owusu et al., 2019a). For example, women experience the impacts differently than men (Dube, 2014; IPCC, 2014b; UNFCCC, 2019a) and are among the most vulnerable to climate change due to gender roles socially constructed (Dube, 2014).

To reduce these vulnerabilities to climate change it is essential first to recognize how this unequal access to resources, rights, and services makes women more vulnerable. However, it is also critical to move beyond and consider their capacity as change agents (Goodrich et al., 2019; Hanson, 2016; IUCN, 2021; Ramirez, 2016; Tanjeela and Rutherford, 2018).

Gender equality and the participation of women are recognized as essential for the effective action against climate change by the United Nations Framework Convention on Climate Change (UNFCCC) in different decisions that include the Lima Work Programme on gender and the Gender Action Plan. Moreover, the Paris Agreement encourages countries to have gender equality and women's empowerment in their nationally determined contributions (NDC).

This research will follow vulnerability to climate change with a gender lens, analyze the factors that influence vulnerability in the urban context in the Global South, using Latin America and specifically Buenos Aires as case study.

### 1.2. Structure of the thesis

This thesis is divided into six chapters. The introductory section (Section 1) is divided into four sub-sections: the first one presents the structure, the second one the importance and relevance of this study, the third focuses on the subject and objective of the research, and the fourth describes the hypothesis and research questions.

The second chapter introduces the theoretical framework, divided into seven sections, presenting the concepts and variables that limit the scope of the analysis—facilitating the understanding of concepts with specified definitions that give the foundation to build into new knowledge.

The third chapter presents the methods applied in this study. In this chapter, there are different sections that present in detail the methodology for the literature review, surveys and questionnaires.

The fourth chapter focuses on the case study of the Global South, specifically on the city of Buenos Aires. The main section describes the characteristics of the area. It is divided into three subsections that set the context of the research area going through the socioeconomic context, the social vulnerability to natural hazards, the current climate, and the climate change projections.

The fifth chapter presents the description and analysis of the relevant data, presenting the results of the surveys, questionnaires and interviews. In this chapter, the thematic topics are presented and explained.

Finally, the sixth chapter focuses on the discussion and conclusion, presenting the limitations of the study and the ways forward.

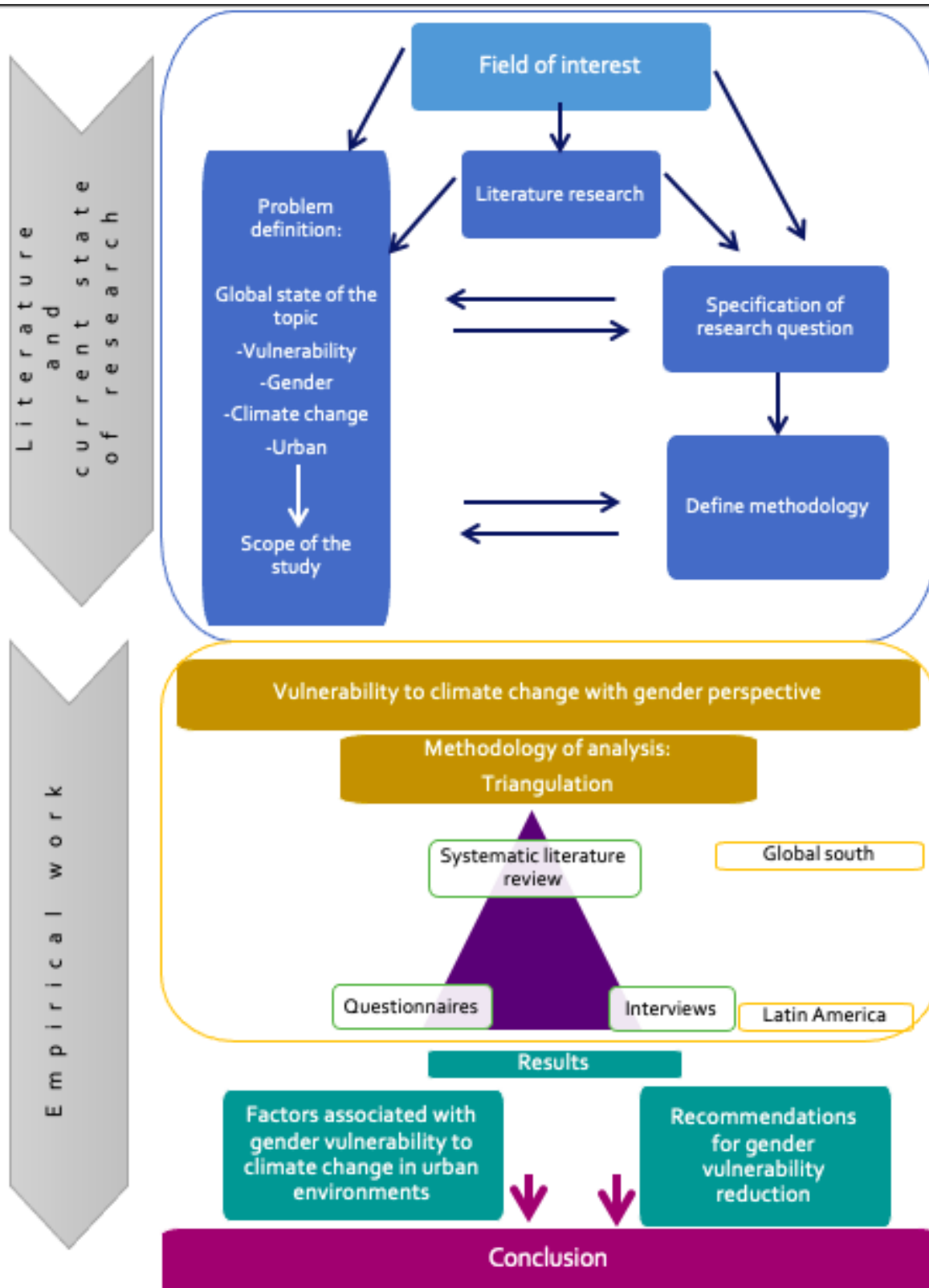


Figure 1 Steps followed in the thesis. Source: Zavala, 2021.

### 1.3. Focus and aim of the research.

Many researchers of different disciplines investigate the relationship between gender and climate change trying to answer questions such as: Does climate change impact women and men in the same way? How does gender intersect with race, ethnicity, and other aspects in a changing climate?

There are several empirical and theoretical studies on this topic in the literature, establishing an undeniable relationship between gender and climate change, especially related to vulnerability, impacts, and adaptation (IPCC, 2014b; IUCN, 2021).

Women are usually more vulnerable than men to environmental hazards and extreme weather events due to aspects related to gender roles in society, as mentioned before. On average, in the Global South, women are less educated, poorer, less mobile, and live longer than men (Nagel, 2015; Röhr et al., 2009). These factors influence their capacity to adapt and cope with climate change hazards.

Cities are becoming a relevant actor in the face of climate change since risks, impacts, and causes converge (UN-Habitat, 2020). The IPCC estimates that the urban agglomerations will be exposed to a rise in temperature over 1.5 C, over preindustrial levels in the middle of the century (Revi et al., 2014). Moreover, meteorological phenomena are estimated to increase in intensity and frequency, consequently raising the risk of mortality and morbidity of the population and material losses (IPCC, 2021). Cities are expanding in an unplanned and exponential way. Consequently, the rapid urbanization, lack of planning, and lack of affordable housing generate growth in informal settlements and vulnerable populations, especially in middle- and low-income countries in the Global South (UN-Habitat, 2020; UN-HABITAT, 2008).

Despite this, most of the research in gender and climate change adaptations has a focus on rural communities, leaving urban areas/communities without coverage (Owusu et al., 2019b).

From a gender perspective, this thesis analyzed the factors that influence the vulnerability of women to climate change, beyond the idea that vulnerability is passivity and weakness (IUCN, 2021).

The goal is to advance knowledge on vulnerability to climate change with a gender perspective in the urban environment of the Global South. A literature review on the topic provided a Global South perspective, and a case study analysis is complemented with surveys composed of questionnaires and interviews from relevant stakeholders from a megacity of the Global South.

### 1.4. Hypothesis and research questions

This thesis investigates the factors that influence vulnerability to climate change from a gender perspective. The research is based upon the following hypothesis that inspired the two research questions:

*Hypothesis: In the context of climate change, women are more vulnerable due to socioeconomic aspects and gender roles.*

For a better understanding of the vulnerability to climate change with a gender perspective, this thesis poses two *research questions*:

1. What factors are associated with gender vulnerability to climate change in urban environments of the Global South?
2. How does gender vulnerability is experienced in Latin America?

## 2. Theoretical framework

This section presents the theoretical framework and definitions used in this thesis, starting from the state of the art on climate change projections by the IPCC, continuing with definitions of vulnerability, gender and intersectionality that frame this research.

### 2.1. Climate change projections

Human activities have contributed to a rise in the temperature of the atmosphere, oceans, and land at a rate that has been unprecedented in the last 2000 years (IPCC, 2021). The IPCC report presents evidence that improves understanding this influence in detail.

A set of five new illustrative emission scenarios were presented in the IPCC Sixth Assessment Report (AR6) for the near-term (2021-2040), mid-term (2041-2060), and long-term (2081-2100) period relative to 1850-1900. The shared socioeconomic pathways show that global warming of 2°C will be exceeded during the 21st century under high and very high GHG emissions scenarios (Figure 2).

Scenario	Near term, 2021–2040		Mid-term, 2041–2060		Long term, 2081–2100	
	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)	Best estimate (°C)	Very likely range (°C)
<b>SSP1-1.9</b>	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
<b>SSP1-2.6</b>	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
<b>SSP2-4.5</b>	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
<b>SSP3-7.0</b>	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
<b>SSP5-8.5</b>	1.6	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7

Figure 2. Changes in global surface temperature, which are assessed based on multiple lines of evidence, for selected 20-year time periods and the five illustrative emissions scenarios considered Source:(IPCC, 2021)

Due to the intensification of global warming, the climate system has been showing changes that include an increase in the frequency and intensity of hot extremes, heavy precipitations, regional droughts, reductions in Arctic Sea ice, snow cover, and permafrost (IPCC, 2021). Moreover, the IPCC projects that the rising sea level, a consequence of the retreat of glaciers, melting of sea ice sheets, and thermal expansion of water, increases the risk for communities living in low-lying areas that will experience extreme sea levels around 2050 (IPCC, 2019a). The IPCC warns that this warming leads to increased climate-related hazards, such as storms, heatwaves, and wildfires, that are projected to increase intensity (IFRC, 2020; IPCC, 2021, 2019a, 2019b). As mentioned, climate change increases risks related to rising temperatures, storms, heatwaves, and the ferocity of extreme weather events that impacts vulnerable populations (idem). Moreover, EM-DAT (International Disaster Data Base) reports that in 2019 there were 308 disasters caused by natural hazards, and 77% of these disasters were climate or weather-related (IFRC, 2020). The number of events related to climate and weather hazards increased from 76% in 1960 to 83% in the past decade (2010-2019) (idem).

These climate-related disasters have killed more than 410,000 people in the ten years, with the majority coming from low to middle-income countries (idem). The EM-DAT identifies that heatwaves and storms have been the biggest killers; on the other hand, floods have been the

most frequent, since 1960, with a total of 4,435 and a steady proportional increase, with an annual average of 127 (IFRC, 2020).

## 2.2. Vulnerability

The importance of defining vulnerability is to give a frame to the research question since there are several definitions of vulnerability; the differences in meaning arise from different epistemological orientations and backgrounds (political ecology, human ecology, physical science, engineering and economics).

According to Cutter (1993):

*"Vulnerability is the likelihood that an individual or group will be exposed to and adversely affected by a hazard. It is the interaction of the hazards of place (risk and mitigation) with the social profile of communities".*

Blaikie et al. (1994), on the other hand, define vulnerability as:

*"The characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood are put at risk by a discrete and identifiable event in nature or society."*

The United Nations Office for Disaster Risk Reduction (UNISDR, 2009) defines vulnerability as:

*"The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard."*

This definition includes the physical, social, economic, and environmental factors that emphasize the susceptibility of a community to the effects of the hazard, including the socioeconomic and cultural dynamics that shape climate change impacts and adaptations (UNISDR, 2009).

Lastly, the definition by the IPCC (IPCC, 2014c) is:

*"The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. "*

Vulnerability could also be understood as a pre-existing condition (figure 3) (Joakim et al., 2015). Drawing upon this, this thesis conceives vulnerability as a condition already present before the hazard or stress occurs. It is understood as the result of socio-political and economic processes that generate different levels of capacity among individuals, groups, and communities to resist, respond, and recover from climate change stresses (Anderson and Woodrow, 1998; Blaikie et al., 1994; Cannon, 2000; Cutter, 1996; Hewitt, 1997).

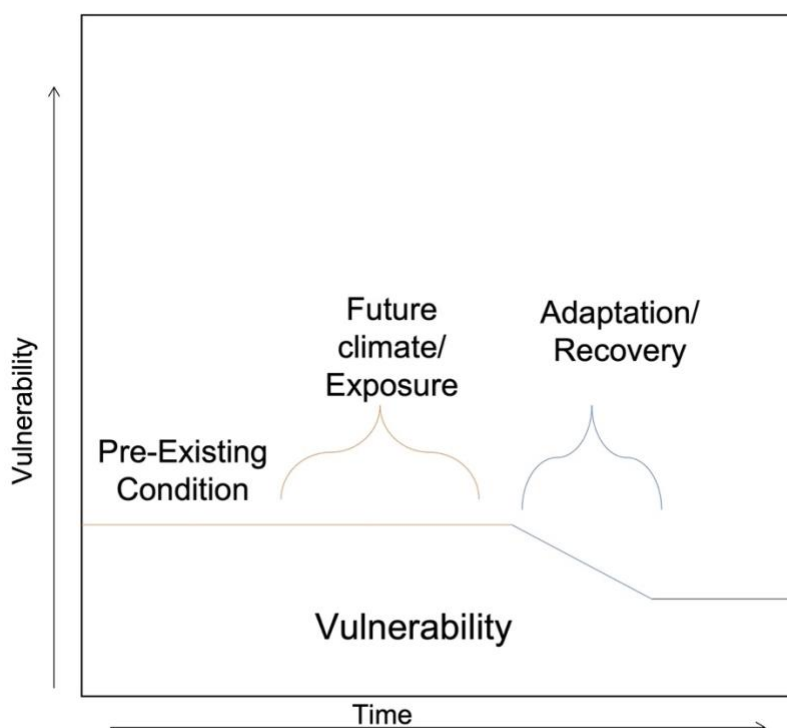


Figure 3 Vulnerability as a pre-existing condition. Source: Own adaptation from Joakim et al., 2015

It is relevant in the context of this analysis to define also social vulnerability that refers to “*the characteristics of a person or a community related to their capacity to anticipate, cope, resist and recover from the impact of a natural hazard*” (Wisner et al., 2004). Like resilience and adaptation, vulnerability is determined by multiple factors, a combination of biophysical and social factors that determined the predisposition to be affected (Burkett, 2014). Cutter and Emrich (2006), on the other hand, look to a broader societal driver:

*"The product of social inequalities' it is defined as the susceptibility of social groups to the impacts of hazards, as well as their resiliency or ability to recover from them adequately...susceptibility is not only a function of demographic characteristics ... but also more complex constructs such as health care provision, social capital and access to lifelines".*

As stated by the IPCC, differences in vulnerability and exposure result from non-climatic factors and multidimensional inequalities resulting from the unequal development process. Intersecting social processes result in unequal socioeconomic status, income, and exposure. Usually marginalized populations, socially, economically, culturally, politically, are the most vulnerable to climate change (IPCC, 2014c) In this sense, gender is a crucial determinant for vulnerability to climate change since it interacts with other socioeconomic variables producing different degrees of vulnerability for different genders (Djouidi et al., 2016; Van Aelst and Holvoet, 2016)

### 2.3. Gender and vulnerability to climate change

The term gender represents social roles, norms, identities, relations, responsibilities, and opportunities associated with being a man or a woman; this may change but exist in all societies (WHO, 2014). There must be a distinction between gender and sex since these concepts are not synonymous. Gender is a cultural construction, while sex is determined by biology (WHO, 2011a, p. 201).



Gender is a fundamental factor of vulnerability to climate change related to socioeconomic, institutional, and situational variables that create different degrees of vulnerability for diverse groups of men and women (Djoudi et al., 2016; Van Aelst and Holvoet, 2016).

Climate change is conceived to be a global problem but its impact is not gender-neutral; it affects women, men, boys, and girls in different ways, this is a result of socially constructed gender roles that influence how women and men experience the environment, and the way they relate to it (UNEP, 2016).

There is a long list of research studies that show that gender inequality exacerbates the vulnerability of women due to unequal distribution of rights, opportunities, resources, and power (Aguilar, 2009; Demetriades and Esplen, 2009; Levy, 2003; Oxfam, 2010; UN-Habitat, 2020) and to the triple role carried by women because of gender; reproductive, productive and community-managing activities. (Moser, 1995).

The gender gap between men and women, established by culture and society, is found in many spheres, including ownership, salary, access to labour markets, care responsibilities, decision making, power, education, just to mention a few (UNDP, 2020; UNEP, 2020). Consequently, it is recognized that climate change impacts women and men differently; women face the worst situations due to their restricted access to economic resources, education, and legal rights (UNEP, 2020).

Also, due to the socially constructed roles, men and women interact and relate differently with the environment (UNEP, 2020). There are inevitably different relations with natural resources, resulting in a different perception of natural hazards, resource degradation, and how climate change impacts genders. These different relationships result in an inevitable unlike perception over priorities and adequate interventions. It is argued that due to gender roles, men and women have different assessments to confront environmental issues and mitigate or find a solution (UNEP, 2020).

With an intersectional lens, this thesis focuses on urban poor women, recognized to be under disproportionate risk of the negative impacts of climate change (UN-Habitat, 2020). They reside in hazard-prone locations within cities, exposed to intense and frequent natural hazard events. Their houses, as we mentioned, are often inadequately constructed (UN-Habitat, 2020). Following the occurrence of a natural hazard, women struggle to rebuild their houses as they simultaneously bear the responsibilities of child-caring, household management, and income generation (triple burden) (Moser, 1995). Consequently, the roles linked with gender increase the weight over women in a climate change scenario due to the responsibilities mentioned (Hathaway, 2020).

However, it is essential to point out that even though most of the literature agrees that women are more vulnerable to the effects of climate change, it would be mistaken to consider them as passive agents since their role is crucial for adaptation and response in the climate crisis (Aguilar, 2009; Habtezion, 2016; Oxfam, 2010; Ramirez, 2016; Rodenberg, 2009).

Following the feminist political ecology, which argues that human/environment interactions are socially constructed and specific to historical context, rejecting the idea that women are biologically closer to nature (Jarosz, 2011). Women have crucial knowledge and skills for guiding the adaptation processes due to their role in society (productive, reproductive, and community) (Carvajal-Escobar et al., 2008). For example, there is extensive evidence that women play an essential role in dealing with disasters by successfully mobilizing communities in the different periods of risk management; therefore, their lack of participation would challenge the effectiveness of climate change programs.

Consequently, we do not consider women in a situation of vulnerability as designated "in need of protection," negating their capacity to act politically. Some visions tend to underestimate the political agency and resistance present in the so-called vulnerable populations (Butler et al., 2016).

## 2.4. Intersectionality

The origin of the feminist intersectional theory goes back to the United States of the 70s when the Black feminist and the Chicano movement made visible the effects of the coexistent discrimination around race, gender, and social class (Almendra, 2015). The term was coined by Kimberlee Crenshaw (1989) to defend Black women's rights; Crenshaw critiqued the tendency of considering gender and race as excluding categories and argued the need to assume heterogeneity inside groups to stop the reinforcement of subordination by gender and race.

There are multiple definitions of intersectionality. Nevertheless, there is a common ground between the different definitions: the limitation supposes treating gender as an unique category of oppression (Galindo et al., 2014). The intersectional approach argues that exhibiting domination only by gender, excluding other factors that co-exist (class, race, sexuality, and others.), would mean reinforcing the logic of oppression.

Patricia Hill Collins (1990/2000) proposes the domination matrix, where different systems of oppression are in interaction since some groups may play the role of oppressed and oppressors simultaneously (E.g. Black men; white, wealthy women). Essentially, the feminist debate around intersectionality is extensive, and establishing a detailed development map exceeds the limitations of this analysis.

Furthermore, to understand vulnerability from a gender perspective, it must be contemplated in an intersectional way. It considers other socioeconomic factors that influence the relationship between gender and climate change, like race, sexuality, education, class, religion, and geographic location. As Vinyeta et al. (2015) argued, gender and climate change interact with other forms of oppression, creating unique vulnerabilities.

The need for an intersectional approach has been suggested by feminist scholars (Lykke, 2009; Nightingale, 2006; Osborne, 2015) to prevent simplistic miss-conceptualizations of women or men and fall into stereotypes that exclude and marginalize, avoiding the notion of homogeneity and recognizing the differences among women and men due to age, income, education, and combinations of factors that shape the individual social position and affect their experiences of power, oppression and vulnerability (Osborne, 2015; Owusu et al., 2019b). An intersectional approach works as a tool to comprehend how the interplay among social dimensions of power shape the adaptation strategies to climate change (Adger and Kelly, 1999; Nightingale, 2011).

Concerning poverty as an essential driver of vulnerability, the definition of poverty by CEPAL is used, which considers it a result of a socioeconomic process, with cultural and political components, where people, due to different causes, cannot access opportunities and elements that are essential for their personal development. Poverty is multidimensional and goes beyond the material definition (CEPAL, 2003b).

The UN-HABITAT identifies that most of the world's urban poor are women, trapped in a poverty circle thanks to the limited probabilities of employment, low income (women are reported to earn 24% less than men), and other factors that will be mentioned briefly in the following paragraphs (UN-Habitat, 2020).

Incorporating the gender dimension into the analysis of poverty implies that what is experienced by women is different and more acute than what a man experiences because of discrimination and exclusion by gender. As Paola Bonavitta mentions in her work, with an intersectional approach, discussing poor women is about women who suffer double oppression from gender and class (Bonavitta, 2010).

From an intersectional feminist approach, we cannot assume that all women experience the same degree of oppression and discrimination. Further inequalities and oppression experienced are influenced by class, sexuality, and other factors (UN Women, 2020a). As explained by Kimberlé Crenshaw (Crenshaw, 1991) social identities can overlap, creating

different experiences of discrimination. A feminist intersectional approach often focuses on the voices that experience these overlapping forms of oppression based on gender, class, sexuality, immigrant status. Majandra Rodriguez Acha (UN Women, 2020b) a climate justice advocate from Peru, argues that the most impacted by gender-based violence are the most impoverished and marginalized, the indigenous Black and Brown.

Moreover, women face poverty in worst positions than men due to unequal power relationships that reinforce their vulnerability (Bradshaw, 2002). Besides, the so-called "triple burden" faced by women in society is one of the barriers to women's economic empowerment; this is the reproductive responsibility, the formal job, and the communitarian responsibility (Moser, 1995).

Diverse studies have proven that the feminization of poverty is a historical phenomenon increasing in Latin America (CEPAL, 2007; GUERRERO MORALES, 2006). Moreover, the UN Human development report of 2020 states that no country, rich or poor, has achieved gender equality.

The power imbalance and gender inequality are reflected within households and in communities. Replicated in how households share resources, leaving women to eat last and least in some cases (UNDP, 2016). Early marriage still condemns girls in some countries, with 12 million victims every year. Also, women spend on average 2.5 times more than men on unpaid work, occupying less time in other activities (UNDP, 2020). Moreover, and this is especially the case for poor urban women, even if they find a job, this is usually precarious, and the wage is not enough to escape poverty. It is stated that globally women earn 24% less than men (UN-Habitat, 2020). Additionally, it is observed that urban poor women tend to interrupt their studies to dedicate themselves to unpaid work (UN-Habitat, 2020) investing almost 46 hours weekly to domestic tasks in Latin American countries, where also, almost 60% of poor women have been teenage mothers (ONUMUJERES, 2017). In contrast, men dedicate themselves to paid work (CEPAL, 2003b).

Even though analphabetism is in decline, women still represent 2/3 (493 million) of the adults of the world (774 million) that do not have an education (UNEP, 2020). This fact affects the participation of women in the labour force, which is lower than that of men globally. In 2018, the participation rate in the labour force was 75% for men and 48% for women (UNDP, 2019).

Furthermore, women that live in poverty are often deprived of access to essential resources like ownership of land, loans, and inheritance; on average, they represent 43% of the agricultural labor force in developing countries, while the amount that owns them is only 18% (UNDP, 2020). In this way, women find themselves trapped in a cycle of poverty without access to resources to change their reality (Bonavitta, 2010).

## 2.5. Social capital, capacity building and empowerment

This section introduces the concepts of social capital, capacity building and empowerment due to the importance of considering women capacities, skills and abilities in the context of climate change. As refer by Mukoni (2013), the empowerment of women decrease their vulnerability through their full control of decisions.

Pierre Bourdieu defines social capital as those nets used by individuals to obtain resources for the social systems (Bourdieu, 1986). On the other hand, for Adger, social capital consists of nets and fluxes of information created by individuals and groups that make collective action possible (Adger, 2003). Furthermore, it is argued that social capital is essential for adaptive capacity in the face of climate change, specially local-level social networks for marginalized communities to face climatic risks (Adger, 2003). Social capital, in this sense, work as networks and flows of information between individual groups that build into collective action and can influence decision making (Adger, 2003).

Moreover, capacity building is defined by the United Nations as the process that aims to develop and strengthen the "skills, instincts, abilities, processes and resources that organizations and communities need to survive, adapt, and thrive in a fast-changing world." This is related with the Sustainable Development Goal 17, that aims to revitalize the global partnership for sustainable development.

For the purpose of this study, the definition by Kabeer (2001) will be used for women's empowerment, where empowerment refers to the expansion of women's abilities, knowledge, skills, capacities and capabilities to make strategic life decisions where previously these abilities were denied. In the context of climate change, the empowerment of women is the development of skills and confidence to give full control to them of the decisions they make about climate change adaptation and mitigation (Mukoni, 2013).

## 2.6. Cities

### 2.6.1. Urbanization

Globally, cities concentrate population and most of the gross domestic product (GDP) and investment (World Bank, 2008). In many countries, around 80% of the GDP is produced in urban areas (Dobbs et al., 2011; Weiss, 2001). Cities are under exponential growth in size and number; in 2018, it was estimated that 55% of the world population was residing in urban settlements (Danan, 2019), and it is projected that by 2030 60% of the global population will be living in cities. Additionally, by 2018 the number of cities with at least 1 million inhabitants was 548; by 2030 is projected to rise to 706 (United Nations, 2018).

Informality plays a crucial role in shaping cities and is a growing trend in the Global South (UN-Habitat, 2020), that is why it is helpful to establish what is intended by "informal". In this thesis, "informality" is understood in Roy's words, as a "convergence of legality and extra-legality in the same process (Roy, 2011). Here, the term "informal settlements" is used as well as "slums." This way we are not searching to reinforce pejorative (Gilbert, 2009) or derogatory (Mitlin and Satterthwaite, 2012) associations, rather recognize that "slums" are associated with informality. Although informal does not necessarily mean low-income (Roy, 2011), there is a tendency for low-income populations to reside in these areas of scarcity and are disproportionately vulnerable to a series of risks, including those associated with climate change (Schofield and Gubbels, 2019).

### 2.6.2. Megacities and climate change

Cities with more than 10 million are termed "megacities," globally, the number of this type of city is projected to rise from 33 in 2018 to 43 in 2030 (United Nations, 2018). Of the 33 megacities in 2018, 27 were located in the Global South (Figure 4), and it is projected that 9 of 10 new megacities for 2030 will be located in developing countries (United Nations, 2018).

It is assumed that the exponential growth of cities must be accompanied by infrastructure and services, but this is not frequently the case. As mentioned in the IPCC report of 2014, approximately 1 in 7 people globally live in overcrowded conditions with a lack of basic infrastructure and services (Revi et al., 2014).

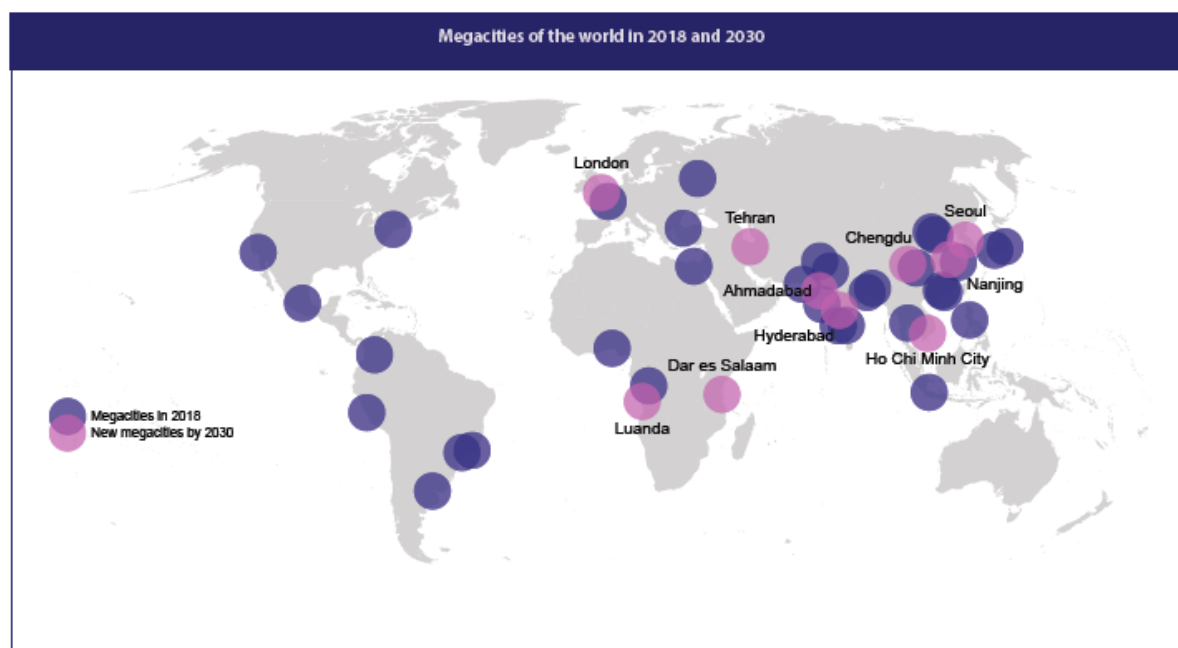


Figure 4 Location of megacities worldwide. Source: UN,2018

### Impact of climate change

Climate change can aggravate urban problems, difficult to solve existing problems such as poverty, inequality, infrastructure shortages, and housing, to name a few (UN-Habitat, 2020). It is argued that cities are more susceptible than rural areas to be severely affected by natural hazards due to the high population concentration, economic assets, and socioeconomic vulnerabilities (Gencer, 2013; IFRC, 2020; UNISDR, 2009).

Cities are diverse, and climate change impacts them, and the capacity to adapt differ. This section focuses on low to mid-income nations centered on low-income populations, identified as the most vulnerable to climate change (Revi et al., 2014).

The exponential growth of population in cities is accompanied by a rapid expansion of vulnerable populations and informal settlements, especially in low to middle-income countries (Revi et al., 2014). Unplanned urbanization is being intensified by climate-driven migration from rural to urban areas. It is estimated that 1 billion people live in informal settlements globally, most of them in developing countries (Cities Alliance/UNOPS, 2021; UN, 2018; UN-HABITAT, 2015).

As mentioned, climate change impacts are not distributed equally. Impacts are worst for populations residing in Informal settlements; their vulnerability is increased by their multidimensional poverty (Cities Alliance/UNOPS, 2021).

There is a direct correlation between areas occupied by informal settlements and a higher vulnerability to climate change. Frequently poor households are located in hazardous areas in the periphery of the urban settlements, and these vulnerable populations are excluded from decision making (Adger, 2003).

Their hazardous location within cities (riparian areas, steep slopes, or low-lying coastal areas), the lack of safe infrastructure that cannot withstand hazards or stress, summed with the lack of health care, access to emergency services, and the inclusion in disaster risk reduction make informal urban areas more vulnerable to the adverse effects of climate change (IFRC, 2020; Levy, 2003; Revi et al., 2014; UN-HABITAT, 2011; UNISDR, 2009).

There is high confidence that urban climate change-related risks are increasing, identifying the most relevant risks in urban areas related to storms, floods, heatwaves, and landslides (Revi et al., 2014).

The United Nations Habitat report (2020) identifies urban poor women as a priority for sustainable urbanization. Their empowerment and inclusion in decision-making, the recognition of their disproportionate number of domestic responsibilities, the reduction of inequalities, and the security of land property, should be the top priorities towards gender equality.

### 3. Methods

The methodological steps of this study are discussed in this section. Firstly, the research design and methodological triangulation are introduced. Secondly, the steps followed for the development and design of the questionnaires, the interviews, as well as the process of the systematic literature research are thoroughly described. The chapter also critically discusses how the data collection and interpretation process is conducted and how the interviews, literature reviews, and questionnaires were guided. Moreover, in this section it is briefly explained how the representative case study, a megacity from Latin America Buenos Aires is selected, although the next chapter cover the case study in detail.

#### 3.1. Research design and triangulation

This thesis investigates the factors that influence gender vulnerability to climate change in the urban context of the Global South with a mix of qualitative-interpretative methods. These methods allowed not only to understand the factors but also to analyse how vulnerability to gender is defined, constructed and interpreted in the Global South context, focusing on Latin America. By using a qualitative approach, it is possible to explore the complex meaning of vulnerability to gender in different contexts, enable the finding of essential concerns, attitudes, and behaviours by including the possible connections that might be found between the study of the object and the setting (Brinkman, 2014). Besides, since the interest is in the factors that influence vulnerability to climate change with a gender perspective, rather than measurements and or quantifications, a qualitative approach is considered suitable.

To reinforce the internal validity, a triangulated perspective was adopted. Although there are different forms of triangulation, here were chosen three methods: literature review, semi-structured interviews, and questionnaires. The data acquired were compared and cross-checked utilizing several data gathering methods, which will be explained in more detail in the next section (Yin, 2014).

The focus of this study is the factors associated with gender vulnerability in the urban environment of Global South, specifically Latin America. The literature review presents cases from cities in the Global South, and the study is delimited to Latin America due to time constraints, analysing one city to provide a contextually grounded contribution to a growing literature on gender, climate change, and cities. As mentioned in section 3, a representative of the Latin America part of the Global South, the case study is a megacity with a growing population and an economic hot spot. Despite cultural differences among cities of the Global South, the case study gives a good insight into the situation complemented with the literature review analysis..

For this study, a trustworthy, rigorous, and precise research design has been applied, paying careful attention to the collection, analysis, and interpretation of data as the way results are presented (Merriam, 2009).

#### 3.2. Research method and data collection

This section elaborates on analysing the factors that influence gender vulnerability to climate change; the workflow is shown in Figure 5. As mentioned in the previous section, a triangulated perspective with a combination of literature research, semi-structured interviews, and questionnaires is applied (Read and Marsh, 2002).

The focus is firstly on a systematic literature review that assesses the current growing body of literature on vulnerability to climate change in urban environments of the Global South. Additionally, the methodology applied to the questionnaires and interviews will be explained in this section, with further detail on the case study in the next chapter.

The interviews and questionnaires of this thesis are developed to answer the research questions and analyse the factors that influence gender vulnerability to climate change in urban poor populations. These data gathering methods, interviews and questionnaires can be applied in other case studies in order to compare the results of this research. Figure 5 shows the diagram of the triangulation methodology applied in this research, which combines three data sources resulting in the identification of relevant factors associated with gender vulnerability to climate change.

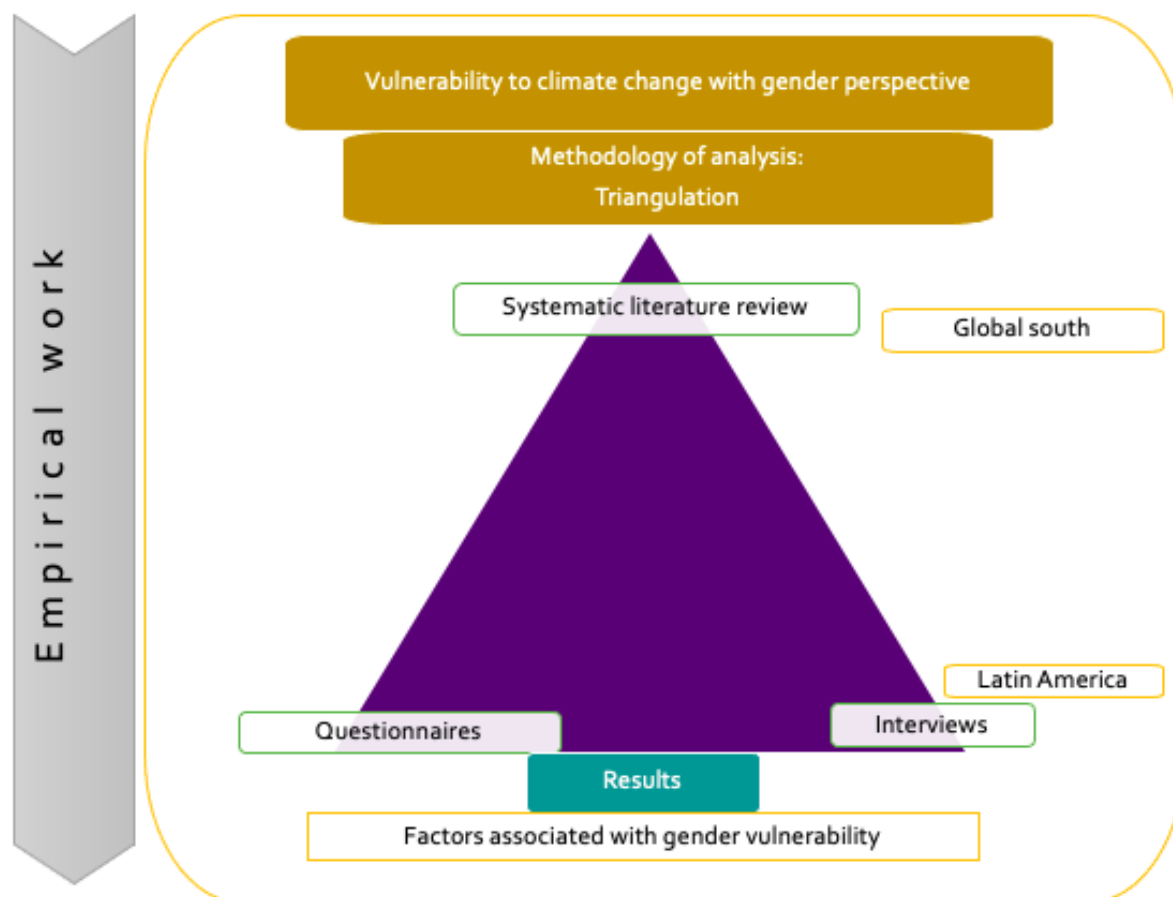


Figure 5 Methodology of this thesis. By Zavala, 2021

### 3.3. Methodology of literature review

The systematic review was conducted following a stepwise process developed by PRISMA 2020 methodology (Figure 6) using the checklist (Page et al., 2021). The objective of this systematic review was to assess the actual body of literature on gender roles and vulnerability to climate change in an urban Global South context. Systematic review approaches are frequently used in climate change research to evaluate a growing body of literature and provide methodological precision and transparency (Berrang-Ford et al., 2015). The review focus on work published after the IPCC's Fifth Assessment Report (IPCC, 2014a) and draws on peer-reviewed literature.

Web of Science database is the source of peer review articles published between 2014 and 2021 that addressed the vulnerability of women to climate change, using a Boolean search for keywords and synonyms related to gender, vulnerability, cities, and climate change in publication topics (for a complete list of search strings and keywords, see annex material table 1)



The year 2014 was chosen as a benchmark because the literature on climate change adaptation before 2014 is assumed to be included and summarized in the IPCC's Fifth Assessment Report. Moreover, the language included in the search was Spanish and English.

After the keyword search (table 1 of the annex), 125 articles were filtered by date (2014 to 2021), leaving 95 articles for the second step of the process, screening the title and abstract for relevance. After the screening, only 15 articles were left for further analysis due to the relevance of the content. In this step the articles were fully read and one was eliminated of the review due to lack of relevance on the topic, the focus was masculinities and nothing regarding gender vulnerability to climate change. Only 14 articles were relevant for our study of vulnerability to climate change with a gender perspective.

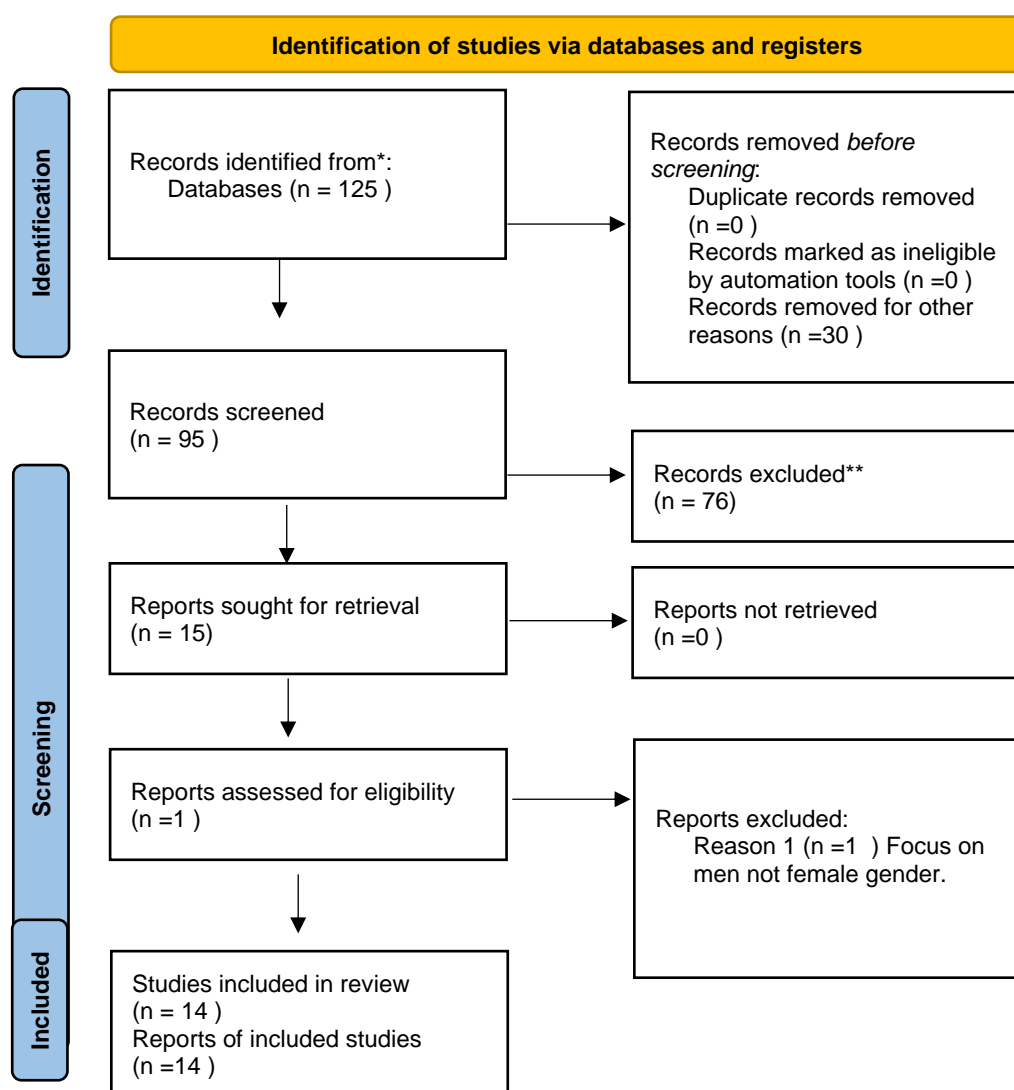


Figure 6 Steps followed in the literature review. Checklist Prisma statement: Guideline for systematic review. Source: Zavala, 2021 referring to Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews.

### 3.3.1. Eligibility criteria

The criteria for inclusion were as follows: the publications must directly address gender vulnerability to climate change as the core topic of analysis, with a focus on femininity. Articles were selected to include theoretical contributions to the field or empirical data on gender

relations to climate change. Moreover, articles were included to focus on urban environments in the Global South.

Articles were excluded if the publications did not focus on gender or if gender was considered a dichotomous variable (m/f) among a set of other variables (like age, education, income) since this assumes gender as a static variable.

Moreover, another factor that would make a study ineligible to be included in this review was to focus on agriculture or rural environments or in countries that were not of the global south. This literature search had additional limitations: books and book chapters and early access and proceeding papers were not considered.

### 3.3.2. Selection process

The study selection is a multi-stage/phase process where potentially eligible studies are first selected by screening titles and abstracts and then assessed through a full-text review. The process is diagrammed in the previous chart by "Prisma" (Figure 6).

As mentioned in the chart by Prisma, the first phase is the screening of the abstracts and titles. In this case, 93 titles and abstracts were screened to select studies with clear relevance for women's vulnerability to climate change that contributes with empirical data or theoretical findings to the research question.

The main exclusion criteria were the lack of relevance for the topic of interest; papers that did not consider gender in their research or focused on the rural environment were excluded, with other factors that were mentioned previously. The first selection phase was applied, resulting in 15 publications kept for analysis after the abstract and title screening. The papers were collected, processed, and organized in an excel table by title, year of publication, location, objective, method, and result. The author translated the titles that were in Spanish.

## 3.4. Methodology of the questionnaires

The questionnaire was developed to assess the population's vulnerability to climate change with elements linked to capacity building, the complete survey can be found in the Annex.

The questionnaires was constructed from the revision of similar studies developed in other countries (Leiserowitz, 2005; Vignola, 2010). Based on these studies, different questions were developed that referred to the knowledge and perception of vulnerability to climate change. Moreover, the collection was in Spanish and was translated to English afterwards.

The questionnaire was divided into four blocks (shown in the Annex). The first block is the "Socio-demographic profile" and has the objective to assess the subjects' social aspects and find information on the social vulnerability of the individuals involved. This information is taken from the educational level, the number of people that reside in the house, the amount of children under-age, the immigrational status, the work status, and if the woman is the head of the family in charge of the primary income, among other factors that influence the vulnerability of the subject.

The second block, "Climate change," has the objective to assess the knowledge on climate change of the subjects and their perception of risk.

Moreover, the associative thinking of the subjects was analysed concerning the word "Climate Change." This type of analysis was used in studying risk perception to climate change by (Leiserowitz, 2005) on EEUU and Costa Rica population by Vignola (2010). Associative thinking is related to experience lived by the individuals, identifying the emotional roots linked with the word "Climate Change" within the population, usually is a fast intuitive and automatic thinking. Also, it was aimed to identify the perception of the significant impacts for their health, livelihood, or other personal aspects. Later, we inquire about their perception of the main

hazards (floods, winds, heat waves) identified for the area under study (GobBsAs, 2020; Natenzon, 2018).

The third block, "Caring Chores," is gender role oriented. It aims to identify if the participants are responsible for caring tasks in their families that add extra responsibilities to their daily lives. Also, ask about the involvement of other family members in these chores.

Finally, the fourth block has the objective to assess the participation of the subjects in collective groups and the perception of the benefits from being part of this movement.

The resulting questionnaires were analysed in Excel, developing a table with all the answers and graphs representing responses. The questionnaire results and limitations will be presented in the next section.

In the case study chapter 4 the questionnaires will be explained further in detail regarding some field applications.

### 3.5. Methodology of the semi-structured interviews:

Qualitative semi-structured interviews are one of the most used methods of data collection in social science (Bradford and Cullen, 2012). It was chosen to apply semi-structured interview due to the flexibility, fluency, and conversational style, and because it allows gathering subjective viewpoints (Flick, 2009).

The primary goal of this process was to conduct meaningful dialogues with research subjects while seeking qualitatively valuable information to understand the subjects' interpretations of specific events and settings (Brinkman, 2014). An interview script focused on relevant topics throughout the interview (Choak, 2012). At the same time, semi-structured interviews allow flexibility and are more fluent rather than just following the guide (Brinkman, 2014), this configure the interview depending on the responses and cover non-expected topics that emerge.

Interviews were carried out through the phone and video calls due to the participants' different time zones and availability. The interviews are anonymous, even though there is a previous acknowledgement that the results will be used in this research study. The interviews were semi-structured, aided by a guide with topics and issues covered during the conversation to avoid losing control (see the Annex).

These semi-structured interviews enable us to cross-check data with literature and surveys, allowing triangulation.

The last methodological step of the interviews is analysing the data with a computer-assisted qualitative data analysis software (CAQDAS) called Nvivo. This software aids the analysis process and allows a thematic examination of the interviews, organizing the data in different codes or thematic topics. A code in qualitative research is a word that summarises the essence of a portion of data.

After transferring the documents with the transcript of the interviews to the software, the next step is coding. In Nvivo coding is the process of putting together extracts of different interviews that are related to each other into containers called nodes (Richards, 2020) now onwards referred in this thesis as thematic topics.

The thematic topics are created with the research questions in mind:

"What factors are associated with gender vulnerability to climate change in urban environments of the Global South?" and

"How is gender vulnerability experienced in Latin America?"

The codes used were "deductive" based on topics that emerged from the literature review and "inductive" since some were generated while examining the interviews collected.

There are two central "parent" topics created in Nvivo, "empowerment" and "vulnerability factors." Inside the "parent" node of vulnerability factors, there are 4 "child" topic that summarise the essence and topics of interviews and the literature review findings. These factors that influence vulnerability are "gender roles," "gender violence," "inequality," and "participation." A graph (Figure 7) shows the outlines of the thematic topics.

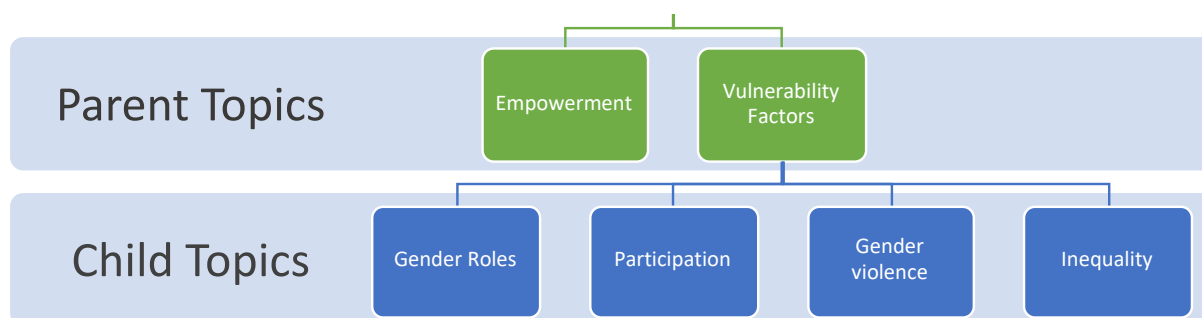


Figure 7 Thematic topics used for coding of interviews. Source: Zavala, 2021

### Purposeful sampling

When deciding whom to interview, the aim was to gather multiple experiences that gave us insight into factors that influence vulnerability in the specific case study. Purposive sampling was applied, also known as selective or subjective sampling, which relies on the researcher's judgment to choose the population that participates in the study. This method is the most cost-effective and time-effective sampling method, which can tackle bias by choosing participants who confirm our point of view.

By this means, a purposive sample does not necessarily mean that it is a representative sample. Instead, the aim is to increase information while ensuring that some participants have opposite views.

In this regard, a non-random purposive selection was applied based on the first interviewees who lived or worked on the area of interest. Secondly, that had experience working with vulnerable populations or was knowledgeable on environmental and gender cases and social vulnerability.

Furthermore, a snowball sampling was applied by selecting new participants from existing ones to reach more participants with different perspectives (Merriam, 2009). Moreover, the anonymous list of interviews can be seen in Table 1. The details from the interviews will be discussed in the case study section.

Table 1: List of interviewees presented anonymously by characteristics of participants.

Interviewee	Gender	Representative	Department/ Organization	Interview Type
1	Male	Government	Government of Buenos Aires, Subsecretary of Human potential	Video call
2	Male	Government	Government of Buenos Aires, Project of recycler communities	Video call
3	Female	Cooperative	Excluded workers movement (MTE)	Video call
4	Female	Cooperative	Madre selvas	Video call
5	Female	Cooperative	Excluded workers movement (MTE)	Video call
6	Female	Grassroot	Vivera Organica	Video call
7	Female	Cooperative	Excluded workers movement (MTE)	Video call
8	Female	Government	The city of Buenos Aires, Program of gender and habitat.	Video Call

## 4. Case study-Buenos Aires, Latin America

Following the design of the methodology the topic is examined with a gender perspective of the Global South through a literature review and complemented with an analysis on a case study of Latin America, specifically of Buenos Aires.

This chapter introduces the case study and the reason for selecting this region and specifically Buenos Aires city. Furthermore, the city was selected because it is considered a representative Latin American megacity as the urban economic centre of Argentina.



Figure 8 Women part of the Grassroot organization- Viveras from Soldati. Source: Esteban Mastroperi.

#### 4.1. Relevance of the case study

This thesis argues that the Latin American region is relevant in the context of the Global South due to the contextual socio-economic factors that influence vulnerability, which will be mentioned next, and the identified gap in the literature review on the topic of vulnerability in this region. This is viewed as an opportunity to fill the gap with new research on the area.

Regarding climate change, this region is identified to emit only 10% of the world's CO<sub>2</sub> emissions but is unfairly highly impacted by the effects of climate change (Revelo, 2021). This vulnerability is due to its geographic location, climatic situation, socioeconomic, demographic, and institutional realities, and the high sensitivity of its natural resources (CEPAL, 2018). Moreover, as stated before, the IPCC defines vulnerability as the intersection of socio-economic processes linked with discrimination related to gender, class, age and with other factors (IPCC, 2014c)

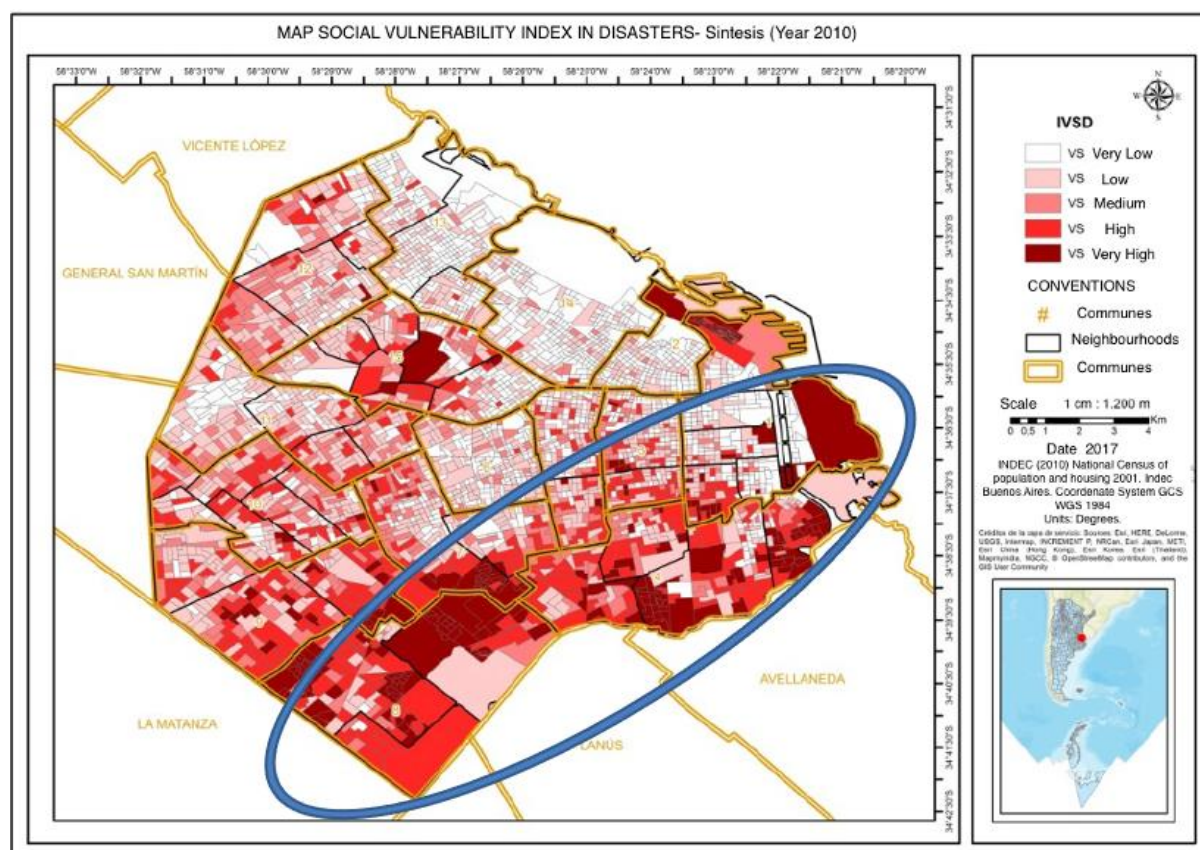
The region of Latin America and the Caribbean is still the second more unequal region in the world. United Nations development program (UNDP) highlights the slow growth of the region, and the contrasts that co-exist with populations experiencing extreme poverty and vulnerability, with the resources and wealth concentrated in the hands of a rich minority. The inequality is multidimensional and is related to gender, class, and race, among others. It involves access to education, services and job opportunities. It is stated that this slow growth in the region is related to the high inequality of race and ethnicities, discrimination against LGBT+ communities, disparity in the quality of education and inequality of gender. All these inequities result in the regional labour force being underutilized (UNDP, 2021).

Regarding gender, women in 2019 were found to be poorer than men in Latin America. For every 100 men living in poverty, 112,7 women were experiencing this situation (Revelo, 2021). In this context, it is understood that climate change increases the gender inequalities already present, this is an extra burden that can push women to chronic poverty (IPCC, 2014c).

Regarding gender roles, in Latin America women spend 2/3 of their time on/doing non-paid work and 1/3 on paid work, whereas men spend 1/3 on caring tasks (Revelo, 2021). Moreover, woman participation has increased in the past years due to the activism of feminist movements but there are still spaces with a lack or low representation of women, resulting in decisions that are not equal and inclusive to gender (Revelo, 2021).

#### 4.2. Spatial delimitation of the research area

This section presents the selection of the area under study from the city of Buenos Aires, where the scope of analysis is limited to an area identified as highly vulnerable based on previous studies. The Climatic Action Plan of Buenos Aires for 2050 (CAP) (GobBsAs, 2020), the IPCC projections RCP 4.5 and RCP 8.5 for the area of study, and the social vulnerability to disasters study developed for the City of Buenos Aires by Natenzon (Natenzon, 2018) were used as a foundation of data to identified the vulnerability in the area. The area showed in Map 1 was selected based on the research mentioned and resulted on the area that identified sectors with very high and high social vulnerability to disasters



Map 1 Map of social vulnerability to disasters by Natenzon 2018. Modified with the selected area under study circled in blue zavalá, 2021.

The areas identified as highly vulnerable are particularly between the South and East that follow the basin of Matanza-Riachuelo and Río de la Plata coast. The Map (Map 1) has a chromatic scale from the lightest colour, showing the lowest vulnerability, to the darkest colour, indicating the higher vulnerability case, and the area under study is circled in blue.

The areas identified in Map 1 as high and very highly vulnerable are distributed all over the city, but the majority match the location of informal settlements and poor neighbourhoods (Natenzon, 2018). Also corresponding to areas identified as high risk of flooding and waterlogging.

#### 4.2.1. Socio-economic context

The United Nations identified that inequality is dominant in Buenos Aires with a concerning Gini index from 2007-2010 of 0.51 (UN, 2013). Besides, The National Institute of Statistics and Census (INDEC) identified that 16,5% of the population is living in poverty and 5,3% under extreme situations (INDEC, 2021).

In this context, according to official statistics, in 2020 Argentina identified that 12 million people, representing 42% of its population, were living in poor conditions, with 10,5 % living in conditions of extreme poverty (INDEC, 2021). While in the Greater Buenos Aires area, 44,3% was living in poverty and 13,3% in extreme poverty (INDEC, 2021). In 2010 the city had 117.787 homes with critical overcrowding (more than three people per room), representing 10% of the households. The higher levels of overcrowding correspond to informal neighbourhoods distributed mainly in the South and East of the city (Natenzon, 2018).



The Autonomous City of Buenos Aires (CABA) has a surface of 202 km<sup>2</sup> with around 3 million and a transitory population of 3.5 million, where 53% of this population are women (GobBsAs, 2020).

Regarding access to the water network, over 4%, 4.653 households, lacked access in 2010. The main problem involves obtaining an official connection from the company that provides the service, mainly in precarious neighbourhoods (slums and settlements). Moreover, regarding access to the sewage system/network, 21.218 households (18% of the total) did not have access in 2010.

Natenzon argues that the most relevant indicator that influenced vulnerability was the education level and illiteracy of the family heads.

The identified neighbourhoods with high vulnerability are (Natenzon, 2018):

- Villa Lugano with 73.663 inhabitants (58,3% of their total population)
- Villa Soldati, with 37.680 inhabitants (80,5% of their total population)
- Barracas, with 39.930 inhabitants (44,6% of their total population)
- La Boca, with 20.907 inhabitants (46,3% of the total population)
- Nueva Pompeya with 7.031 inhabitants (16,50%)

#### 4.3. Social vulnerability to disasters

The Report on social vulnerability to climate change-related hazards identifies the socioeconomic conditions of the population before the occurrence of a disaster and evaluates the material and non-material resources to cope with the challenges that impose risks to climatic hazards with different indicators (Annex figure 9).

It is identified that a quarter of the city has a very high and high vulnerability index to climate change related hazards, consequently, there is a demand for a priority intervention of public policy to decrease this negative influence. The most affected neighbourhoods are located on the Southeast side, following the Matanza-Riachuelo and La Plata river (Natenzon, 2018).

#### 4.4. The climate profile and climate change

Buenos Aires has a humid subtropical climate (Cfa) according to the Köppen-Geiger climate classification, with an annual average temperature of 18 °C, a maximum average of 22°C, and a minimum of 14°C. Precipitation is about 1100 mm on average per year, with eight rain days a month (Figure 9)

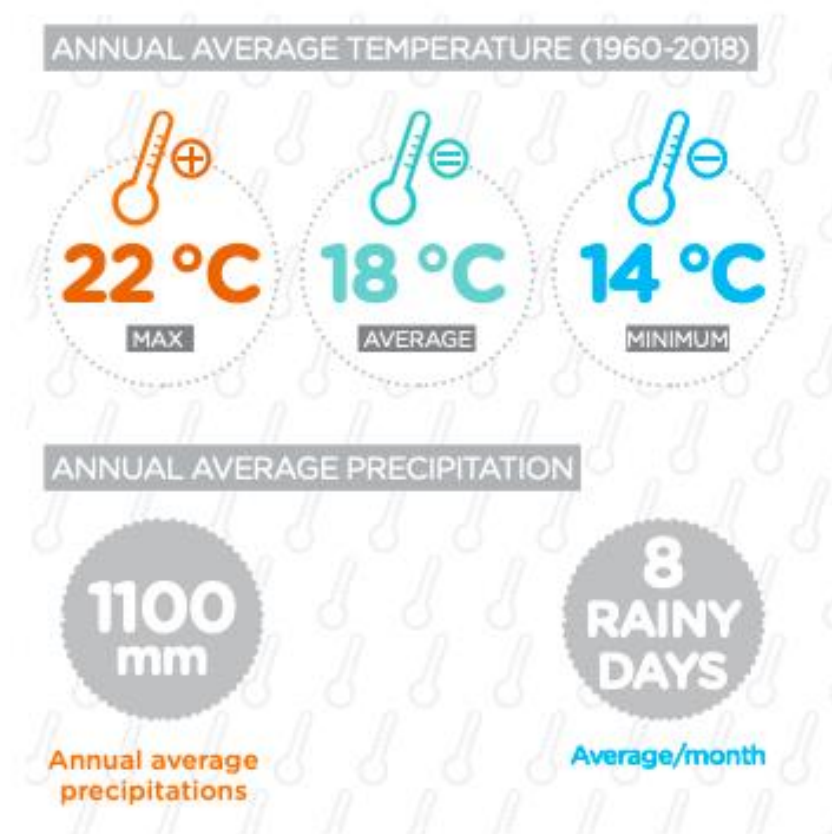


Figure 9 Actual Climate Buenos Aires City-Source: Climate action plan 2021

### Climate Change Projections

The climate action plan of the Autonomous City of Buenos Aires (CAP) bases its projections on the IPCC report of 2014, estimating an increase in maximum temperature for the Representative concentration pathway (RCP) 4.5 of +1.6°C and the business-as-usual scenario or RCP 8.5 of +3.8°C.

Concerning precipitation, an increase in the annual average rains for the year 2100 of +80mm for RCP 4.5 and +62mm for the RCP 8.5 is expected. Heatwaves have doubled between 2010 and 2018 compared to the 90s, and this tendency is expected to increase (GobBsAs, 2020).

Moreover, the historical records show an increase in annual precipitation, with an average of 47 mm per decade from 1960 to 2020. Projections for 2050 and 2100, both emission scenarios, maintain the increasing trend but with a high standard deviation in the models (GobBsAs, 2020).

Additionally, eleven hydrographic watersheds cross through the city. During the first half of the 20th century, most streams lost their original features by rectification and channelling; the disappearance of the natural drainage network and floodplains increased the number of areas affected by floods. The topography of Buenos Aires and the impermeabilization of the soil aggravated the risk of flooding in the area. The IPCC reports that an increase in flood events during 1980–2000 has been observed also in the Buenos Aires province and Metropolitan Area (Marengo et al., 2014).

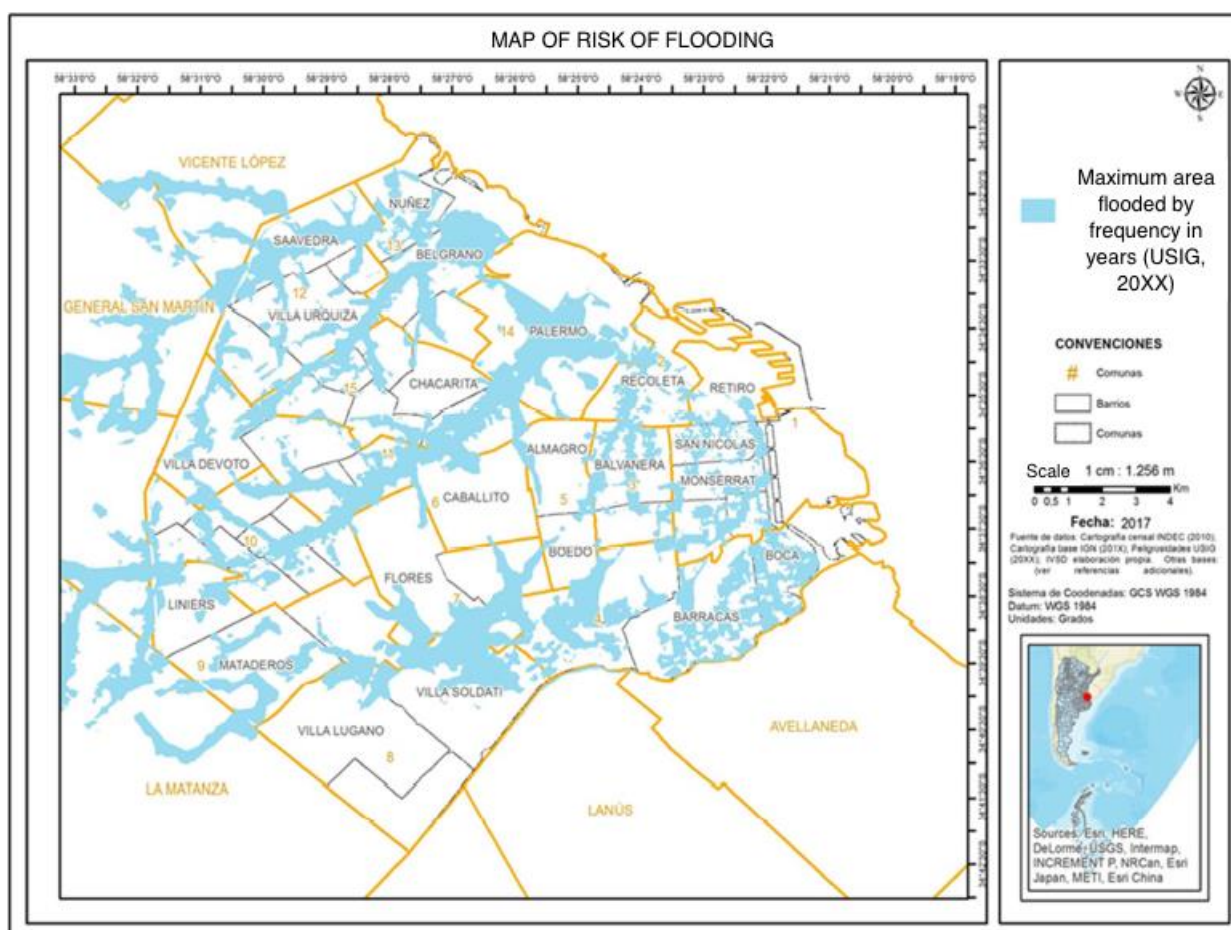
The CAP states that the risk of flooding has been managed due to new infrastructure, and the areas with higher flooding risk are the ones in the Matanza-Riachuelo basing in the South of the city. This basin has a complex and long story of pollution that began with the first meat salting companies settling in the area in 1801. The impact on vulnerable populations is

ongoing, with a legal obligation of the National and Local Government to clean up the basin and improve the conditions started in 2006.

In addition, the flooding profile of the city "La Sudestada", a phenomenon characterized by strong winds from the southeast coast in the La Plata River, aggravates the coastal flooding risk. It usually occurs in spring and autumn generating winds over 35 km/hr. Furthermore, consistent precipitations increase the water level and reduce the drainage capacity of rivers and streams that cross the city and end in the La Plata River. This phenomenon is aggravated by the rise of the water level, which during the 20-century increased around 17 cm in the city of Buenos Aires (GobBsAs, 2020).

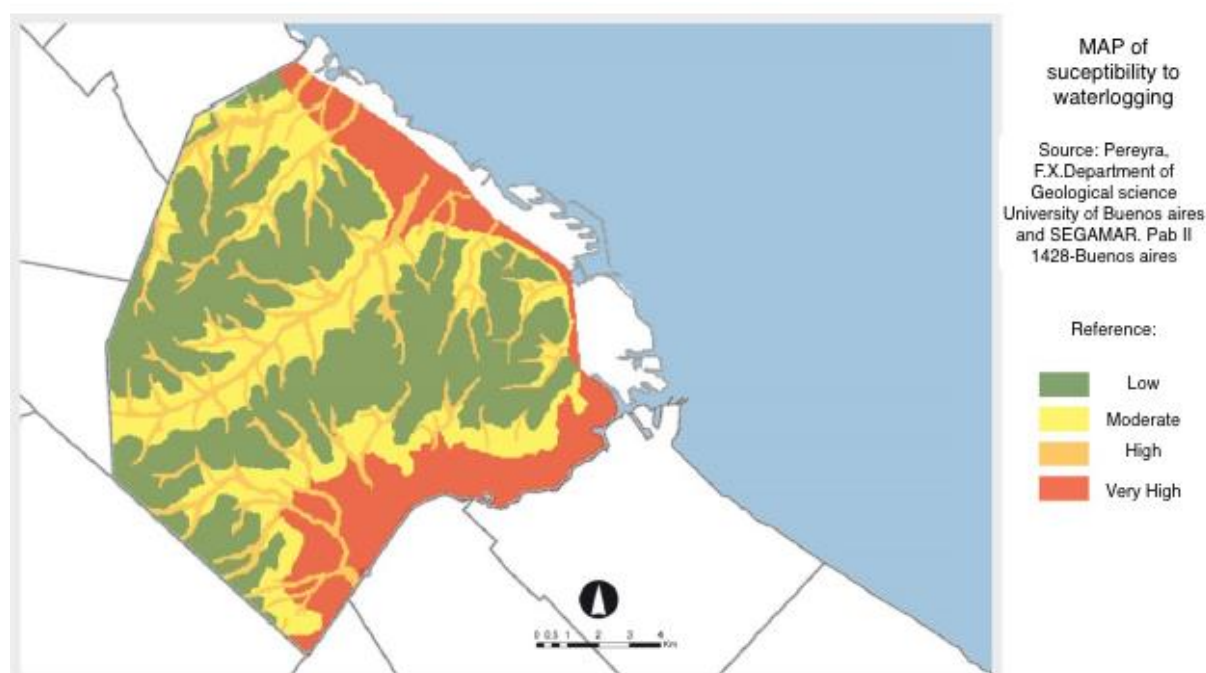
#### 4.4.1. Flooding Risk

The analysis is based on the Report by Natenzon, using the area of maximum inundation on a recurrency of 2, 5, 10, 20, 50, and 100 years and the areas susceptible to flooding due to precipitation. There are limitations and uncertainties within the data used in this analysis. First of all, the data is from 2004, since then the city has changed due to a new hydraulic plan and other infrastructure that consequently affected the maximum flooding area. The following map (Map 2) shows the maximum flooding and recurrency areas for Buenos Aires from 2004.



Map 2 Risk of Flooding of Buenos Aires. The maximum area flooded

We can also observe a coincidence between the flooding area and the waterlogging areas found on the governmental page of Buenos Aires (map 3).



Map 3 Susceptibility to waterlogging. Natenzon, 2018.

#### 4.5. Data collection:

##### Questionnaires and interviews

Regarding the data collection in the case study initially, the questionnaire included female populations residing in "Barrios Populares" or vulnerable neighbourhoods of the study area "Matanza-Riachuelo Basing". Later it was decided to include male and other gender identities perspectives to have a more diverse input and compare points of view. Moreover, the distribution of the questionnaire was planned with the assistance of a network in these vulnerable areas, grassroots organizations, neighbourhood groups, and organizations of workers in the area. The connection to these organizations was facilitated by colleagues in the Ministry of the environment of Buenos Aires. The link with these organizations was made by phone and video calls during several months, meeting with the leaders helped the connection with neighbours residing in the area of study. Also, the distribution was by social media, posting an explanation of the importance of the survey (Facebook neighbourhood groups)

Regarding the interviews, as presented in chapter 3.5, the qualitative semi-structured interviews were applied due to their flexibility and conversational style that facilitated the data gathering (Flick, 2009). In this case study, eight interviews were conducted in total, all were in Spanish and video calls because of geographical constraints. The interviews were recorded, transcribed, and translated soon afterwards. Our sample of interviewees was from diverse backgrounds, but all related to the case study. The analysis and presentation of the interviews were anonymous and was carried out through the software Nvivo, by coding of thematic topics that will be explained further in the next chapter.

Most of the participants were women who led social movements with government agents in relevant environmental and gender areas, grassroots organizations, and cooperatives in Buenos Aires. The link with the grassroots organizations was through the author's professional network. These grassroots organizations were identified as relevant by their work in the neighbourhood and their involvement with the population that resides in the area of focus.

Due to the context of the Covid-19 pandemic, fieldwork was not possible; for this reason, most of this research was desk work and online/telephone work; this resulted in some limitations that will be mentioned in a later chapter.

## 5. Description and analysis of the relevant data

This chapter provides a description of the results of the case study analysis after the application of the methods described above.

In the first section of this chapter, the results of the data collection are presented, that being the data taken from the questionnaires, the literature review, the interviews and the data triangulation. First, the results of the questionnaires are presented in a set of graphs that correspond to the four blocks already mentioned in chapter 3. Second, the literature review is presented in a chart that links the number of papers reviewed with thematic topics that guide this work to answer the research questions, showing the relevance of each topic. Third, the results of the semi-structured interviews are presented in a chart where the thematic topics are linked with each interview by relevance, in this table, the thematic topic is presented by colour and size depending on the number of interviews that refer to this topic.

In the second section of this chapter, by using methodological triangulation, this thesis links three sources of information: literature review, interviews and questionnaires. These sources are linked by thematic topics identified to assist the structuring of the data. five main thematic topics enable to answer the research questions, namely: a parent topic "empowerment", a parent topic "vulnerability" that contains relevant factors that influence vulnerability: "gender roles", "gender violence", "participation" and "inequality". Moreover, these thematic topics assisted the answer to the stated research questions.

### 5.1. Results

First, the results from the questionnaires are presented with a set of graphs. Second, the results from the literature review are presented by thematic topics showing the relevance of each topic found in literature from the global south. Last, the results from the semi-structured interviews show the relevance of each thematic topic found after the analysis on the software Nvivo.

#### 5.1.1. Questionnaires

The questionnaires were divided into four blocks. Firstly, the socio-demographic profile of the respondents has the objective to assess the social aspects and find information regarding social vulnerability. Secondly, the "climate change block" assesses the knowledge on climate change and perception of risk. Thirdly, in relation to gender roles as it aims to acquire more knowledge of their experience with caring responsibilities. Lastly, the fourth block has the objective to assess the empowerment of the subjects through collective groups and their perception of this.

As mentioned in the methodological section, in the first block a mix of factors inferred the socio-demographic characteristics of the questionnaire respondents, such as the level of education, age group, number of children younger than 18, employment status, neighbourhood where they reside, and others, as mentioned in chapter 3.3.

The questionnaire sample was of 21 people, being all all-female participants from Argentina, except for one participant who was born in Peru but has been living in Argentina for the past decades. The age of the respondents was variable, 60% were under 40 years old and 40% of the respondents older. Moreover, regarding the areas of residence, all the respondents resided in vulnerable and informal neighbourhoods showed in figure 10, 27,3% of the respondents from Villa Lugano, 36,4% from Villa 21-24, and 22,7% from Villa Soldati and 13.6% from villa 1.11.14 (Figure 11 ).



Regarding the family structure, almost 73% of women had children under 18 years old, that were economically dependent. More than 50% of the women stated that they lived with more than four persons in their house, and 72,7% lived without a husband or a partner and considered themselves the head of the family, being the primary income source to the family.

A factor that influences vulnerability to climate change from a gender perspective is the responsibility for domestic and caring tasks of the family. The result was that 80% were responsible for the household care after their working hours (Figure 12), finding themselves overburdened with responsibilities daily.

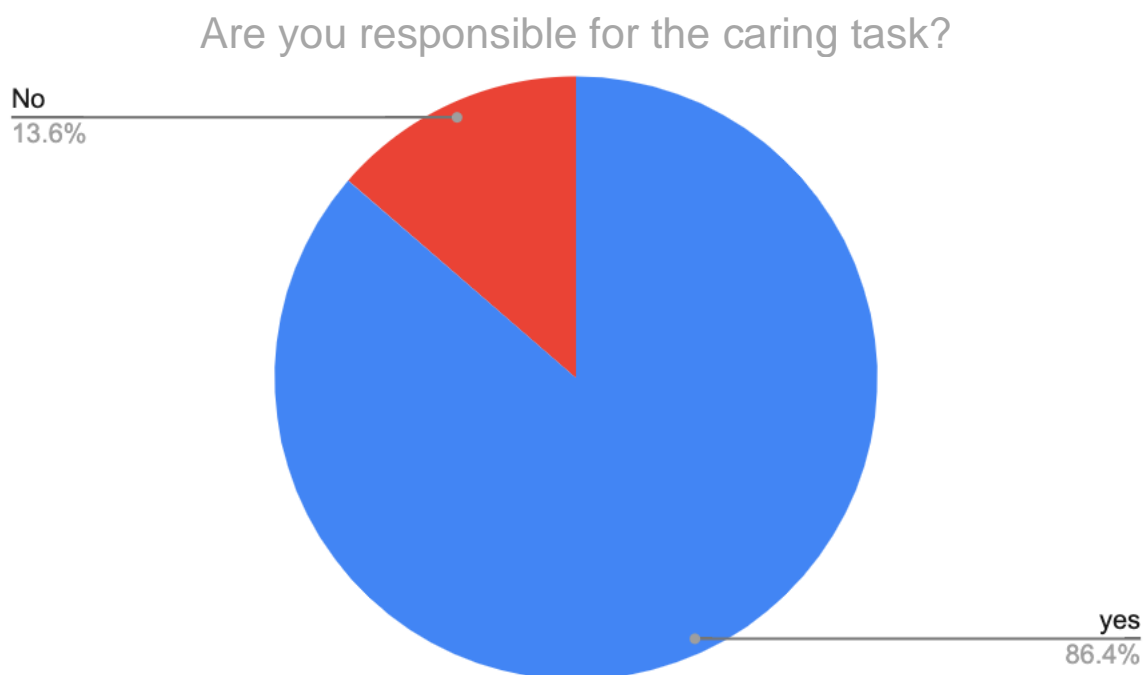


Figure 12 Percentage in charge of domestic responsibilities. Zavala, 2021

More than 50% of the participants expressed that they oversaw the care of an old or disabled person, adding more responsibilities and burdens to their daily life. McKinley et al. (2016) contended that the social role of women in numerous countries limits their ability to adapt to climate change.

### Head of the Family: Main income

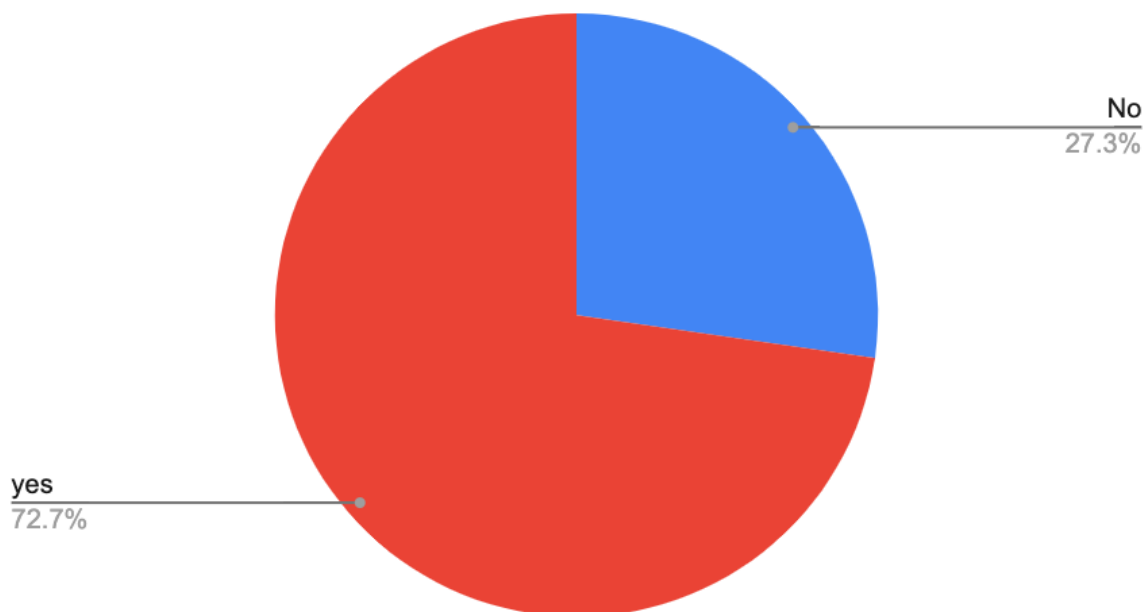


Figure 13 Head of the family: Main income. Source: Questionnaires

The educational level of the respondents showed that 36,4% did not finish primary school (Figure 14). In contrast, 27% completed secondary school, and almost 32%% did not finish secondary education. Moreover, 68% were employed and had an income.

### Educational level

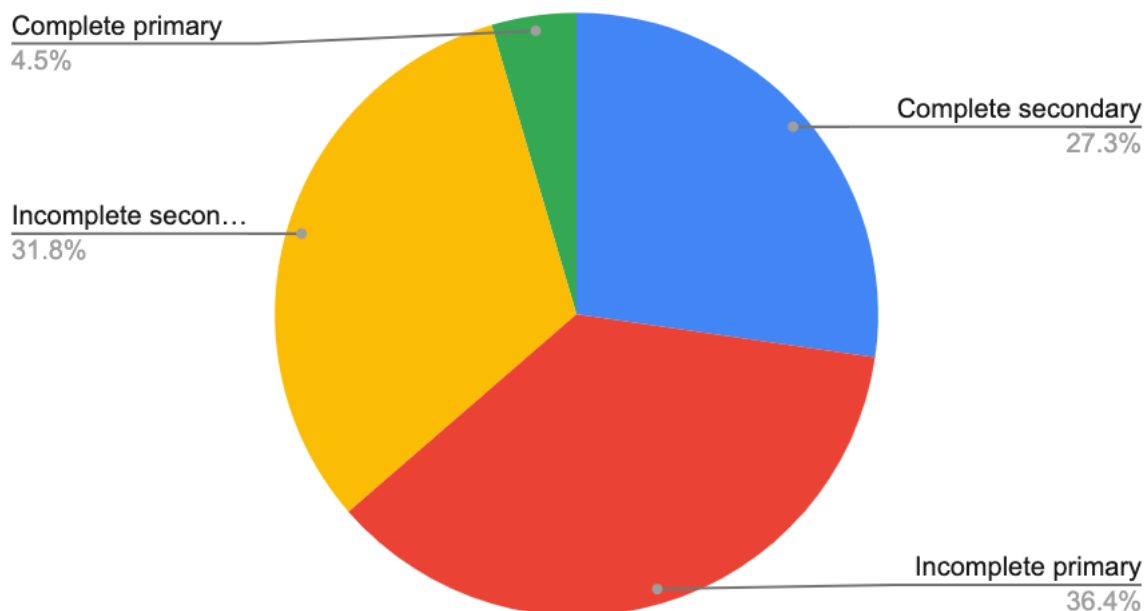


Figure 14 Educational level. Source: Zavala, 2021



Concerning climate change, all the respondents claimed to know what it is. When asked for a definition of climate change, 93% responded "abrupt climate changes". With 46%, the second popular answer was "increase of rains, temperature changes, and increase of extreme events". Also, the participants were asked if they consider climate change as a problem of the future or not a problem; 66% agreed that climate change was a present problem, and 80% agreed it harmed their family lives.

The participants were enquired what hazards impacted their lives in the past five years; almost 47% agreed that floods were the highest threat, heatwaves and strong windstorms and rainstorms were a hazard for 27% of the respondents (Figure 15).

### What climate related hazards impacted your life in the past 5 years?

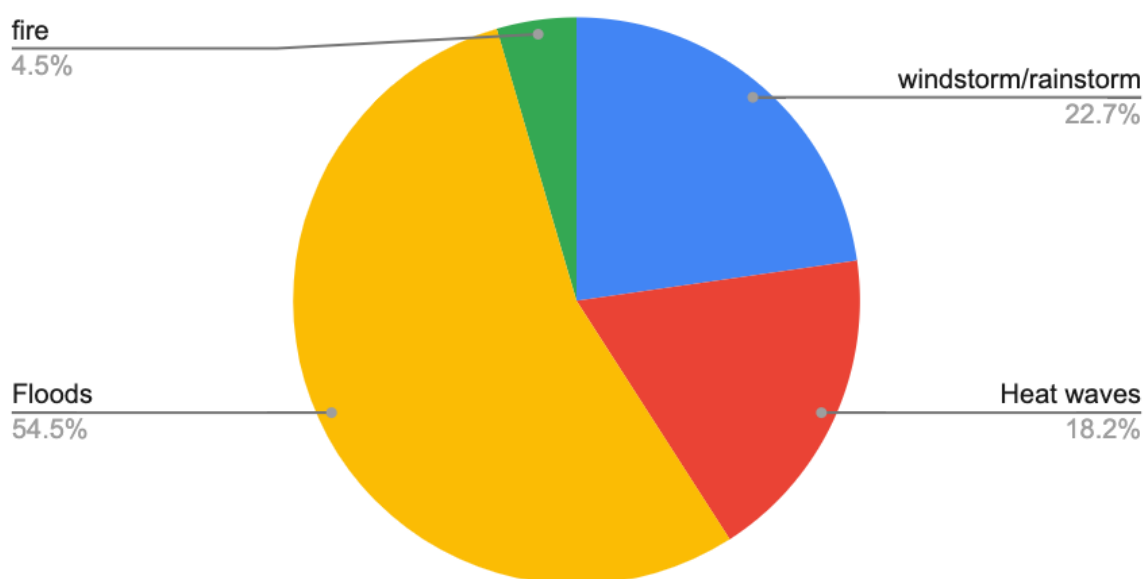


Figure 15 Climate change perception. Zavala, 2021.

When asked if they noticed changes in weather or climate, 70% agreed that floods were more frequent than before, 50% agreed that there were more fires and 40% agreed extreme rains and heatwaves were rising. When asked if they took any measures to adapt to these hazards, most of the participants acknowledged that they did not have enough money to take measurements, and 20% said that they did not know which measures to take.

In relation to block 4 of the questionnaire, the focus was on the participation of women in communal groups and grass-root organizations. This has proven relevant to understanding the influence on empowerment and social capital. Additionally, the participation of women in communal groups and grassroots organizations is linked with the theme topic (Table 2) "empowerment" identified in the literature review and interviews.

Moreover, 77,4% of the participants were involved in a collaborative group as volunteers and community referents. Almost 50% expressed that through the involvement in this group, they had the chance of accessing education or capacitation. Also, it increased their friendship circle and social capital. Additionally, 33% stated that their quality of life improved and they felt empowered by the inclusion in decision making and consequently got a better salary.

### 5.1.2. Literature review

The analysis of the literature review is structured in five thematic topics relevant to answer the research questions as shown in table 2. These topics are empowerment, lack of participation, inequality, gender roles and gender violence. The identified topics are presented together with the number of papers that mentioned these determinant factors and the countries addressed in the papers. In table 1 it is clear that most of the papers found gender roles as a crucial factor that influence vulnerability.

**Table 1:** Results from literature review organized by relevant topics and number of papers. Source: Zavala, 2021

TOPICS	Papers	Number of papers	Countries
Participation	(Goodrich et al., 2019; Hanson, 2016; Owusu et al., 2019b; Tanjeela and Rutherford, 2018)	4	Mexico, Hindu-Kirsh Himalaya, Bangladesh, Ganha.
Gender roles	(Gaisie et al., 2021; Goodrich et al., 2019; Hanson, 2016; Hudson et al., 2021; Kher et al., 2015; Mason and Agan, 2015; Owusu et al., 2019b; Patel et al., 2021; Porio, 2014; Ramalho, 2019; Ramirez, 2016; Reckien et al., 2017; Tanjeela and Rutherford, 2018))	13	Peru, Mexico, Bangladesh, Philippines, Pakistan, India, Vietnam, global, Ganha, Hindu-Kirsh Himalayas
Inequality	(Gaisie et al., 2021; Goodrich et al., 2019; Hanson, 2016; Kher et al., 2015; Owusu et al., 2019b; Patel et al., 2021; Porio, 2014; Ramirez, 2016; Reckien et al., 2017; Schofield and Gubbels, 2019; Tanjeela and Rutherford, 2018)	11	Peru, México, Bangladesh, Tanzania, Ganha India, Pakistán, Philipines and Hindu-Kirsh Himalaya
Gender violence	(Goodrich et al., 2019; Patel et al., 2021; Ramalho, 2019; Reckien et al., 2017; Schofield and Gubbels, 2019)	5	Philipines, Tanzania, Hindu-Kirsh Himalayas, global,

			Bangladesh, Pakistan, India
<b>Empowerment</b>	(Gaisie et al., 2021; Goodrich et al., 2019; Hanson, 2016; Ramalho, 2019; Ramirez, 2016; Tanjeela and Rutherford, 2018)	6	Peru, Mexico, Bangladesh, Ganha, Global, Philipines, Hindu-Kirsh Himalaya

### 5.1.3. Interviews

The interviews were held on the phone and by video calls due to different time zones and availability. As mentioned in the methodology, the interviews were semi-structured, aided by a guide and were held in Spanish and translated by the author. In this process seven participants related to gender and environmental topics were interviewed, three of them government agents that worked with vulnerable populations and the other women representatives of social movements that worked in the area of study.

To process and analyse the data obtained from the interviews, coding with Nvivo software was used in correspondence to the identified relevant theme topics in the literature review and the interviews.

Firstly, the interviews were analyzed with coding by the Software Nvivo. The participants were asked about their perception of the factors that influence the vulnerability of women to climate change-related to gender role, inequality, gender violence, participation of women in decision making, and lastly, within the topic “empowerment” women were asked about the role of women as agents of change. (See interview guideline in the Annex).

In Figure 16, the thematic topics were organized by the number of interviews that mentioned these topics. The bigger the size and the darker the colour represent the higher number of interviews coded under these topics. Furthermore, inside the parent theme topic “vulnerability factors”, participation and gender roles were coded in 6 interviews each. Inequality in 4 interviews and gender violence in 2. On the other hand, empowerment was coded in 7 of the 8 interviews.



Figure 16 Thematic topics presented by the number of interviews coded. Source: Zavala, 2021

A word map (Figure 17) was also generated to review the relevance of the words mentioned in the interviews, while codes are not necessarily the words mentioned by the interviewees but the content or intention of their speech.



Figure 17 Word cloud from interviews. Source: Zavala, 2021

## 5.2. Analysis

As was previously mentioned, the method chosen for analysis is methodological triangulation. Referred by Patton (1999) uses multiple data sources in qualitative research to develop a comprehensive understanding of a phenomenon, in this case, the analysis of interviews, questionnaires and literature review (Table 3).

**Table 3:** Triangulation of data sources. Description and number of sources analysed. Source: Zavala, 2021.

Method	Participants	Number
<b>Semi-structured interviews</b>	Women that are a part of collective organization from the area of study, government representatives linked with gender and environmental topics.	8
<b>Questionnaires</b>	Population from the area of interest	21
<b>Literature Review</b>	Papers found following the search criteria explained in the methodology.	14

For organizational reasons, the triangulation analysis is structured in thematic topics. These topics are the same thematic topics that emerged from the literature review and the interviews related to the research questions and the questionnaires. Figure 18 shows the thematic topics that organize the triangulation analysis of the questionnaire, literature and interviews.

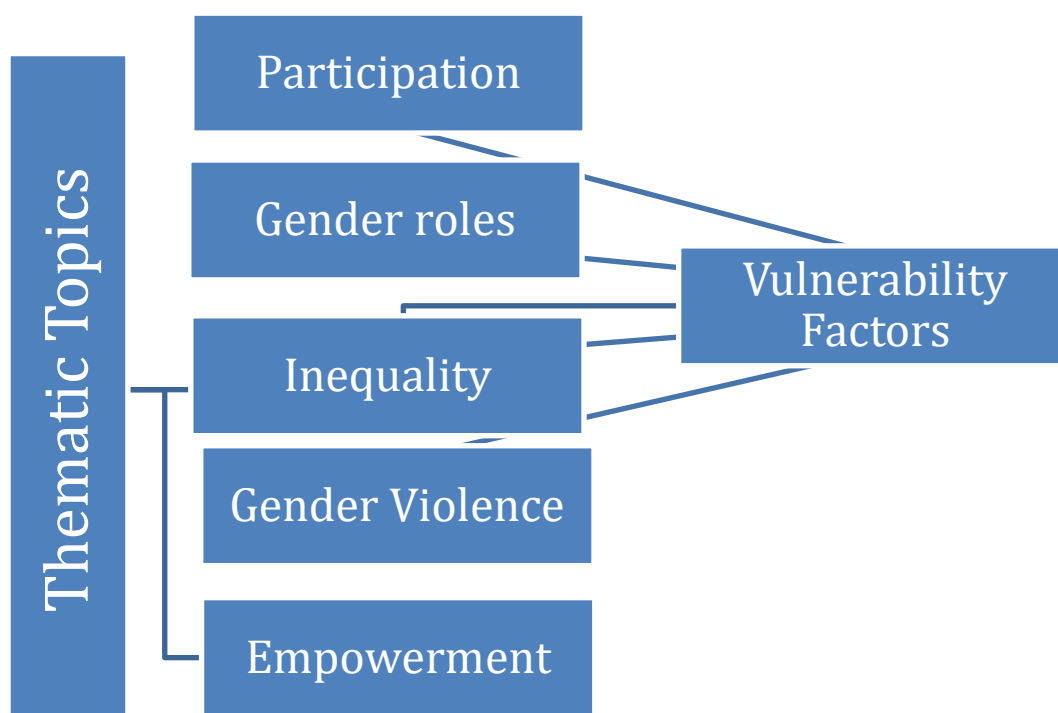


Figure 18 Emergence of thematic topics of analysis- Zavala, 2021.

### 5.2.1. Thematic topics

This section organizes the analysis in the thematic topics previously introduced (Figure 18) showing the relevance of the factors that influence vulnerability and answer the research questions.

#### Participation

The domination of men in most institutions concerned with climate change and adaptation policy and actions could increase the vulnerability experienced by women due to the lack of inclusion in these critical decisions (Dube, 2014). In the context of Buenos Aires, interviewee 4 from the cooperative "Madre Selva" agrees that there is a misrepresentation in terms of gender and class."

*"Although the voice is there, the leading role is still not there. There are too many men speaking on our behalf. Moreover, I say this not only in terms of gender but also in terms of class".*

In a case study of Bangladesh, Tanjeela and Rutherford (2018) identified that the lack of participation of women at a leadership level in climate change programs results in an unequal power relationship between men and women, this gender power structures generate a male-biased environment that discourages women's involvement.

Moreover, a case study of different cities in the Hindu-Kush Himalayas reminds women's limitations in a patriarchal society (Goodrich et al., 2019).

*"Women are conditioned to remain at home and not participate, or to wait for men to accompany them to most activities taking place in the public space."*

## Gender Roles

Interviewee 1, part of the government of Buenos Aires, expressed that:

*"The time that women dedicate to tasks assigned to them by "social mandate" may mean that women cannot occupy part of their time with other educational and training activities of their own and this may generate, in the medium term, not participating in the areas where decisions are made or where programs, plans, and projects are planned."*

Furthermore, in the case of Buenos Aires, Interviewee 4, a representative of "Madre Selva cooperative," believes that gender roles limit the opportunities of women:

*"Women usually suffer greatly due to the passive place given to women in society."*

Besides, the overburden of women with domestic and community tasks with a double working day creates a ceiling on what they can achieve. As expressed by interviewee 7, from the movement of excluded workers (MTE):

*"Women have a double working day, domestic work, care tasks, responsibility in their communities that demand a lot of energy and time. Men usually occupy the spaces of power. It is difficult for the female companions to prioritize the instances of political discussion because that implies running away from other spaces in which they are necessary. Moreover, there is a strong sense of responsibility and sometimes even insecurity of occupying spaces of greater power, such as speaking in public to take the floor, which is more complicated".*

Evidence presented in the literature argues that women are responsible for domestic activities and as caregivers in several urban contexts, which implies an extra burden to their daily tasks, limiting their participation in communal activities. In a case study of the Amazonian city of Iquitos, Peru, women were found more vulnerable due to the caring tasks that confine them to their homes, limiting their mobility making them more vulnerable to climatic extremes (Ramirez, 2016). Additionally, a global study presents evidence that women face a higher risk of infections as they must take care of children and old, sick family and community members (Reckien et al., 2017).

Concerning a case study of Bangladesh (Tanjeela and Rutherford, 2018), the significant barrier limiting participation in extra-household activities faced by women is the burden of domestic tasks and the lack of cooperation from other family members. Moreover, another case study from the same country states that women have less access to ventilated public and private spaces due to gender constructions, making them more vulnerable to heatwaves (Jabeen, 2014).

Regarding the interviews of the case study of Buenos Aires, all agreed on the extra burden created by responsibilities related to domestic life and care activities, on the words of interviewee seven from the movement of excluded workers (Mte):

*"Women have to fetch water in a faraway place. Alternatively, if kids get sick from living in contaminated places it also has an impact on female lives since women generally take care of the children."*

Studies on urban areas show that women spend several hours queuing for water, which reduces their social participation or opportunities for economic activity (Brody et al., 2008).

The literature agrees that women who take the role of caring for the family, and community, are usually in charge of the supply of water and food for the family, resources, and stability (Goodrich et al., 2019; Porio, 2014; Ramalho, 2019; Ramirez, 2016; Reckien et al., 2017; Tanjeela and Rutherford, 2018). In a study by Dube (2014), women were reported to work harder than men to sustain household food security due to their role as food suppliers. Moreover, as mentioned before, after a flooding/landslide/storm event, women face malnutrition due to the gender diet hierarchies (Reckien et al., 2017).

Regarding water supply, water scarcity is likely exacerbated with climate change; women are responsible for water fetching in their communities and homes. This resource shortage might result in more time and distance for finding water and may expose women to conflict and diseases (Dube, 2014; UNDP, 2013a). Consequently, leaving less time for education and income generation is also a problem in Buenos Aires. As stated by interviewee 7, representative of the MTE:

*"For example, not having drinking water is related to domestic life, and women have to fetch water in a faraway place."*

Wright and Chandani (2014) suggested that in extreme weather events resulting from climate change, women are more likely than men to lose their livelihoods due to their traditional roles, social norms, and power structures (Wright and Chandani, 2014).

## Inequality

Most respondents perceived vulnerability with an intersectional lens that relates class and socioeconomic characteristics to gender. As expressed by interviewee 8, sociologist and part of the Buenos Aires government:

*"In the city, the most impacted women are the poor women who are in the neighbourhoods, in the slums, migrant women, racialized women are women who suffer different functions of violence... the most vulnerable populations are those women who are discriminated against because of their social class, skin colour, ethnic origin."*

Interviewee 7, part of the "movement of excluded workers" of the south of Buenos Aires, agrees that women and diversities are: "the primary victims". Adding to this perception the Interviewee 4, part of a cooperative organization "Madre Selvas," agrees that inequality is the main problem

*"At Madres Selva, we say that the main environmental problem is inequality. Furthermore, it is inequality in its most complex sense: class, but also gender."*

The unequal gender relationships prevent women from getting an education and getting involved in decision-making and society. Cases from the literature reviewed from the urban context in Ghana, Bangladesh, Peru, and Himalayas agreed on this unequal power relationship and representation of women. As an example found in literature, in the case of Bangladesh (Tanjeela and Rutherford, 2018), women receive lower wages than men. Moreover, women's mobility is controlled by male family members. Usually, husbands make the economic decisions around women's health and employment issues.

Likewise, in the case study of the Himalayas is stated that the discriminatory social norms as lack of ownership, education, early marriage, are the barriers against women's mobility and economic empowerment (Goodrich et al., 2019).



Women often receive less education and are excluded from political and household decision-making that impacts their lives (UNDP, 2013a). A study that involved Pakistan, Bangladesh, and India showed that women had lower incomes than men, had lower education, and lower participation in decision-making (Patel et al., 2021). As mentioned, access to education empowers and gives the ability to read and interpret critical information to adapt to climate change (Owusu et al., 2019b), giving male counterparts an advantage.

Moreover, a global study states that women face malnutrition in the event of flooding, landslides and storms, due to gender diet hierarchies affecting their health and well-being (Reckien et al., 2017). Studies show that women are more likely to die in a disaster due to gender differences in their capacity to cope and lack of access to information and early warning. For example, women accounted for 61% of fatalities caused by Cyclone Nargis in Myanmar in 2008, 70–80 % in the 2004 Indian Ocean tsunami, and 91 % in the 1991 cyclone in Bangladesh (UNDP, 2013b). Moreover, in Peru, more women were found to be affected by the flooding, increasing their mortality and morbidity (Ramirez, 2016)

## Gender Violence

There is evidence that women are exposed to higher risks of violence due to gender. Some testimonies from Buenos Aires consider women with an intersectional approach more vulnerable due to this fact, on the words of interviewee 8 part of the program of gender and habitat of the City of Buenos Aires:

*"...in the city, the most impacted women are the poor women in the neighborhoods, in the slums, are migrant women, racialized women are women who suffer different functions of violence than cannot be covered by only feminism."*

Adding to this, interviewee 5, one of the leaders of the MTE, agrees that:

*"We are always the more vulnerable group since we suffer gender violence, we are in charge of the caring of our sons, and we have the responsibility of going out to work."*

Furthermore, in cities of the Global South, women are more prone to suffer gender-based violence from a non-partner and less likely to report it than their rural counterparts (McIlwaine, 2013). This greater exposure to gender-based violence is due to informal settlements' marginal environment, such as the lack of toilets, negatively impacting women's health and well-being (Gómez et al., 2007). Women are forced to wait until night-time to relieve themselves increasing the risk of abuse (FISHER, 2006).

A woman living in Villa 31 bis Slum (Buenos Aires, Argentina) states regarding her safety and the social capital that (Gómez et al., 2007):

*"I came to Buenos Aires all by myself, no husband or family, looking for better living conditions. The worse part was finding a place to live. Finally, I rented a room in a crowded house in the oldest part of the slum. At that time, safety was one of my biggest concerns. As a woman, I feared something could happen to me all by myself. However, I immediately became friends with other women who helped [me] get a job and a better-kept company. The support from other women and friends was essential to get through"*

Moreover, a higher level of abuse and sexual violence has been reported by teen girls after disasters, related to the lack of privacy in this harsh situation. Also, a literature review by Reckien identified the risk faced by women in these temporary accommodations/shelters (Reckien et al., 2017).

## Empowerment: Women as agents of change

Globally, women are crucial actors for adaptation, mitigation, and rehabilitation responses presented in the literature review from the Global South, including Asia, Africa, and Latin America. Giving tools and space to women is crucial for a positive change towards an inclusive future. As stated by interviewee 5, leader of the MTE:

*"Women have a central role in social movements as in political and environmental sectors. Now that we are heard, this is an important step. Women proved to have the transformative capacity that is needed. We are organized; we build nets between each other. We occupy sectors that have not been filled before. It is essential to have more female participation for the change to be permanent and inclusive."*

Agreeing with this, interviewee 8, a feminist sociologist of the government of Buenos Aires, thinks that the inclusion and empowerment of women have a positive collective impact on society:

*"Participation of women is very significant because when women are organized, in a neighborhood group, an association or a social movement, this is reflected in improvements both in their life and in the life of the family and the community because the work of women is linked to the sustainability of life, is collective, it is not individual, so the whole network is powerful, the community fabric that she strengthens, then to be able to influence institutional public policy. The fact of being organized represents a possibility of personal, political and collective change."*

Evidence presented in a study from Peru found that women were crucial actors of adaptation and response in times of climatic crisis using traditional medicine and organizing the collective work, as communal kitchens, to sustain the community (Ramirez, 2016).

The interviewees agreed that a gender approach should be part of the design and implementation of mitigation actions against climate change, as mentioned by the interviewee 1 part of the Buenos Aires Government:

*"Mitigation actions for climate change should be thought, planned, debated, and carried out with the public. In my opinion, actions that lack a gender vision are biased, and their effectiveness will be less".*

In a case study of Ganha, Bangladesh and Sri Lanka it was stated that women played essential roles in mitigation, rehabilitation, caregiving, and rebuilding during disasters (Aladuwaka and Momsen, 2010; Enarson et al., 2018; Nasreen, 2000). For example, women have been found to meet evacuation orders that help mitigate the impacts of disasters on their households (Bateman and Bob, 2002; Enarson, 2006). Aladuwaka and Momsen (2010) argue that as responsible for the domestic environment, they are usually the first to notice changes and to activate preparatory measures (Aladuwaka and Momsen, 2010). Moreover, households that faced natural disasters in Asia could survive because of women's tasks and coping mechanisms (Nasreen, 2000).

It is suggested that women are agents of change (Butler et al., 2016; Habtezion, 2016; Patiño Jaramillo, 2017) opposite to the dominant assumption that vulnerability is understood as victimization and passivity capacity building of women that led them to overcome and transform their reality.

### 5.2.2. Summary of the triangulation of the findings

This analysis has provided a better understanding of the factors that influence gender vulnerability to climate change in the Global South, with a special focus on a representative case study of Latin America. This case study from Latin America is relevant because it advances knowledge on a gap in research. It was found through the literature review that there is an important lack of studies on the area of gender, climate change and urban environments in Latin America.

Moreover, the focus of this study was on poor urban populations, limiting the scope of analysis with an intersectional perspective to women. Furthermore, this section allowed us to understand, but also to analyse how vulnerability is defined, constructed and interpreted in the Global South with a focus on Latin America.

To reinforce the internal validity and avoid bias, a methodological triangulation (Yin, 2014) was applied, paying full attention to the collection, analysis and interpretation of data (Merriam, 2009).

The methodological triangulation chosen was to triangulate three methods: interviews, questionnaires and literature review. The analysis was organized by the thematic topics, mentioned previously. These thematic topics reveal the factors that influenced vulnerability and guide us to answer the research questions.

In summary, the analysis of the three data sources showed that gender vulnerability, in the context of analysis, is influenced by five main factors: gender roles, participation, inequality, gender violence and a positive influence is identified from the empowerment of women.

Table 4: Analysis of the literature review and the interviews by thematic topic.

TOPICS	Number Papers	Papers	Countries	Interviews
Participation	4	(Goodrich et al., 2019; Hanson, 2016; Owusu et al., 2019b; Tanjeela and Rutherford, 2018)	Hindu-Kirsh Himalaya, Bangladesh, Mexico, Ganha.	6
Gender roles	13	(Gaisie et al., 2021; Goodrich et al., 2019; Hanson, 2016; Hudson et al., 2021; Kher et al., 2015; Mason and Agan, 2015; Owusu et al., 2019b; Patel et al., 2021; Porio, 2014; Ramalho, 2019; Ramirez, 2016; Reckien et al., 2017; Tanjeela and Rutherford, 2018)	Peru, Mexico, Bangladesh, Philippines, Pakistan, India, Vietnam, global, Ganha, Hindu-Kirsh Himalayas	6

<b>Inequality</b>	11	(Gaisie et al., 2021; Goodrich et al., 2019; Hanson, 2016; Kher et al., 2015; Owusu et al., 2019b; Patel et al., 2021; Porio, 2014; Ramirez, 2016; Reckien et al., 2017; Schofield and Gubbels, 2019; Tanjeela and Rutherford, 2018)	Peru, México, Bangladesh, Tanzania, Ganha India, Pakistán, Philipines and Hindu-Kirsh Himalaya,	4
<b>Gender violence</b>	5	(Goodrich et al., 2019; Patel et al., 2021; Ramalho, 2019; Reckien et al., 2017; Schofield and Gubbels, 2019)	Philipines, Tanzania, Hindu-Kirsh Himalayas, global, Bangladesh, Pakistan, India	2
<b>Empowerment</b>	6	(Gaisie et al., 2021; Goodrich et al., 2019; Hanson, 2016; Ramalho, 2019; Ramirez, 2016; Tanjeela and Rutherford, 2018)	Peru, Mexico, Bangladesh, Ganha ,Global, philipines, Hindu-Kirsh Himalaya	7

Firstly, a relevant factor found to influence vulnerability is “gender roles”, resulting from social constructions that influence how women and men experience life (UNEP, 2016). This topic was predominant in 13 of the 15 papers reviewed in the literature (Table 1) and coded in 6 of the 8 interviews (Table 2). The case study of Buenos Aires presents valuable testimonies from professionals who are part of the government of Buenos Aires and female leaders from grassroots organisations that refer to this topic as an important factor influencing the vulnerability of women. As shown in the analysis, gender roles influence the daily responsibilities of women, overburden them with caring and community tasks that limit what they can achieve in their professional and private life. Cases from the literature review agree that this role of caring is related to the supply of food and water for the family and is a factor that limits the education, income generation and empowerment of women. Moreover, this topic was relevant in the questionnaires, with more than 80% of the respondents being responsible for the household care after their working hours (Figure 11) and 50% responsible for the care of an old or disable person, finding themselves overburdened with extra responsibilities daily.

The second factor identified as relevant is the lack of participation of women, this concerns the inclusion of women in decision making and power positions. In the interviews, this topic was relevant in 6 of 8 interviews and mentioned in three papers of the literature review. The domination of men in most institutions, concerned with climate change and adaptation policy can increase the vulnerability experiences by women due to the lack of gender perspective (Dube, 2014). Clearly, the topic is predominant in the case study of Buenos Aires, showing an insight into the contextual relevance of the lack of participation of women in Latin America and a need for further research on this area.

A third factor identified as influencing vulnerability is inequality, an outcome of socioeconomic factors, like education, class, and race that intersects with gender influencing the relationship

with climate change (Vinyeta et al., 2015). In the case study of Buenos Aires, the topic was found relevant in 4 interviews, where the importance of inequality intersects with poverty, class, education and gender, increasing the marginalization of women. Additionally, the topic of inequality was found relevant in 10 papers reviewed from Peru, Mexico, Bangladesh, Tanzania, India, Pakistan, Ghana, the Philippines and the Himalayas. In this literature, inequality is related to unequal gender norms, access to education, gender gaps in unequal salaries and property rights. Furthermore, the vulnerability of women is reflected in the unequal distribution of food in the case of Tanzania (Schofield and Gubbels, 2019) or the malnutrition due to hierarchy in a global case study by Reckien (Reckien et al., 2017) and the lack of awareness and education identified by Patel in South-east Asian cities (Patel et al., 2021).

Furthermore, the fourth factor that influences women's vulnerability is gender violence. As mentioned, violence against women is manifested in physical, psychological and sexual forms. This is present in all parts of society; class does not distinguish gender violence but is aggravated with poverty. Women and girls that live in poverty face multiple forms of discrimination and, as a result, face an increased risk of violence and domestic partner violence, lacking options to leave this situation due to absence of income and resources. This topic was mentioned in 5 papers of the Global South and coded in 2 of 8 interviews. The statements from Buenos Aires highlighted the increased vulnerability experienced by women for being the most impacted by gender violence. On the other hand, literature from Tanzania, Bangladesh, India, Pakistan and the Philippines mention the relevance of this topic and how climate change often exacerbates violence suffered by women.

The fifth thematic topic "empowerment" was identified as a positive factor influencing vulnerability. This topic was coded in 7 of 8 interviews stating the relevance of the case study. In Buenos Aires, this topic was related mainly to the participation of women in social movements and grassroots organizations, and the benefit of building a network of women that increased their social capital. As mentioned, in the questionnaires, almost 50% expressed that through their involvement in this group, they had the chance of accessing education or capacitation. Also, it increased their friendship circle and social capital. Additionally, 33% stated that their quality of life improved and they felt empowered by the inclusion in decision making and consequently got a better salary. On the other hand, the reviewed literature mentions this topic in 5 articles from Mexico, Peru, Bangladesh, the Philippines and Himalayan cities. The literature highlights the important role of women as agents and leaders of the adaptation strategies against the negative impacts of climate change.

## 6. Discussion and conclusions

Gender vulnerability to climate change is not an intrinsic consequence of women as a group, it is rather the intersectional relation of gender with other socioeconomic and cultural characteristics that put women in the position of vulnerable in front of climate change.

This thesis departs from the hypothesis that in the context of climate change, women are more vulnerable due to socioeconomic aspects and gender roles. To better understand gender vulnerability the scope is on urban areas of the Global South with a focus on Latin America.

As stated in chapter 2.6, this thesis departs from the conception that urban areas are a main actor in the climate change context, since is estimated by the United Nations that cities are responsible for 75% of global CO<sub>2</sub> emissions and that population, jobs and assets are concentrated in cities. Due to the exponential growth of urban areas, in 2018 it was estimated that more than 50% of the global population was residing in urban settlements projecting an increase to 68% by 2050 (Danan, 2019). Consequently, this rapid unplanned growth in developing regions generates an increase in informal settlements (Revi et al., 2014; UN-Habitat, 2020; UN-HABITAT, 2008) estimated by 2018 to contain 1033.546 million people globally (UN-Habitat, 2020).

The effects of climate change projects to exacerbate challenges already present in cities like poverty, inequality and marginalization. As mentioned before, populations will not be affected equally by climate change; the socioeconomic disadvantaged and marginalized people are in a worse situation to confront climate change (IPCC, 2014). Consequently, populations that reside in informal settlements will be impacted worst due to their lack of resources to cope (IFRC, 2020; Levy, 2003; Revi et al., 2014; UN-HABITAT, 2011; UNISDR, 2009)

In this thesis, vulnerability is understood as a pre-existing condition before the hazard occurs, a result of socio-political and economic processes (Joakim et al., 2015). To understand vulnerability with a gender perspective, this thesis argues that it must be understood with an intersectional approach considering the socioeconomic factors that shape gender vulnerability, avoiding the homogenization of the term (Lykke, 2009; Nightingale, 2006; Osborne, 2015). With this perspective, the focus of this study is on poor urban female populations, considered with higher vulnerability due to gender roles and unequal distribution of rights, opportunities, resources, and power (Aguilar, 2009; Demetriades and Esplen, 2009; Levy, 2003; Oxfam, 2010; UN-Habitat, 2020)

To clarify and discuss this topic, this thesis poses two research questions which will be discussed below:

1) What factors are associated with gender vulnerability to climate change in urban environments of the Global South? 2) How is gender vulnerability experienced in Latin America?

This study advances knowledge on the factors that influence gender vulnerability to climate change in urban areas of the Global South with a deeper insight into the experience of vulnerability in Latin America.

Regarding the first research question, this study exposes that gender vulnerability in urban areas of the Global South is associated with five relevant factors, namely: “gender roles”, “participation”, “gender violence”, “inequality”, and “empowerment”. Furthermore, after the systematic literature review and the analysis of data on the Global South, a clear prominence of the factor “gender roles” followed by “inequality” and “empowerment” was found, with “inequality” and “gender roles” being present in more than 70% and more than 90% of the papers reviewed (as showed in table 2, chapter 5.1.2).

Concerning gender roles, the relevance as a factor influencing vulnerability is clear in the literature reviewed. Culturally constructed roles are associated with how genders experience vulnerability to climate change. Different papers, (presented in Table 3 and 4) showed that

women invest extra time in household activities and caring tasks consuming energy and time consequently un-attending other activities that could provide profit, education and capacity building for them (Kher et al., 2015; Mason and Agan, 2015; Owusu et al., 2019b; Patel et al., 2021; Tanjeela and Rutherford, 2018). Respecting inequality, it is present in 70% of the literature reviewed as a factor of vulnerability in the Global South. Some authors argue that women have a higher vulnerability because they represent a larger proportion of the poor population (Tanjeela and Rutherford, 2018), have a lower level of awareness and access to education (Goodrich et al., 2019; Patel et al., 2021) and they face malnutrition due to diet hierarchies (Reckien et al., 2017; Schofield and Gubbels, 2019). Moreover, women migrate with their children to cities without an extra economic support undermining their resilience (Gaisie et al., 2021). Regarding empowerment, it is found in more than 40% of the literature reviewed, the research presents evidence that it is a crucial factor to reduce the vulnerability of women to climate change. In this review, some authors argue that women are crucial agents of change and the construction of adaptation strategies (Goodrich et al., 2019; Hanson, 2016; Ramalho, 2019; Ramirez, 2016; Tanjeela and Rutherford, 2018).

In this study, Buenos Aires is acknowledged as a representative of the Latin American urban context due to its relevance as a megacity, regional economic hub, growing population and vulnerable and informal areas within the city. As aforementioned, to answer the second research question a triangulation methodology was applied, enabling the study on the perception of vulnerability in Latin America. Due to this, it is possible to determine that gender vulnerability in Latin America is experienced similarly to the Global South in certain aspects that will be outlined below.

As far as the second research question is concerned, the Latin America case study supports the relevance of the five factors associated with vulnerability. The factors, above-mentioned, were found significant in most interviews and questionnaires. A major prominence of certain factors was observed, suggesting relevance in what is experienced by the population. Similarly to the Global South review, the Latin America case study agrees on the significance of “gender roles” in women's life due to the extra burden of domestic responsibilities. Additionally, gender roles reduce the available time of women to engage in income-earning activities and to build adaptive capacities (Owusu et al., 2019b) and also impacts their capacity to adapt to climate change (Sellers, 2016). This agrees with the statement by McKinley et al. (2016), that the social role of women in many countries can constraint their abilities to adapt to climate change and that their responsibilities relating to childcare, water collection, and cooking, fuel collection often enhance their sensitivity to climate change.

Furthermore, in the Latin American case study, “participation” is likewise a relevant factor with 75% of the interviews highlighting the importance of the involvement of women in power roles and at the leadership level, and the impact that the lack of representation of women has on their vulnerability. The lack of representation of women results in an uneven power relation among women and men. Latin America has made an important shift in the environmental and climate policies, including gender considerations in 100% of the 18 NDCs presented (IUCN, 2021). This reaffirms the relevance in the context of increased participation of women in climate change policies and adaptation measurements.

Likewise, in the Latin American case study “empowerment” was a predominant factor with more than 80% of the interviews and the questionnaires agreeing on the positive impact on women's livelihoods. Above all, this relevance of empowerment in Latin America is predominant in interviews and questionnaires and can be interpreted as prevalent due to the importance of social feminist movements (Safa, 1990). There is a strong tide in the Latin American feminist movement in the 21<sup>st</sup> century that has its own identify, this movement claims for decolonization and empowerment of the native populations of the region (Miñoso et al., 2014), manifested in the social movements in favour of abortion, sexual rights, economic gap, and against femicides (Revelo, 2021). This does not mean that “empowerment” is not relevant in the Global South, only that there is a lack of literature on the topic in the whole area.

A report from the IUCN (2021) states that Latin American and the Caribbean (LAC) has the greatest percentage of NDCs that characterise women as stakeholders (56%) and as agents of change (33%).

Methodologically, the research questions were addressed from a qualitative approach, through the triangulation of three sources of data. This allowed the comparison and cross-check of the data and enhances the internal validity of our study.

Through this analysis is concluded that Latin America's perception of gender vulnerability to climate change agrees with the Global South literature in the identification of five factors associated with vulnerability. Similarly, the factor that was found predominant in the case study, questionnaires and interviews, was "gender roles", agreeing with the literature review of the global south. This confirms the importance of further research on the influence of gender roles and caring tasks assigned to women and the impacts that this time-consuming job has in the adaptation and empowerment of female populations.

Therefore, it can be established through the analysis of three sources that in the Global South the factors that are associated with gender vulnerability to climate change are the thematic topics identified in this study: "gender roles", "lack of participation", "gender violence", "inequality" and empowerment". All these factors were found relevant in the literature of the Global South, in a diversity of countries from Asia, Africa to Latin America.

Above all, an important observation of this research is the lack of literature on this topic in the Global South and Latin America, with only 14 papers found and only two of them focused on Latin America in the topic of gender vulnerability in urban areas to climate change. There is a need for further research due to the relevance of urban environments and the interlinked gender vulnerability to climate change.

As a result, it is concluded that it is imperative for decision-makers to consider a gender-sensitive and intersectional approach to formulate and implement appropriate adaptation measurements. The findings of this thesis show the prominence of gender roles as a factor associated with gender vulnerability to climate change, moreover the significance of the five factors in the Global South and Latin America.

## 6.1. Limitations

It is important to underline that this thesis had limitations due to time and resources constraints. Respectively, findings regarding vulnerability to climate change with gender perspective focus on the cities of the Global South that resulted from the systematic literature review but does not explore each city in detail. Due to time limitations, it was not possible to research in detail a more diverse range of countries and cities. Consequently, in this thesis an assumption that Buenos Aires is representative of Latin America was made, justified for its relevance as a megacity and an economic hub.

Moreover, it was not possible to explore in detail the ways gender roles influence vulnerability in different countries of the Global South due to cultural, political and social differences. This study provides meaningful insight into the Latin America case study and a way forward to build more equal societies and prevent the overburden that is experienced by women due to caring and gender responsibilities.

Regarding the data collection, questionnaires had fewer respondents than expected, with only 21 participants. An essential part of every research project would be to manage the questionnaires personally; introducing the topic and conducting it face to face. This is more straightforward, especially with the focus group being vulnerable populations with a lack of education and access to technology. However, due to the context of COVID-19, in Argentina and especially the city of Buenos Aires, it was impossible to do this on-site. The data collection of the questionnaires was carried out through grassroots leaders that volunteered to distribute face to face questionnaires and also through the internet. The grassroots facilitate the



distribution since they worked in the neighbourhoods and had close contact with the population under study.

The pandemic brought some unexpected limitations, summed to the fact that the study population was marginal, poor, or extremely poor and in most cases lacking education and access to technology making it complicated for them to access and complete an online questionnaire for lack of connectivity. Moreover, it was expressed by several leaders of grassroots organizations that due to the covid pandemic, people were isolated and had other vital concerns, and due to this isolation, the leaders were not able to distribute and help with the completion of the questionnaires as planned. Nevertheless, the data gathered through the responses of the questionnaire is relevant and sufficient to give a contextually grounded contribution of the perception on the topic of climate change and vulnerability of women that live in a situation of vulnerability in the city of Buenos Aires. As mentioned, due to the lack of studies on the area of Latin America, these questionnaires are an important foundation to fill the gap regarding vulnerability gender and climate change in urban environments. This data provided important insights to further comprehend the reality of vulnerable populations from this megacity, where the literature regarding this topic is scarce, suggesting an opportunity for further research on this area.

Moreover, due to time constraints, and limited access to data, the research left out gender diversity populations (LGBTQ+), focusing on binary data, limiting the scope of analysis. Further research on these limitations would be recommended in the next section of the thesis.

## 6.2. Recommendations for additional research:

Despite the relevance of the topic on gender vulnerability to climate change in urban environments and the growing literature, there is still a lack of knowledge on the area. There is a need for further research on this important topic, the development of knowledge is essential to reinforce the adaptation and mitigation responses to climate change.

The research on gender vulnerability to climate change in urban environments focuses mainly on sub-Saharan Africa, South Asia and less is known about gender climate change vulnerability in Latin America. Additional research that focuses on this area is important, in order to prevent generalization, it would be interesting to compare different cities of Latin America and the Global South to further understand what factors influence vulnerability in other urban contexts. Additional comparative national and multi-country studies would provide a greater intake of how climate change vulnerability varies in different settings, allowing a comparison between regions. Moreover, it is considered that the incorporation of a more quantitative analysis of gender and climate change would potentially improve the generalizability of the data and the replication of the study.

Further research locally could focus on the area identified as vulnerable in the city of Buenos Aires and aim for a larger response on questionnaires assisting them face to face and including male and other diversities LGBTQ+ communities on the focus group.

As mentioned in this study, the role of women as agents of change is relevant in the context of climate change, additional studies on the key role of women in community base adaptations would be interesting to further understand their role in adaptation under climate change scenarios in the Global South. This would also be relevant to guarantee that their knowledge and skills are not excluded from policy and political climate change agenda.

Another topic for further research would be to conduct a similar study in the United States, Europe or Australia to evaluate disparities in different settings. There is a lack of studies since it is assumed that gender does not play a role in vulnerability of women or girls. Nevertheless, limited studies show the opposite.

This further research that aims at filling the gaps in knowledge on gender and climate change would contribute to the development of more appropriate policies that include all the diversities

that coexist in the city. The focus on climate vulnerability is important to ensure more gender-equitable adaptation policies and outcomes to climate change.

There is a need to strengthen the equal participation of women in all the diversity of processes of decision making, improve the access of girls and women in all their diversities, to technology and climatic knowledge.

## Annex

### Literature review search string

Search Engine	Date	Search Terms	Results
Web of Science	01/08/2021	ALL=(Gender or woman) and ( vulnerable or Vulnerability) and (climate change)	77,182
Web of Science	01/Aug	TS=(("greenhouse gas" or "climate change" or "global warming" or "climate variability" or "climate warming" or "flood" or "drought" or "heat") AND ("gender*" or "wom*" or "fem*" or "matern*" or "mother*" or "intersectional*" or "boy" or "girl" or "male") AND ("Vulnerab*" or "susceptibility" or "Exposed" ))	4557
Web of Science	01/Aug	ALL=(("gender*" or "wom*" or "fem*" or "matern*" or "mother*" or "intersectional*" or "boy" or "girl" or "male") AND ( "greenhouse gas" or "climate change" or "global warming" or "climate variability" or "climate warming" or "flood" or "drought" or "heat") AND ("Vulnerab*" or "susceptibility" or "Exposed" ))	5394
Web of Science	01/Aug	KP=(("gender*" or "wom*" or "fem*" or "intersectional*" or "girl" or "male")	650,389
Web of Science	01/Aug	TS=(("gender*" or "wom*" or "fem*" or "intersectional*" or "girl" or "male")	3,916,339
Web of Science	10/Aug	TS=(vulnerab*) AND TS=(("gender*" or "wom*" or "fem*" or "intersectional*" or "girl" or "male") TS=(("greenhouse gas" or "climate change" or "global warming" or "climate variability" or "climate warming" or "flood" or "drought" or "heat"))	1,754
Web of Science	01/Sep	((TS=(GENDER OR WOM* OR FEM* OR GIRL OR INTERSECTIONAL)) AND TS=("Greenhouse gas" or "climate change" or "global warming" or "climate variability" or "climate warming" )) AND TS=(VULNERAB* )	1210
Web of Science	15/Sep	((((( TS=(("GENDER" OR "WOM*" OR "FEM*" OR "GIRL" OR "INTERSECTIONAL" ) AND TS=("Greenhouse gas" or "climate change" or "global warming" or "climate variability" or "climate warming")) AND TS=(VULNERAB*))) NOT ALL=(rural or agriculture or agrarian or farming or farm*))	521
Web of Science	15/Sep	((((( TS=(("GENDER" OR "WOM*" OR "FEM*" OR "GIRL" OR "INTERSECTIONAL" ) AND TS=("Greenhouse gas" or "climate change" or "global warming" or "climate variability" or "climate warming")) AND TS=(VULNERAB*))) NOT ALL=(rural or agriculture or agrarian or farming or farm*))AND TS=(ADAPT* )	213
Web of Science	18/Sep	((((( TS=(("GENDER" OR "WOM*" OR "FEM*" OR "INTERSECTIONAL" ) AND TS=("Greenhouse gas" or "climate change" or "global warming" or "climate variability" or "climate warming")) AND TS=(VULNERAB*)AND TS=(("urban*") NOT ALL=(("rural*" and "agriculture*")))) and 2021 or 2016 or 2014 or 2015 or 2017 or 2018 or 2020 or 2019 (Publication Years) and Articles (Document Types)	95

Table 3 literature review search string-Source: Zavala,2021

### Index of social vulnerability to disasters from PIRNA

IVSD-2015 VERSION. DIMENSIONS, VARIABLES, AND INDICATORS		
Dimensions	Variables	Indicators
Social Conditions	Education	1. Illiteracy
	Health	2. Infant mortality
	Demography	3. Population of 0 to 14 years old. 4. Population over 65 years old.
Habitational Conditions	Housing	5. Critical Overcrowding
	Basic Services	6. Lack of access to a water network 7. Lack of access to sewage
Economic Conditions	Work	8. Unemployed
	Education	9. Educational level head of the family.
	Family	10. Single parents.

Table 4 Index of social vulnerability. Source: Natenzon, 2014

#### Guideline of the interview:

- 1) What experiences in your life that you consider most relevant placed you in the role you now have in an inclusive feminist movement?
- 2) We consider that “Cartoneros”(recycler movements/grassroot organizations/social movements) have a positive and fundamental impact as agents of climate change mitigation. We wanted to ask whom you think has the most significant responsibility of doing something about this issue? What solutions come to your mind that could be inclusive to your movement?
- 3) Regarding gender, do you think inclusion should be central in climate change mitigation actions?
- 4) We know that generalization would be a mistake since there is diversity between men and women in the context of your aggrupation. Do you believe that gender roles impact women of your grassroots / social movement somehow?
- 5) Through your own experience in the field, do you consider that environmental problems distinctly affect women and men?
- 6) Do you consider that gender roles are situating women in a more vulnerable position and why?
- 7) How do you think that being part of a cooperative, social movement changes or impacts women's lives?
- 8) Do you perceive that female representation is currently increasing in political and environmental issues? Do you consider that it would be essential to increase this participation to have a more inclusive change?

Table 5: Dimensions, variables, and indicators of the social index of vulnerability for disasters (Natezon, 2014)

Dimension	Variables	Indicators
Social Conditions	Education	1 <b>Illiteracy</b> : On the one hand, it is related to the capacity to understand slogans, strategies, proposals, etc., in situations of prevention, attention, and response to disasters. On the other hand, it gives guidelines on how much society allocates through

		state actions to improve the educational level of the inhabitants.
	Health	<b>2. Optimal distance to a health centre (2,5 km)</b> Optimal distance or accessibility to a health center (<2.5 km.). The heterogeneous spatial distribution of the supply of health centres generates differentiated accessibility on the part of the population. The right to be able to receive free care is conditioned by the distance the establishment is from your home; particularly for that population that depends on public transport or that only travels on foot. Faced with an emergency or the attention of a basic need, the vulnerability of this population increases with the distance to the nearest health center.
	Demography	<b>3. Population from 0 to 14 years old.</b> <b>4. Population aged 65 and over.</b> They establish a relationship between the total population and the population of social groups with operational and/or discernment limitations that require assistance. Its determination is relevant in operational terms for planning the different moments of the disaster cycle, estimating the number of people in charge of others and their differential capacities in decision-making and concrete actions.
Housing Conditions	Housing	<b>5. Critical overcrowding.</b> It responds to the possibilities of individuals and families to have a home inhabitable conditions. Indirectly accounts for the housing capital available both under normal conditions and to face the catastrophe
	Basic Service	<b>6. Lack of access to a public drinking water network. 7. Lack of access to sewage drains.</b> The lack of these services corresponds to a shared responsibility between individuals (especially for access to sewage) and the State (especially in the presence of public drinking water network). They account for structural situations of minimal conditions that make the right to drinking water and sanitation
Economic Conditions	Work	<b>8. Unemployed.</b> Indicates the number of people without a fixed

		income from formal work, which results in unfavorable conditions to prepare for, face and recover from disasters.
	Head of a family	9. Educational Level of Heads of Household. It is relevant from the point of view of household income because of its direct correlation between educational level and quality of employment/income (at present). It affects the reproduction of pre-existing conditions in your family (in the future).
	Family	<b>10. Households without a spouse.</b> A single spouse in charge of the home implies having to take charge of both the family organization and the care of the children and obtaining income if this puts the family at a disadvantage for everyday life, much more so in extraordinary disaster situations.

## Questionnaires: Gender vulnerability to climate change

### Block 1: Socio-demographic Profile

1. What is your gender identity?
  - a. Women
  - b. Men.
  - c. Trans-Women
  - d. Trans-Men
  - e. Other...
2. What is your Age?
3. In which country were you born?
4. In what province do you live?
  - a. City of Buenos Aires
  - b. Province of Buenos Aires.
5. In what neighbourhood do you live?
6. Do you have children under the age of 18?
7. How many? 1-2-3-4-5-6-7-8-9-10
8. How many people live in your house<sub>[p1]</sub> 1-2-3-4-5-6-7-8-9-10
9. How many Families Live in your house?<sub>[p2]</sub> 1-2-3-4-5-6
10. Do you live with your Partner/Husband?
  - a. Yes-no

11. Are you the head of the family? (Responsible for the main income?)
  - a. Yes-no
12. Are you employed?
  - a. Yes
  - b. No
13. Are you pregnant/breastfeeding?
  - a. Yes-no
14. What is your academic level?
  - a. Primary incomplete.
  - b. Primary Complete.
  - c. Secondary Incomplete.
  - d. Secondary Complete.
  - e. Tertiary/Universitary Incomplete.
  - f. Tertiary/Universitary Complete.
  - g. Other\_\_\_\_\_

#### Block 2: Impact of Climate change in their life

15. Do you know what climate change is?
  - a. Yes
  - b. No
16. What is Climate Change? (Multiple answers)
  - a. Increase of Rains.
  - b. Less rain.
  - c. Abrupt weather changes.
  - d. temperature changes.
  - e. Increase in extreme events.
  - f. Droughts
  - g. More Flooding.
  - h. Less Flooding.
  - i. Fires.
17. Climate change is a problem of the...
  - a. Present
  - b. Future
  - c. Not a problem.
18. Do you consider that climate change has a negative impact on you and your family?
  - a. Yes
  - b. No
  - c. I don't know.

Why? \_\_\_\_\_  
\_\_\_\_\_

19. What climatic impacts affected your life in the past 5 years?
  - a. Floods.
  - b. Droughts.
  - c. Storms/Strong winds.
  - d. Frost.
  - e. Heat waves.

- f. Fires.
20. Have you noticed any changes in the weather or weather patterns throughout your life?
- a. increase in rainfall
  - b. Decrease in rainfall
  - c. The rains are more erratic
  - d. Longer dry spells
  - e. Less frequent floods
  - f. More frequent floods
  - g. More frequent drought
  - h. Less frequent drought
  - i. More frequent heat waves
  - j. Less frequent heat waves
  - k. More frequent storms
  - l. Less frequent storms
  - m. Stronger storms
  - n. More fires
21. Were you affected by a flood? \*
- a. A lot of
  - b. Little
  - c. Very little
  - d. Not
22. How did the flood impact you?
- a. Destruction of my belongings?
  - b. Lack of clean water.
  - c. Lack of food.
  - d. I cannot go to work.
  - e. I don't have access to transport.
  - f. I cannot take my kids to school
  - g. Diseases.
  - h. Other...
23. Have you been impacted by heat waves? (Maximum of 32 degrees, for at least 3 days)
- a. A lot.
  - b. A little.
  - c. Very little.
  - d. No.
24. How do heatwaves impact you?
- a. My pressure drops.
  - b. I got sick
  - c. I cannot go to work.
  - d. I know people that died or got sick.
  - e. Lack of access to water.
  - f. Kids cannot go to school
  - g. Others\_\_\_\_\_
25. Have you been impacted by strong winds?
- a. A lot.
  - b. A little.
  - c. Very Little.
  - d. No.
26. How do you get informed of climatic extreme events? (Heat waves, Floods, Droughts, Strong winds, Strong rains?)
- a. Radio.

- b. Television.
  - c. Internet.
  - d. WhatsApp.
  - e. Community groups.
  - f. Women from the neighbourhood.
  - g. I don't have access to this information.
27. If you have observed or think you will be affected by climate change, have you made any changes to protect yourself, your family or your community?
28. Reasons for not taking adaptation measures to Climate Change
- a. I do not know what to do.
  - b. I have no money to take action.
  - c. I don't see the need to do something.
  - d. I don't have enough information.
  - e. I think the measures may fail.
  - f. I have other priorities.
  - g. Others:

### Block 3: Domestic work and Care responsibilities

29. Are you responsible for the domestic work and care tasks in your family?
- a. Yes.
  - b. No.
30. Do you share this task with someone?
- a. No.
  - b. Everybody helps, but women work more.
  - c. Everybody helps equally.
31. Are you responsible for caring for someone older than 60 years old? Disable?
- a. Yes.
  - b. No.

### Block 4: Community Actions.

32. Are in your neighbourhood any community network? What is the name?
33. Are you involved in a community group of women?
- a. Yes.
  - b. No.
34. If your answer was yes, what is the name?
35. What is your role in this group?
- a. Leader.
  - b. Neighborhood representative.
  - c. Volunteer.
  - d. Other.
36. How did your reality change by participating in this organization/movement/cooperative?
- a. I access education/capacitations.
  - b. Access to a fair salary.
  - c. I feel more represented.
  - d. I am involved in decisions.
  - e. My close circle grew.
  - f. My quality of life improved.
  - g. Nothing changed.



h. Other.

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