# Power, perception, and adaptation: Exploring gender and social-environmental risk perception in northern Guanajuato, Mexico[*]

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## Abstract

This paper examines how gender relations within rural communities in north-central Mexico affect women's perceptions of and responses to environmental and social risks. Several studies currently exist which suggest various reasons as to how people especially vulnerable to the effects of climate change perceive their risks, and how this influences their responses. In this paper, I take a feminist approach to questions of social-environmental risks and adaptation to argue that risk perception is tightly linked to knowledge production, and knowledge production is a power-laden process involving the constant negotiation of resources, responsibilities and knowledge. I base this argument on the results of fieldwork conducted from September 2009 to May 2010 with women residents of two *ejidos* in northern Guanajuato, Mexico. In drawing from feminist political ecology studies, I intend to show how gender, environmental knowledge, risk perception and thus, adaptation are constituted by and embedded in social relations of power.

**Key words:** climate change, feminist political ecology, knowledge, adaptation, risk perception, agriculture

## Highlights

- Risk perception and adaptation are embedded in gendered relations of power
- Gender is embedded in all aspects of knowledge production, risk perception and adaptation
- Examining risk perception, adaptation and gendered power relations can enhance risk reduction and adaptation policy

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## 1. Introduction

Numerous studies show that risk perception is an important determinant of responses to environmental shocks and stressors (Cutter, 1993; Drake, 1992; Kasperson and Kasperson, 2005; Oliver-Smith, 1996, 2002; Schipper, 2006). In the climate change literature, studies that explore the relationship between risk perception and adaptive responses to climate change often find that climate is rarely seen as the most significant threat to livelihoods (Nyantakyi-Frimpong and Bezner-Kerr, 2015; O'Brien et al, 2004; Reid and Vogel, 2006; Westerhoff and Smit, 2009). Other studies argue that socio-cognitive factors, such as higher levels of risk perception, shape how people perceive their capacity and thus, their responses to climate change and other environmental hazards (Burch and Robinson, 2007; Grothmann and Patt, 2005; Grothmnn et al, 2013; López Marrero, 2010). However, while there is a wealth of scholarship that explains how risk perception shapes capacity and response to climate variation, relatively few studies explore how the seemingly mundane aspects of everyday life shape risk perception, which then influences adaptation (see for example Walker et al, 2014). Studies that investigate how everyday life and the daily experience of risk perception and adaptation relate to the commonly gendered dynamics of knowledge production are also scarce (see for example Wangui 2014b).

This paper examines how gendered processes in rural Mexico contribute to women's perception of socio-environmental risk and thus, adaptation. I argue that risk perception and adaptation are fundamentally about knowledge and power; this includes the constant negotiation of resources, responsibilities and knowledge. In the climate change literature, adaptation commonly refers to specific actions to cope with, respond to, or minimize risks posed by a changing climate, as well the broader social, cultural and economic processes that shape these responses. Furthermore,

adaptation and the capacity to adapt is shaped by interactions among actors and environments as well as political, socio-economic and institutional mechanisms at various scales (Eakin et al. 2014; Eakin and Lemos 2010). However, I do not employ the concept to imply a single change in behavior, but rather as an inseparable part of everyday life, encompassing and embedded in the complex relationship between material practices, social relations of power, and environmental contexts. Thus, I do not endeavor to showcase how specific knowledge transfers into specific adaptations, nor do I intend to illustrate women's knowledge as gender-specific. Given the very context and situated nature of knowledge production, some knowledge may in fact be the same regardless of gender, while others differ. Instead, the point is to suggest that before scholars and practitioners can understand what actions people take in response to certain stressors, we must first study how gendered social relations, material practices, and lived realities produce environmental knowledge and risk perception. My approach draws on feminist political ecology and related feminist theoretical traditions to demonstrate how women's environmental knowledge, and therefore risk perception, is constructed through their daily activities and everyday lives, which are largely an outcome of the performance of gender. In doing so, I demonstrate how gender, environmental knowledge, risk perception and thus, adaptation are constituted by and embedded in social relations of power.

The empirical evidence for this paper derives from research conducted from September 2009 to May 2010 with women in two *ejidos*[‡] in Guanajuato, Mexico (figure 1). Utilizing a combination of qualitative methods, including 70 structured interviews and 52 gender resource maps with women from farming and non-farming households, I sought to understand what women know

[‡] Ejidos are agrarian communities that provide for common ownership of land while members have usufruct rights to farm on plots assigned to them.

about and how they perceive climate change and variability[§]. The resource maps were a visual tool to analyze the spatial and gendered access to and control over resources across a variety of spaces and scales (Slocum et al. 1995). Additionally, participant observation and numerous hours spent with smallholders and their families provided insights into the seemingly mundane aspects of everyday life in rural Mexico, as well as a method for triangulation. To get a sense of the primary risks, as viewed by women in agriculture, I facilitated one risk-ranking-and-scoring activity with women from farming households in each *ejido*[**] (Kesby 2000; Quinn et al. 2003; Tschakert 2007). I excluded non-farming families from participating in the risk-rank-and-score activity, as I was explicitly interested in understanding how women's involvement in agriculture shapes risk perception. In fact, the results that form the basis of this paper focus exclusively on the experiences of women in agriculture.

[§]For an elaboration upon the study design, see REFERENCES REMOVED FOR PEER REVIEW.

[**] To complete the activity, participants were first asked to "free-list", or brainstorm, various worries they had experienced in the past year on sticky notes. The group used both words and images to accommodate the differing literacy rates among the participants. Then participants ranked these "worries" from *most*-to-*least* troublesome, with the most troublesome on top. Finally participants indicated the level of harm with a score of 1 (life threatening) to 10 (barely noticeable). To get a better sense of the structural to addressing the concerns that were ranked and scored, we finished the activity by discussing potential solutions to the worries and what was needed to address them.

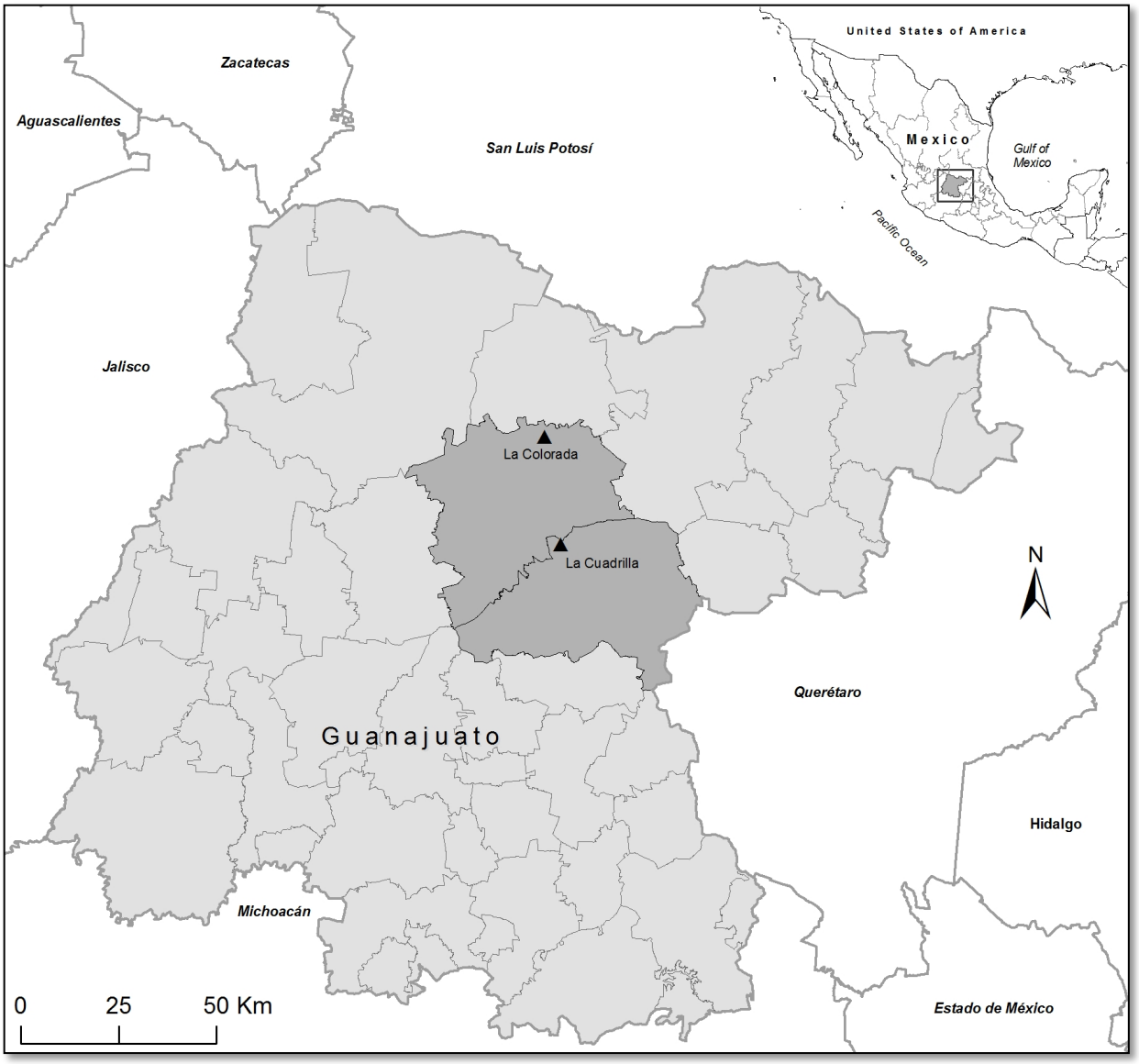


**Figure 1 (here):** Location of the *ejidos* studied in the state of Guanajuato, Mexico. Maps by Gabriela Cuevas García, M.Sc.

This paper merges the results of this study with a conceptual framework that draws on feminist theories of knowledge production, agency and power to understand environmental knowledge production and risk perception. While feminist theorizing is not limited to a focus on gender nor to women's experiences, this particular paper draws on theoretical traditions which suggest that women's lives are an appropriate a starting point for analyzing the power relations and politics

that shape knowledge, risk perception, and adaptation in the face of climatic variability. A focus on women's material practices or their seemingly mundane daily activities, makes agency, or "the socio-culturally mediated capacity to act" (Ahern 2001, 112) visible. Such an examination also makes visible the power structures that provide opportunities and limits for exercising agency. My goal is to infuse feminist theories of knowledge production, agency and power with an empirical study on risk perception and environmental knowledge in Mexican *ejidos*, thereby expanding the utility of feminist theorizing. As such, I hope to build on the small, but growing body of literature that examines the political nature of adaptation through a more theoretically robust examination of how adaptation and the capacity to adapt is mediated by power and knowledge (e.g. CITATION REMOVED FOR PEER REVIEW; Eriksen et al. 2015; Manuel-Navarette 2013; Nightingale 2009; Pelling et al. 2014). A related goal of this paper is to contribute to broader conversations among feminist theorists, political ecologists, and the climate change adaptation literature about how material practices shape environmental knowledge. I also seek to find a common ground between studies which argue for incorporating "local" environmental knowledge, reducing socially produced risks and vulnerabilities, and attending to the mechanisms embedded in places and social relations that produce and structure knowledge, perceptions, emotions, and resource access.

Toward this end, I begin by outlining some of the existing work in the literature that examines questions of risk perception, climate change adaptation and local environmental knowledge. I then elaborate on the work of feminist political ecologists and geographers who demonstrate how gendered subjectivities and environments are co-produced through everyday material practices. This work provides the means by which to not only to think about the material production of

gender, risk, and environmental knowledge, but also to demonstrate how an exclusive examination of the production of women's knowledge and perceptions of climate change risks has a lot to offer risk reduction and adaptation policy and strategies. The hope is that such an approach enhances policies and strategies to build adaptation and reduce vulnerabilities through a focus on agency, power, and knowledge production.

## 2. Adaptation, risk perception and social-spatial relations of power

Current understandings of risk perception come from a variety of disciplines and fields. A hazards approach considers risk perception to be influenced by the type of hazard to which a person is exposed and the perceived severity and frequency of that exposure (Kasperson and Kasperson, 1996; 2005). Socio-cultural framings, on the other hand, argue that risk is also influenced by social and cultural norms about what is harmful, as well as by individuals' tolerance of the harm they are exposed to or anticipate (Crate 2009; Lazrus, 2015; McCarthy et al. 2014; Oliver-Smith, 2002;). Such a perspective suggests that while rural households may be exposed to similar shocks or stressors, the institutional and socio-political context in which the stress occurs may significantly influence their perceptions of risk and climate changes (Eakin, 2006; Eakin and Bojórquez Tapia, 2008).

Other studies have focused on individual socio-cognitive factors that influence adaptation. For example, Frank et al (2011) examined the role that social identity plays in the process of adaptation among coffee farmers in Chiapas, Mexico. Their emphasis on knowledge production centered on how social identity (how a person sees themselves in relation to others, i.e.: "us" and "them") influences perceptions of information and its sources in terms of salience, credibility, and legitimacy. Although the study is insightful with regards of how coffee farmers interpret

information received from various sources in relation to how they perceive their risks, it does not give us any indication of the social relations and processes that shape these identities. An obvious omission in this work is on the gendered and spatial division of labor that is so endemic to daily farm life and how this gendering affects knowledge of farming and perceptions of risk.

Very few of the growing studies of gender and climate change specifically examine risk perceptions. Studies that do explore the gendered dynamics of climate-related risks often focus on disaggregated data sets along sex differences (e.g. Campos at al, 2014; Lujala et al, 2015; McCright, 2010). Such a narrow focus runs the risk of re-producing the binary construction of women as either virtuous, risk averse heroines or as vulnerable victims, while neither of these imaginaries accurately captures the complexity of women and men's lives (Arora Jonsson 2011). In addition, studies that explore gendered processes by disaggregating data reinforce narrow ideas of gender as the comparative differences between men and women, ignoring the complex and intersecting power relations within which gender is produced and enacted. Other studies such as Quinn et al (2003), utilize a livelihoods framework for understanding perceptions of climate-related risks. By analyzing the results of a risk index, generated through risk-mapping activities, their study highlights the heterogeneity of risk perception due to spatial and temporal differences in resource availability, but also in gendered livelihoods. In this study, the authors move beyond simple data aggregation to demonstrate how women's material realities and practices, such as gathering water and property rights, can shape their perceptions of risk. The authors write that, "[T]he risks involved in generating livelihoods can effect women directly through their own livelihood activities or indirectly through the activities of male members of the household" (Quinn et al. 2003, 117).

To delve deeper into theoretical understandings of how women's material realities shape risk perception, I draw on the insightful work of feminist political ecologists. Feminist political ecologists (FPE) have focused on the complex ways that social power, identity, subjectivity, and socio-natures are co-produced and performed across a variety of sites and scales (Nightingale 2006, Sultana 2009, Harris 2006, Hovorka 2006). Drawing on insights from feminist post-structuralism, feminist cultural ecology, feminist geography, and feminist political economy, FPE treats gender as a critical variable in shaping resource access and control (Rocheleau et al, 1996). The work of FPE scholars have identified the need for a focus on gendered relations of power, as opposed to women's roles, and to see these relations as affecting and being affected by rural environmental change (Rocheleau et al, 1996). For example, environmental shocks such as drought can directly shape these relations through the uneven distribution of resources or specific coping strategies. These shocks can also indirectly influence relations such as in the political or discursive or cultural framing of environmental issues that either support or challenge hierarchal relations of power (Leach, Joekes, and Green 1995). A focus on gender relations changes how "we" (scholars, activists, practioners, etc.) understand power, how it affects concepts of nature (human and non-human, cultural and natural, etc.), and how we think about the ability of people to change their lives.

Recent work in FPE illustrates the spatial and embodied practices that constitute gendered subjects (Elmhirst, 2015, Hawkins and Ojeda, 2011). This work follows the poststructuralist turn in feminist and geographic thought to explore how the performance of gender, race, and other categories of social difference, materialize from discursive and material practices that are also

linked to environments and ideas of nature (Mollett and Faria, 2013; Sundberg, 2004; Truelove, 2011; Wangui 2014a). Gender then, as it is utilized in this paper and indeed within FPE scholarship, is conceived as far more than the differences between men and women. It is a dynamic category of identity and social process that shapes roles, responsibilities and characteristics, alongside other intersecting dimensions of power, performed through daily material practices (Bezner-Kerr, 2014). Attention to these everyday material practices provides insights into how subjects produce particular relationships with their environment and how broader relations of power, like gender, shape these relationships.

As I will show, a closer look at the everyday performance of gender in rural Mexico reveals how the institutional and socio-political context, such as the changing context of water management and the gendered relations of power, shape women's understandings of climatic change and variability. And through their daily tasks of providing for the care and maintenance of their families and their communities, women acquire knowledge and skills about social-environmental change that have important implications for adaptation and risk-reduction policy and practice.

## 3. Socio-environmental change in rural Mexico

The two *ejidos* presented in this study, La Colorada (pop. 632) and La Cuadrilla (pop. 398), were purposely chosen based on available data that reflected the agricultural, economic, and climatic characteristics of region. Agriculture in both *ejidos* relies primarily on seasonal precipitation, although several farmers in La Colorada have access to small (one-two hectare[††]), irrigated plots. Located in a semi-arid climate, the average annual precipitation in these *ejidos* ranges from 430mm to 587mm (CONAGUA 2008), which is just at the edge of the rainfall range where

[††] 1 hectare (ha) ≈ 2.5 acres

irrigation is needed[‡‡]. As a result, the *ejidos* in this study present conditions adequate for a 90-day rain-fed growing season, while rain-fed agriculture in the southern Bajío[§§] region of the state is adequate for growing seasons between 90 and 160 days (INIFAP 2005).

Although the state of Guanjuato has been historically known for its agricultural production, it is also known as the second largest consumer of groundwater in the country (Navarro de León, Gárfias Soliz, and Mahlknecht 2005). Since implementing the North American Free Trade Agreement (NAFTA) in 1994, large agribusinesses from the US have relocated several plants to the Bajío region of Guanajuato, with the vast majority comprising the frozen vegetable industry. Firms such as these set up plants to produce principally for the international market and have introduced new water intensive vegetable crops such as carrots, broccoli, okra, and green beans (Hinojosa-Ojeda 1996). Additionally, since 2002, out-of-basin transfers to Mexico City and the state of Jalisco have further reduced available groundwater to agriculture (Lloyd 2004). For example, of 810 families in northern Guanajuato, 62 percent had access to water only six hours each day due to the need to share water with neighboring communities (CEDESA 2007). The result is that small-scale farmers find it difficult to compete with larger commercial farms that use groundwater and irrigation as their principal water source.

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[‡‡] 25mm=1in; 600mm=24in. Regions with 483-610mm of precipitation are considered semi-arid. Irrigation is often required in areas that receive less than 600mm/year

[§§] The *Bajío* region encompasses the fertile southern lowland municipalities of Guanajuato, the lowlands of Queretaro, the northern state of Michoacan and the eastern plains of Jalisco. From the 17th-19th centuries, this area was the principal source of grains for the country (Maganda 2003).

In September 2009, the governor declared the state of Guanajuato a disaster zone as an estimated 90 percent of seasonal rainfed crops were lost due to an El Niño[***] (ENSO) induced drought (García et al. 2009). Farmers in both *ejidos* were deeply affected by this drought, as I will explain. Although droughts have regularly destabilized agricultural production and livelihoods throughout Guanajuato's history (Conde et al. 1999; Endfield 2008; Liverman 1999), climate models predict that the frequency and severity of drought events will increase in water-stressed regions like northern Guanajuato (Conde 2003; Cubasch and Meehl 2001; Liverman 2001). The result is a potential decrease in the region's suitability for seasonal rain-fed agriculture (Conde, Ferrer, and Liverman 2000; Conde et al. 2004; Gay and Estrada 2007). The climatic risks faced by small-scale farmers in La Colorada and La Cuadrilla is only compounded by agricultural policies that significantly altered land tenure and agricultural livelihoods throughout Mexico (Appendini and Torres Mazuera, 2008; de Janvry et al, 1997; Hecht 2010). Furthermore, as the majority of smallholders included in this study lack access to irrigation, the options by which to diversify into high value, cash crops are limited. As access to irrigation is also a highly gendered resource (both between men and women and among women with differing access and rights to land), responses to environmental hazards such as drought, are also gendered (Buechler 2009; Caretta and Börjeson 2015; citation removed for peer review).

As a result of agricultural restructuring in Mexico, as in many parts of the world land use patterns and economic activities have shifted away from small-scale subsistence agriculture and

[***] El Niño Southern Oscillation is commonly defined as a periodic warming of the tropical Pacific sea-surface temperature that causes major shifts in the pattern of tropical rainfall. In central Mexico, ENSO creates a marked decrease in seasonal summer rain, which in turn negatively impacts seasonal rain-fed crops (Magaña et al. 1997).

towards other forms of employment including migration to the US. As a reflection of this trend, the number of men and women occupied in agricultural activities dropped eight percent between 2000 and 2007 (Appendini 2009). The *ejidos* included in this study are no exception to these institutional changes, and as farming in both communities relies primarily on seasonal precipitation, agriculture is primarily a means of food security and a compliment other forms of income. According to the structured interviews conducted as part of this study, the primary occupations in both *ejidos* include mostly subsistence farmers, agricultural laborers, construction laborers, un-paid homemakers, and small business owners (usually small grocery stores). In 2008, remittances from the US to homes in the state of Guanajuato totaled just over 2.3 million; the second highest state recipient of remittances (Banco de Mexico 2009; Masika 2002b). These additional sources of income and public and private transfers to rural households impact the economic and agricultural strategies and the management of economic and environmental risk of rural households. Furthermore, male migration alters the role of women in agrarian households as they often take on more field labor in the absence of a male spouse and also become responsible for investing in and supervising agricultural activities (Beneria and Feldman 1992; Denton 2002; Hunter and David 2009; Masika 2002a; Stephen 1992). At the same time, increased responsibility for the household and fields can also increase the autonomous decision-making of the female head of household (Appendini 2009; Radel and Schmook 2008).

However, only fourteen percent of all interview participants were *ejidatarias*[†††], which masks the number of women who participate in non-remunerated agricultural activities, but who do not

[†††] The federal government defines "agrarian subjects" (*sujetos agrarios*) to be *ejidatarios/as (women and/or men with land parcels and full ejido rights)*, *possessionarios/as* (those who have

identify as 'farmers' (Radel, 2011). This number closely matches national statistics, which find that women *ejidatarias* make up 13.5 percent of all "agrarian subjects" while male *ejidatario*s comprise 57 percent (INEGI 2007). The stark contrast between women and men with titled landholding reflects several aspects of state policy that has historically impeded women's ability to acquire land of the own, as well as inheritance practices within families. However, the decline in small-scale, subsistence agriculture reflects a variety of factors including state favoritism of large-scale agribusiness, land scarcity, and as I will show, the attitudes of young *campesinos*[‡‡‡] that have witnessed their parents' struggles and do not see a viable future in farming. Thus, as an increasingly variable climate poses new challenges for smallholders in northern Guanajuato, there is a critical need to understand risk management in northern Guanajuato that accounts for both the social dynamics and environmental realities of the region.

## 4. Gendered responsibilities and embodied knowledge production

The resource maps depict several daily and seasonal activities of women, in the fields, in the home, and in the community, demonstrating gendered socio-spatial relationships. As I have shown elsewhere, these maps also demonstrate the ways in which women's labor and responsibilities in the fields contribute to knowledge production, the reproduction of this knowledge, and of gendered responsibilities and labor (citation removed for peer review). Doña Alicia's[§§§] experience as the wife of an *ejidatario* was illustrious of the experiences of women who have spent their entire lives in the fields.

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a parcel of land but do not have *ejido* rights), and *avencindados/as* (landless families). So a woman who is married to an *ejidatario*, for example, is not considered to be an agrarian subject by this definition.

[‡‡‡] A person living in a rural area.

[§§§] I use pseudonyms for all names.

At the beginning of the season, she seeds the fields, prepares meals, and de-weeds them twice or three times a season. For the harvest, she first gathers the beans and squash, and then when the corn is dry, she takes off the ears and brings them back to the house to be cleaned. Then she of course mills the corn for tortilla, and prepares the meals with whatever has been harvested. The only day of the week she does not go to the fields is on Sunday, when she attends church and does the washing, and the months between harvest and sowing. Not surprisingly, the daily and seasonal routine of women in the fields has granted them intimate knowledge of such things as soil moisture, edible weeds, and pests that is comparable to "expert" knowledge. For example, her method of knowing when the fields are ready for seeding: "When you put your hand in the soil and it is moist all the way up (demonstrating to me on her arm) it's ready," closely resembles the explanation given to me by an extension agent: "Fields are ready for planting when there is 20cm (8 in) of moisture." Doña Irene's experience is common among women who are raised and then marry into farming families, and illustrates the breadth of agro-ecological knowledge held by women, even as they are discursively constructed as "helpers" or altogether invisible in agricultural contexts (Radel, 2011).

Other scholars have documented this kind of local knowledge and its relevance for managing risk and adapting to climate variability (Nelson, 2010). Although this particular knowledge of soil moisture does not necessarily reflect gender differences, it is important to note that it represents situated, embodied knowledge derived from women's everyday experiences in farming and her subsequent performance of gender, which remains overlooked in agricultural labor despite more than thirty years of research on the issue (see for example Boserup, 1970).

Feminist scholars have argued that the common description, even self-descriptions, of women's labor as supplementary contributes to the invisibility of women's labor and their roles; an invisibility that is too often reproduced in policy and in environmental studies (Arias, 2009; Zapata Martelo, 1996). This invisibility also serves to maintain traditional hierarchical rights and obligations within the home (Arias, 2009).

By making women's spaces visible, the gender resource maps also make women's agency visible. Specifically, they illustrate that women's work in the space of the home is the space over which most women not only contributed their labor and had the responsibility of maintaining, but also had the most decision-making control (citation removed for peer review). In both *ejidos*, women were in charge of buying food products or other items for the home and, if time permitted, they made these purchases in community stores, or by taking the hour-long bus ride to the next closest large town. As such, women's role in making household purchases made them expertly aware of the rising price of consumables as well as the costs for such things such as electricity and water use for the home and the fields. So, while other studies on adaptation and risk management in Mexico have focused exclusively on agricultural strategies and land-use (Eakin, 2006; Eakin and Bojòrquez-Tapia, 2008), these domains are not the only spaces where decisions are made that enable families to manage the variety of risks they face daily and over the long-term. Women's knowledge of prices regarding utilities and food items is an example of how knowledge reflects gendered experiences; experiences that shift along with changes in economic and social realities. And has been documented elsewhere, this knowledge along with women's concerns over labor time, has been shown to influence cropping strategies among women who are primary landholders (citation removed for peer review). The performance of

gender through these activities and the subsequent knowledge were critical material practices that contributed to the ongoing maintenance and reproduction of the household and community. In the next section, I will discuss how this knowledge is reflected in their perceptions of risk.

## 5. Climate memory and embodied knowledge

Through a series of visits I made with Doña Yolanda, the wife of an *ejidatario* in La Cuadrilla, I became acutely aware of how women's labor in the fields contributes to their agro-ecological knowledge and perception of risks. I often accompanied Doña Yolanda and her family to her husband's fields where they cultivate corn, beans, and squash. During the hour-long walk to the fields from their home in La Cuadrilla, she often commented to me how difficult the current growing season (2009) has been due to the drought. She estimated that they had lost roughly half of their crop - mostly corn and beans - but this did not seem to weigh too heavily on her or her husband's minds. The leftover stalks, once they are dry, were fed to the livestock, and their practice of seed saving provided a sort of insurance. Back at the house, she and her family showed me the enormous bin of corn seeds from last season, and Doña Yolanda explained how each year they always saved seeds as insurance for a bad growing season. They will need enough seed to replant the fields next time, and enough for household consumption. During one of my visits, when I asked her about her memory of previous droughts, she responded, "The years go one then one: one good, then one bad." She remembers that 2006 was a good year for the harvest, because that was they year that her oldest son, who had migrated to Texas, was killed. Because of this she didn't help with the harvest that year, but she remembers that the harvest was very good. "Yes, the harvest was full in 2006, then in 2007 no, 2008 yes, this year no. That's how it goes. We are accustomed to the rhythm. Two years ago [2007] it rained as we were preparing the fields to be seeded, and then it didn't rain again until the following year. That year,

we had nothing." Although Doña Yolanda's understanding of variable precipitation patterns over the years may not point to a specifically gendered set of knowledge, this does demonstrate how women's involvement in agriculture lends itself to an awareness and understanding of changes in long-term climatic patterns, even if these changes are subtle. Furthermore, her knowledge of precipitation in relation to family dynamics, such as the death of a loved one, reveals a key connection between knowledge and family events, which are typically gendered. Recognizing this connection is imperative to understanding how knowledge develops in rural households, how it is transferred, and the implications this holds for adaptive capacities.

The interviews I conducted included questions about people's experience with and understandings of climate change and variability. Specifically, I asked how many years, of the previous 20, had been "good" climatically, how many had been "bad," and how many had been "about the same." I left these categories open to interpretation to include all variations of climatic hazards (e.g. pests, floods, frosts), although the "good" years were consistently described in terms of a "good" harvest. These interviews made clear, and as Doña Yolanda's experience reveals, women involved in agriculture had a keen awareness of climate variability. The interviews revealed that 59 percent of these women felt that up to half of the previous 20 years had been "bad" years. On the other hand, 37 percent of these women felt that more than 10 of the past twenty years were about the same climatically. Specifically, most people talked about the past four-to five years as being the worst they could recollect, even if there had been other "bad" years, and everything previous to that was considered to be good (figure 2).

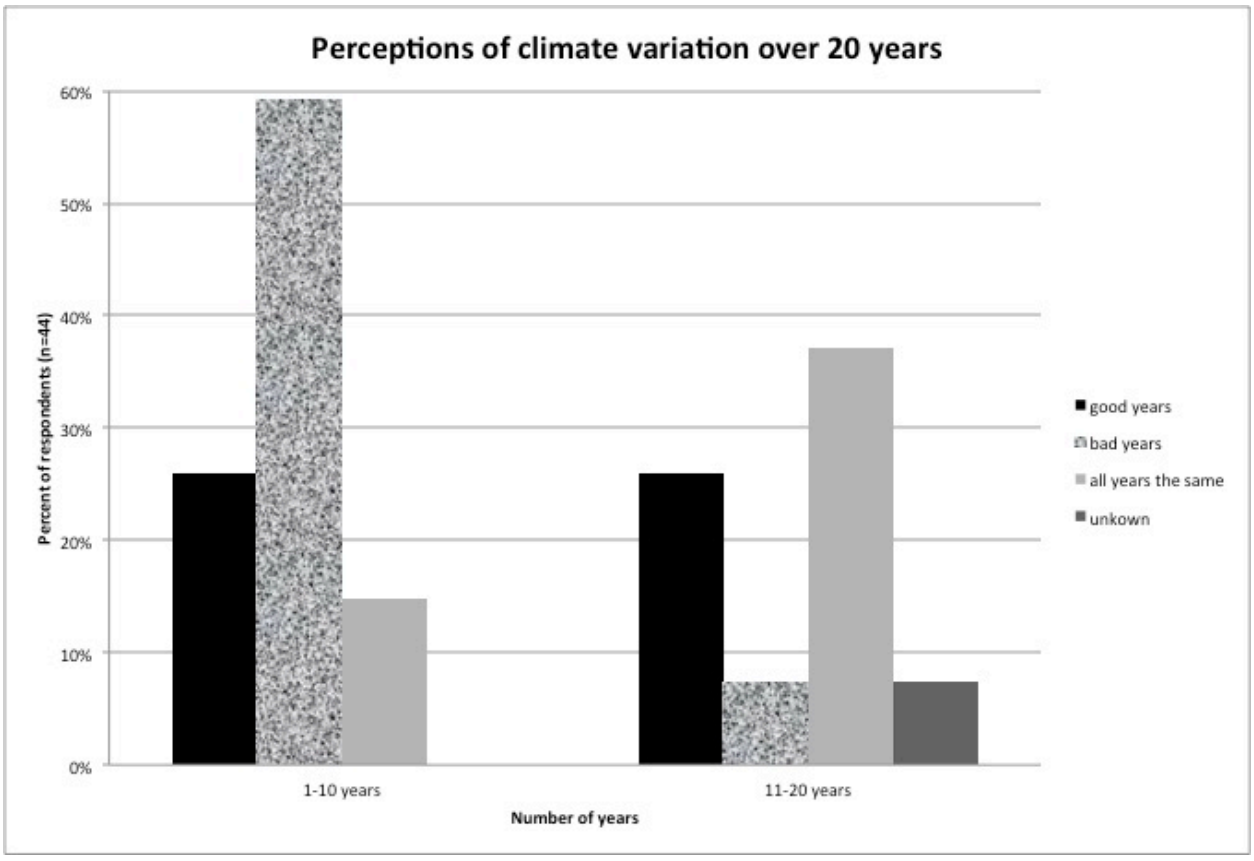


**Figure 2:** Perceptions of climate variation by women involved in agriculture. (Source: interviews).

Also apparent in the early stages of research, was the role that place-specific contexts also play in shaping memories of environmental change. For example, many women in La Cuadrilla, which was located next to the Rio Laja, framed their responses about environmental change in terms of the life of the river. Residents of this *ejido* could remember when the water flowed year-round as opposed to its current seasonal flow and often contextualized their comments about economic or climatic changes with a reference to the river. Many also commented that when it flowed year round, although there were fluctuations between wet and dry seasons, the flow tended to be fairly high and their general memory of climate was that during this time, precipitation was more plentiful.

Before piped water was introduced to the *ejido* (about seven years ago), women would do the washing in the river. When I asked participants who mentioned changes to the river flow how long ago they think things changed in the river, the answers were consistent: fifteen years ago. Fifteen years before my interviews, in 1994, the same year NAFTA was implemented, industrial agriculture in and around Guanajuato began to flourish. As a result of this, out-of-basin water transfers[****], the increased drilling of wells, an increase in river rock extraction, and the redirection of surface flow from the Rio Laja into agricultural fields in the fertile *Bajío* region just to the south, are all speculated to have changed both the surface flow of the river, as well as the quality and availability of groundwater in the corresponding aquifer (Navarro de León et al, 2005). Although it has not yet been tested, another hypothesis is that the gradual decrease in average annual precipitation (figure 3) has also created circumstances, which have reduced the flow of water in the Rio Laja (Ortega Guererro, Personal Communication).

[****] In a famous campaign speech given by the governor of Guanajuato (1991-1995) former Coca-Cola executive and aspiring president of Mexico (2000-2006), Vincente Fox stated that, "…starting today, not a drop of water leaves Guanajuato," (as quoted in Maganda, 2005, 398). While this sentiment conveyed disapproval for the water transfers toward a neighboring basin, transfers continued throughout his governorship (Maganda, 2005).

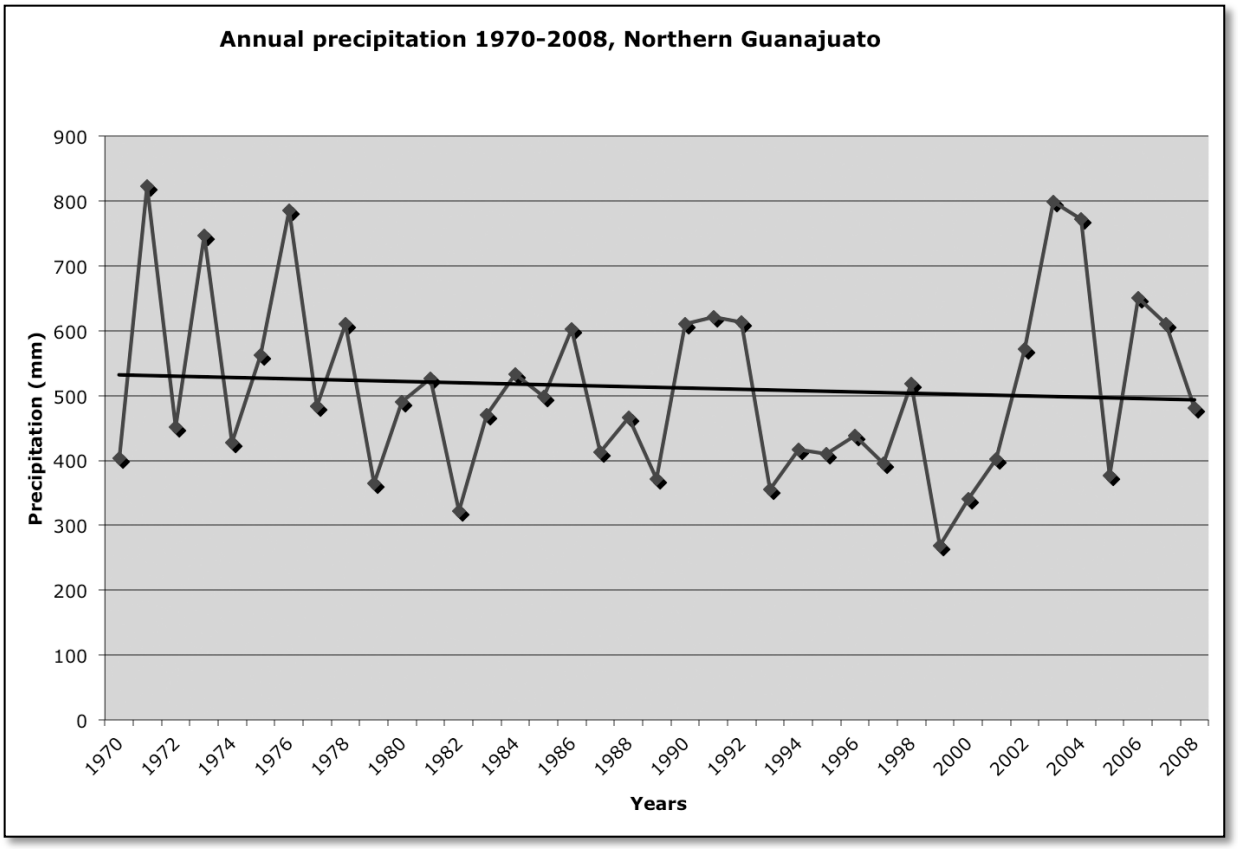


**Figure 3**: Average annual precipitation trends

Women's memories of climatic changes as directly related to changes to the river is an example of how gendered activities, such as washing, but also the daily mundane tasks, such as crossing the river to get from one place to another, provided a clearly consistent recollection of changes that reflect both environmental changes. In this way, the memory of environmental change is produced by the performance of gender in the *ejido*. However, individuals' memories of good and bad growing seasons do not necessarily reflect how this knowledge then shapes their attitudes about climate risks. Several studies have demonstrated that factors driving responses to climatic risks are complex and variable and that often, climate is not a primary risk (Castellaños

et al, 2013; McDowell and Hess, 2012), while others have found that climate is a significant factor amongst a variety of risks (Thomas et al, 2007).

## 6. Locating climate risks among multiple stressors

| Risk/Worries | Ranking of worries | | Severity of worries | |
|---|---|---|---|---|
| | La Colorada | La Cuadrilla | La Colorada | La Cuadrilla |
| **Lack of rainfall-not enough water** | **3** | **1** | **1** | **3** |
| **Migration** | **5** | **9** | **3** | **1** |
| **Drug and alcohol addiction** | **6** | **5** | **4** | **5** |
| Sale of land | 1 | - | 1 | - |
| Food security (quality of food, less people growing themselves) | 2 | | 3 | - |
| Very hot sun | - | 2 | - | 3 |
| No work | - | 3 | - | 1 |
| Aquifer drying up | 4 | | 1 | |
| Things are expensive | - | 4 | - | 1 |
| Contaminated air | - | 6 | - | 3 |
| Reduced bee population | 8 | - | 1 | - |
| Cutting trees in the open space | 9 | - | 1 | - |
| GMO corn | 7 | - | 5 | - |
| Trash everywhere-burning trash | - | 7 | - | 3 |
| Lack of community health services, grave illnesses | - | 8 | - | 6 |
| Trees drying up | - | 9 | - | 4 |
| Violence among youth (and family violence) | - | 10 | - | 2 |

**Table 1:** Risk-ranking and scoring results. Scale: 1-10, 1=highest, 10=lowest; Bold=high rank, high severity in both *ejidos*.

The process of completing the risk, rank, and score matrix (table 1), as well as the ensuing collective analysis of the results revealed several important points. First, three issues were listed, ranked and scored as being high risk and high severity in both *ejidos.* These included the lack of rainfall and the lack of water in general, migration (to the US), and drug and alcohol addiction.

In some instances, the differences between the risks listed reflected the specificity of place and local context. For example, participants in La Cuadrilla, on the other hand, were concerned about the lack of jobs and the price of consumables rising. These concerns reflected the high rates of unemployment in that *ejido*, and specifically among the activity participants. Socio-economic information gathered through the interviews and the national census painted a more desperate picture in La Cuadrilla than in La Colorada: unemployment was close to seven percent; only fourteen percent of households had a combination of piped water, a drainage system and electricity; and illiteracy rates were higher than in La Colorada. At the same time, arable land represented a means of financial and food security, particularly for families who had no adults currently working in salaried jobs. Families without land became increasingly dependent upon the social and kinship networks to help ease the burden. However, when these networks could no longer serve as a safety net and incomes were scarce, the women in La Cuadrilla told me that buying half of what you normally buy was the only recourse. Additionally, parcel sizes were much smaller in La Cuadrilla (3.8 hectares) than in La Colorada (5.6 hectares) and farmers in La Cuadrilla had absolutely no access to irrigation, while a handful of the wealthiest landholders in La Colorada did. These specific, local contexts shaped attitudes about the environment, their risks, and their own responses to both climatic and economic uncertainty, as shown in the risk, rank and scoring activities. In addition, and as feminist theory shows, these results demonstrate that local knowledge is also embodied and subsequently gendered, such that any desire to incorporate local knowledge into risk reduction strategies and adaptation must address the underlying social factors, like gender, that contribute to the production and transfer of this knowledge.

After a long discussion among the group members in La Cuadrilla about the importance of economic concerns over environmental ones, they decided in the end to leave economic concerns as secondary to the environmental concerns (water and hot sun). The similarities between the responses from women in La Cuadrilla and La Colorada to questions of risk - lack of water, alcoholism/drug addiction, and migration - reflected issues that were common concerns throughout Mexico, which also reflected broader issues of political economy, institutional arrangements, resource management, and social stressors.

Although climatic events (drought, frost, etc.) and climate change in general were not among the worries listed in either *ejido*, broader environmental concerns were included in both lists. While they may have been ranked and scored differently in each *ejido*, the unease over water resources in particular reflects both the institutional and environmental context in which these communities are situated. Women in both *ejidos* participated in a bi-monthly water committee meeting, whereby members of the extended *ejido* (which typically includes five to seven other communities) met to discuss and address water issues. These issues centered on the scarcity of water in the area, and as one participant told me, the meetings urge everyone to watch how much water they consume and hold others accountable if they are seen wasting water.

These water committees can be seen as a local institutional mechanism that shapes both perceptions of water-related risks as well as the responses to this risk. Institutions regulate access and rights to resources, like water, which in turn regulate exposure to risks and can reduce vulnerabilities (Agrawal 2010). However, these local water committees are unable to address the complex social and political factors at other scales that shape local water access and availability.

Access to water is clearly constrained for both *ejidos*, due to a history of governance at other scales, which has prioritized large-scale, commercial agriculture since the 1980s. This has resulted not only in agricultural policy, which has increased the vulnerability of small-scale agriculture, but also in a variety of water governance mechanisms that have shifted water access and rights toward commercial agriculture. These complex political and institutional arrangements, coupled with a decline in precipitation and an increase in annual average temperatures, has created socio-environmentally induced water stress. As other studies have suggested, adaptation and the capacity to adapt depends significantly on the ways institutions regulate and structure the interactions between vulnerability and climate variability (Agarwal 2010). The perceived water risks and subsequent responses (or lack thereof) in both La Colorada and La Cuadrilla reflect local challenges to adaptation and building adaptive capacities that are shaped by institutional changes in agriculture and water management at broader scales, as has been demonstrated elsewhere (Eakin 2006; Eakin et al. 2010; Engle and Lemos 2010).

In addition, the worry that "water is running out," as reflected in the matrix, also relates to the lack of rain experienced by residents of both communities. Several women commented that although the lack of jobs and price of consumables are important, the lack of water takes precedence because it threatens their ability to produce their own food, which these women valued over the ability to purchase food. So although other studies have documented that economic risk prevails over environmental risks (Eakin 2006; Tschakert 2007; Tucker et al, 2010), this study seems to point to a greater overall concern with environmental issues in both communities, as the environmental risks perceived here are directly related to economic concerns (i.e.: the ability to produce food versus purchasing it).

While economic risks are clearly inseparable from many of these issues it is not always so easy for people dealing with an array of stressors to prioritize one over another. Mertz et al (2009) have shown similar results as farmer concerns related to rainfall also include mentions of the economic situation. On the other hand, Tucker et al (2010) found that health and coffee prices on the Gulf coast of Mexico were more concerning than risks of extreme weather events. As the results from the risk, rank and score activities show, local and institutional contexts, such as land sales and water resource availability, serve to shape how people perceive their risks. Furthermore, it reinforces other studies that demonstrate the tradeoffs between broad-scale adaptation policy and building local capacities to adapt (e.g. Eakin et al. 2009). My study also shows how analyzing agency, power, and knowledge production through a feminist lens uncovers the gendered contexts and material practices that shape how people perceive climate-related risks. This, in turn, shapes how people perceive their capacity and thus, their responses to climate change and other environmental hazards.

## 7. Conclusions

In this analysis of social processes and women's material practices in two *ejidos*, I demonstrate how gender is infused in all aspects of knowledge production, resource distribution, risk perception and adaptation. Women's everyday experiences in and around the home, and in agriculture and water management, shape and are shaped by their understandings and knowledge related to environmental change. This knowledge and the complex power structures, including institutional contexts, and processes within which it is embedded, shapes how they perceive their risks and in turn, their capacity to respond to these risks. The results presented in this study how knowledge, risk perception and adaptation are constituted by and embedded in gendered

relations of power and thus any understanding of these processes requires an understanding of the political nature of risk perception and adaptation. Approaching these issues through a feminist political ecology lens demonstrates how these issues are directly related to the political production of knowledge, environmental resources, and social responsibilities. In so doing, this study contributes to the literature on risk perception and climate change adaptation by finding a common ground between addressing people's underlying vulnerabilities and incorporating "local" knowledge into scholarship about risk reduction and adaptive capacities in particular places at particular times.

The results of the risk, rank, and score activities point to a wide range of concerns that reflect local contexts as well as women's material practices. These results demonstrate how changing institutions, politics and landscapes in rural Mexico have impacted women differently. For example, the women in La Colorada included concerns about land sales, while this issue was not relevant to the women in La Cuadrilla. The women in La Cuadrilla, on the other hand, debated whether or not economic or environmental concerns were more pressing as both are intricately linked, and although consensus was reached for this particular activity, the process of achieving these results point to the fact that within communities, priorities can vary and are based on lived experiences. These subtle nuances need to be understood and addressed in risk reduction and adaptation programs if they hope to be successful. Additional comparative research on explicitly gendered knowledges will be an important next step in developing successful programs that reduce people's climate-related risks.

These insights can also provide a greater understanding of why people perceive their risks the way they do. Several studies exist that describe what risks people perceive, but explaining 'why' does not directly attend to questions of social relations and power structures. Furthermore, as other authors have argued adaptation programs and policy are often inadequate for addressing the underlying causes of vulnerability and the power dynamics that maintain such vulnerabilities (e.g. Popke et al. 2015). Addressing these questions through a feminist political ecology framework is one possibility. Risk reduction and adaptation strategies grounded in women's lives bring into focus issues not previously considered and therefore works towards building more holistic, socially just responses to climate change.

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