The final publication is available at Springer via http://dx.doi.org/10.1007/s10460-014-9503-9

"Si no comemos tortilla, no vivimos:"[1] Women, climate change and food security in central Mexico[2]

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Accepted: 28 February 2014/Published online: 30 April 2014

Abstract In recent years, it has become clear that food security is intimately related to complex environmental, social, political and economic issues. Even though several studies document the impact of climate on food production and agriculture, a growing segment of research examines how climate change impacts food systems and associated livelihoods. Furthermore, while women play a crucial role in providing food security for their families, little research exists that examines the nexus among gender relations, climate change and household food security. This study investigates these relationships by asking: a) how is the production and reproduction of knowledge about food security and climate change shaped by gender and lived experience, and b) how does this knowledge influence attitudes and strategies for maintaining food security in a changing climate? Drawing on the results of research in two communities in central Mexico, I argue that women's perceptions of and strategies for maintaining food security are derived from their socio-political, environmental, and economic contexts. This study contributes to both the growing literature on the gender dynamics of climate change, as well as debates about the role of bioengineered seeds in helping farmers to adapt to a changing climate.

Key words food security, knowledge, gender, climate change, adaptive capacity, Mexico

Abbreviations

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[1] "If we do not eat tortillas, we die". Author translation.

[2] Article should be cited as: Bee, B. 2014. "Si no comemos tortilla, no vivimos": Women, climate change, and food security in central Mexico. *Agriculture and Human Values*, 31(4), 607-620.

CEDESA	*Centro de Desarrollo Agropecuario A.C.* (Center for Agricultural Development)
ENSO	El Niño Southern Oscillation
GM	Genetically modified
INIFAP	*Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias* (National Institute for Forest, Agriculture, and Fisheries Research)
SAGARPA	*Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación* (Secretary of Agriculture, Livestock, Rural Development, Fisheries, and Food)
US	United States

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Acknowledgements

I am indebted to the participants of this study and especially to Elizabeth Torrez Rodriguez and the late Teresa Martinez Delgado, without whom this work would not be possible. I am also grateful to Gabriela Cuevas García whom designed the maps of the study site and Frida Güiza Valverde who provided invaluable feedback on earlier drafts. I want to also thank Harvey James and the anonymous reviewers for their insights. Any errors or omissions are solely my responsibility. This research was funded through an American Association of University Women Fellowship, a Thomas F. Morgan Graduate Scholarship, a Supporting Women in Geography

Fellowship, and through contributions from the College of Liberal Arts and Department of Geography at Pennsylvania State University.

Introduction

The quote included in the title of this paper, as told to me by a woman in a conversation about food and drought in her community, is a telling example of how food concerns weigh heavily on the minds of rural families in Mexico during times of crisis. The particular crisis that provided the context for this conversation included "double exposure" (O'Brien and Leichenko 2000) to one of the worst droughts in recent memory and an economic recession. While droughts have regularly destabilized agricultural production, food security and people's well-being throughout Mexico's history and prehistory (Conde et al. 1999; Endfield 2008; Liverman 1999), various climate change scenarios for central Mexico suggest a continued rise in annual average temperatures and greater variability in the amount of precipitation (Conde et al. 2004; Magaña et al. 2000). At the same time, the economic crisis impacted rural families as prices for consumables rose, and the availability off-farm jobs and remittances from the US, once a significant source of income for rural areas, continued to decrease. It is well known that neoliberal agrarian policies threaten household food security in Mexico and limit farmer's ability to respond to climate risks (Adger et al. 2008; Appendini and Liverman 1994; Eakin 2006; Mercer et al. 2012).[3] However, while women's contributions to food security (e.g. Kabeer 1990), agriculture (e.g. Sachs 1996) and the environment (e.g. Merchant 1980) is well documented, less understood are how their knowledge, derived from everyday experiences, influences their strategies and ideas toward maintaining food security in a changing climate.

This study investigates these relationships by asking: a) how is the production and reproduction of knowledge about food security and climate change shaped by gender and lived experience, and b) how does this knowledge influence attitudes and strategies for maintaining

[3] This paper draws on the Food and Agriculture Organization of the United Nations (FAO 1996) concept of food security as, "when all people, at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." This conceptualization of food security addresses issues such as access, availability, and choice, which share similarities with the concept of food sovereignty.

food security in a changing climate? To address these questions, I draw on feminist theories of knowledge production and gender-environment relations to examine how the gender division of labor and access to resources in two *ejidos* in the central Mexican state of Guanajuato affect women's knowledge of food security and climate change issues that directly impact their households and broader communities.[4] Drawing on fieldwork in these two communities, I endeavor to unpack how knowledge is produced, reproduced and embedded in social and spatial relations of power by examining women's everyday material practices. I hope to show how gender influences not only access to resources but also the production of knowledge as well as the ability to act on that knowledge in communities regarding the problems they face and the potential solutions to them.

In this paper, I present the results of this research in combination with the theoretical analysis to highlight the significance of these findings as seen through the lens of feminist theory. The results are divided into two key sections. The first details examples of strategies women employ during the drought to enable food security, based upon embodied knowledge of edible plants. The second subsection of results provides examples of how women's material lives manifest into particular beliefs about maize, climate change, and food security. As I will demonstrate, women in this study are neither victims of gender, economics, place, or climate change; nor do they embody environmentally-oriented ideals, endowed to them by virtue of their relationship to agriculture or to the environment. Instead, their perceptions of and strategies for maintaining food security are derived from their socio-political, environmental, and economic contexts. As such, this study contributes to the growing effort of feminist scholars to alter reductionist discourses that construct women as either victims or virtuous environmental activists

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[4] Ejidos are part of the communal system of land tenure established after the Mexican revolution. The Mexican government recognizes three types of land tenure in Ejidos: 1) *ejiditarios/as* (have both access and rights to farm on plots assigned to them, 2) *posesionarios/as* (have access to farm on land assigned to them but do not have any associated rights), 3) *avecindados/as* (landless individuals and families). Rights include the right to vote in assembly meetings and participate in communal decision-making, the right to receive government benefits for the cultivated land, and the right to receive compensation for crops lost during a state-declared disaster, such as drought.

which mask the reproduction of power relations and inequalities in institutions and climate change discourses (Alston & Whittenbury 2013; Arora-Jonsson 2011; Tuana & Cuomo 2014). Furthermore understanding women's material contexts and the production of knowledge informs debates about the role of bioengineered seeds or "transgenic adaptation strategies" (Mercer et al. 2012) in enabling farmers to adapt to an uncertain climate.

Literature review

Climate change, food security, and gender

In recent years, it has become clear that food security is intimately linked to complex environmental, social and economic issues. With a few notable exceptions (Bohle et al. 1994; Devereux and Edwards 2004; Gregory et al. 2005; Ziervogel et al. 2006), most of the research that focuses on climate change adaptation and food security has emphasized the potential impact of climate change on agricultural production and food supplies or technological solutions to ensure food security in a changing climate (Butt et al. 2005; Howden et al. 2007; McCarthy et al. 2001; Morton 2007; Parry et al. 1999; Parry et al. 2004; Washington and Downing 1999). Recently, scholars have argued that analyses of climate change and food security need to more comprehensively address not only the biogeophysical aspects of food security, but also the socio-economic factors that shape food access, availability, stability, and utilization (Ericksen et al. 2009; Ericksen 2008a, 2008b; Ingram et al. 2010; Ziervogel and Ericksen 2010).

As the climate change adaptation and food security literature is becoming increasingly concerned with questions of access and distribution, there is a growing recognition that climate change has gender-differentiated impacts and implications. For example, several scholars argue that the gendered division of labor contributes to a gendering of options and resources in relation to adaptation and responses climate change. (Dankelman 2010; Masika 2002; Rossi and Lambrou 2008; Segnestam 2009). Other scholars have also argued that differential power relations and levels of access to resources are key to understanding gender differentiated vulnerability, exposure to risk, coping capacity, and women's ability to recover from climate shocks (Bee 2013; Nelson and Stathers 2009; Nightingale 2009; Omari 2010; Tandon 2007;

Resureccion 2011). However, despite the acknowledgement that the climate change-food security nexus directly involves issues of household social reproduction and that gendered relationships are central to that reproduction, few studies currently exist which examine the gender aspects of the relationship between food security and climate change.

Although not specific to issues of climate change, the rich and extensive body of scholarship on gender, intrahousehold relations, and food security illustrates how gender affects the production, distribution, and consumption of food and thus, household food security and coping strategies during times of crisis (i.e. Agarwal 1992; Brown et al. 1995; Corbett 1988; Gladwin et al. 2001; Kabeer 1990; Omwoha 2007; Quisumbing et al 1995; Whitehead 1990). Drawing attention to the broader political structures that shape household food security, Carmen Diana Deere (2005) argues that neoliberal policies have undermined peasant agriculture, and as a result, peasant production becomes increasingly oriented towards household food security and an extension of women's domestic responsibilities. Yet relatively few studies of Mexican food security and agrarian restructuring include an analysis of gender (Ortíz Gomez et al. 2005).

Food security, gender, and agriculture in Mexico

Maize is arguably one of Mexico's most important crops- both historically and culturally (Fitting 2010; González 2001; Sauer 1971; Solís 1998). For many rural Mexicans, the maize plant represents the origin of life, and maize has historically been at the center of farming practices (Barkin 2002; Long and Villarreal 1998). Two studies, which analyze the cultural value of maize among women in central Mexico, also point to the importance of "quality" maize for these women. Appendini et al. (2003) argue that "quality" refers to not only consumption, but also to rural life as well. They argue that the production and consumption of maíz criollo, or landrace corn, are actions that improve the quality of life of rural Mexicans (Appendini et al. 2003). In a later study, Appendini and Torres-Mazuera (2008) found that regardless of access to land and whether or not they've grown it themselves, consumers continue to take into account the quality of maize they grow or buy, despite policies that are contrary to supporting quality, maíz criollo. More recently, Lerner and Appendini (2011) support earlier findings by Preibisch et al. (2002) that even in the face of strong disincentives to do so, the social and cultural ties to maize fuels the retention of maize production in Mexico.

Women make important contributions to household food security in Mexico through their responsibility for maintaining the maize crop, because of its role in household subsistence, and their own limited access to income generating activities (Preibisch et al. 2002). Maize also provides both food and economic security as women in maize-producing households could sell small amounts to buy other food and goods (Preibisch et al. 2002). Several studies have shown how women's knowledge of maize is critical to in situ conservation of crop diversity as well as household food security (Brush and Chauvet 2004; Chambers and Momsen 2007; Rimarachín Cabrera et al. 2001; Vázquez García 2002). Rimarachín Cabrera et al. (2001), for example, found that the maize varieties women preferred (for taste, texture, etc.) were the most resistant to local weather, the most nutritious, and produce the highest tortilla yields (Rimaracín Cabrera et al. 2001). Thus, an analysis of the gender dynamics of food security provides greater insight into the relationship between women's daily responsibilities and the social and economic significance of food production and distribution.

With the onset of climate change and variation, questions of food security and the cultural significance of Mexican maize takes on new meaning as debates about the role of transgenic or genetically modified (GM) maize in adaptation contexts increase (Mercer et al. 2012). The controversy over GM maize as a threat to native varieties was sparked in 2001 following the discovery of transgenic maize in Oaxaca, thought to have originated from the US (Quist and Chapela 2001). As we shall see, the controversy over GM maize in Mexico raises important questions about the loss of agrobiodiversity, Mexican identity, and rural livelihoods (Fitting 2010; McAfee 2008; Mercer et al. 2012).

Conceptual Framework

In this paper, I utilize feminist theories of knowledge production and gender-environment relations to explore how gendered social relations in the two ejidos included in this study affect both the production of knowledge regarding food security and climate change in these communities, and their ability to act upon this knowledge. Although feminist theory is not limited to gender as a category of analysis, this particular paper emphasizes women's lives as a starting point for analyzing relations of power and politics that shape knowledge and decision-

making among marginalized groups in the face of climatic variability. In this paper, I utilize the concept of gender to signify far more than the differences between men and women, but as a platform for analyzing how power operates by tracing its origins in the body and how it travels across spheres. In the case of the study presented, placing women's material lives at the center of the analysis highlights how gendered social relations of power enable and limit the capacity for women to adapt to an uncertain climate within their households and within their communities.

This paper draws specifically on feminist theories of knowledge production that view such processes as directly linked to the power dynamics of social reproduction, including the relationships within and beyond the household (Haraway 1988; Harding 1991). Central to this understanding is the idea that knowledge is always partial, embodied, situated and materially grounded in lived experience. The concept of situated knowledge is useful for in bringing attention to women's agency, their capacity (or lack of) to act, and recognizing women as subjects that are not only constructed by, but also responding to, unequal power relations.

I also draw on the broad body of feminist scholarship that highlights the relational and embodied practices through which gendered spaces, subjects, and environments are produced and mutually constituted. For example, Bina Agarwal (1992) argues that women and men's relationship to their environment should be understood in terms of their material reality. Thus, unequal distribution of power, divisions of labor, gender, and class structures shape individuals' relationship with the environment and their responses to it (Agarwal 1992). Feminist geographer Maureen Reed (2000) expands this work to illustrate how women's relationship to their environment is both embodied and embedded within the historical and material relations of society. In attempting to rupture dualistic notions of women's environmental activism as either pro-environmental or materialistic, she showcases how women`s subjectivities are produced and reproduced within their local socio-political, environmental, and economic contexts (Reed 2000). This work makes visible the ways in which the production of environmental knowledge is grounded in the material production of gendered spaces, bodies, and environments. Such theorizing is helpful for explaining how and under what circumstances women are able to adapt to a changing climate.

Underpinning my analysis is an understanding of climate change adaptation as the specific actions that individuals or societies take to reduce or minimize the risks posed by a changing climate as well as the broader processes that shape these responses (Adger et al. 2007;

Pielke et al. 2007). In the context of climate change, adaptations are widely recognized as occurring within the context of cultural and economic changes as well as changes in information technologies, global governance, social conventions, and the flow of capital, so that it is often difficult to discern decisions related to climate change from other social and economic changes (Adger et al. 2005; O'Brien and Leichenko 2000). At the same time, these decisions occur within the context of interactions among actors, institutions, and environments at various scales (Adger et al. 2009; Eakin and Lemos 2010). Thus, I do not employ the concept of adaptation to imply a single change in behavior, but rather as an inseparable part of everyday life, which is constituted by the interplay among material reality, social relations of power, and environments (Carr 2008).

Examining adaptation to climate change through the lens of feminist theories of knowledge production and the environment is therefore useful for elucidating women's embodied knowledge of climate change and food security, as well as how gendered social relations shape their capacities to act upon this knowledge. As such, I do not intend to explicitly demonstrate the limits and opportunities for adaptation, but rather provide an analysis of the gendered social and spatial relations that shape the capacity for adaptation in the face of a changing environment. As evidenced elsewhere, understanding adaptation by determining who has decision-making power over what resources, such as land, does not fully explain adaptation outcomes nor does it make visible the potential for adaptation (Carr 2008). Instead, a richer investigation into adaptation requires a closer look at how social relations of gender and local contexts shape the interaction among knowledge, space, and food security.

The case study

Study area

The communities chosen for this study are located in the northern, semi-arid part of the state of Guanajuato. Although variable rainfall amounts are common in semi-arid areas such as northern Guanajuato, the 2009 El Niño-induced drought was one of the worst in 60 years (Camarena 2009; SMN 2009). El Niño Southern Oscillation (ENSO) events are thought to be the most significant cause of inter-annual climate variations across the country. In Mexico, it is estimated

that El Niño is responsible for as much as 65 percent of variability in climate conditions (Eakin 2006). Several scholars have documented the devastating impact of strong ENSO events on rain-fed corn production over the past forty years in the central highlands of Mexico (Conde et al. 2000; Liverman 1990; Liverman 2001; Magaña et al. 1997; Magaña et al. 1998). However, climate models predict that the number of ENSO occurrences will increase, thereby escalating the potential for reduced rainfall and drought in regions that are already water-limited (Conde 2003; Cubasch and Meehl 2001; Liverman 2001). Various climate change scenarios for regions very near and similar to northern Guanajuato suggest a continued rise in annual average temperatures and greater variability in the amount of precipitation (Conde et al. 2000; Conde et al. 2004 Magaña et al. 2000). The result is a decrease in the region's suitability for seasonal rain-fed agriculture (Conde et al. 2004; Conde et al. 2000; Gay and Estrada 2007).

Small-scale agriculture in northern Guanajuato is primarily dependent upon seasonal precipitation as the equitable and spatial distribution of irrigation varies widely. For example, in 2007, 1482.7 km2 (73 percent) of the region was planted for rain-fed crops while irrigated crops counted for 558.71 km2 (27 percent) (SDA 2007). The two ejidos that participated in this study, La Colorada and La Cuadrilla (see figure 1) were purposely chosen based on available data that reflected the agricultural, economic, and climatic characteristics of region.

[Figure 1 about here, see appendix]

Both *ejidos* are also primarily involved in rainfed subsistence farming, consisting primarily of *milpa* agriculture, although a handful of farmers in La Colorada have access to small, irrigated plots.[5] In addition to agriculture, ejido members are involved in a variety of non-farm and off-farm labor (table 1).

[Table 1 about here, see appendix]

[5] *Milpa* is a mesoamerican subsistence agroecosystem that consists of corn, beans and squash (Radel, 2005; Vázquez García et al. 2004)

Methods and data

To understand women's experience with climatic and social change, I utilized a combination of ethnographic and participatory methods over the course of nine months. During this time, I conducted a total of 70 structured interviews with women from farming and non-farming households. These interviews sought socio-demographic information about all household members as well as landholding and agricultural information.[6] Interviewees were selected utilizing purposive and snowball techniques in order to sample the range of experiences and strategies employed by women and their families in the face of climatic and social change. Among the 70 interviewees, 52 elected to participate in a gender resource mapping activity (see figure 2 for an illustration).

[Figure 2 about here, see appendix]

To complete the map, women were asked to draw their household and the resources on which it depends. Oftentimes I was the artist, guided by explicit instructions from the

[6] Socio-demographic data collected for each household member included the relationship of each individual to the primary respondent, their age, sex, years completed in school, occupations, location of work, and migration experience. 14 of the households were single female-headed and an additional 6 households were married female-headed as their spouse was located in the US at the time. The remaining 50 interviews were conducted with married women. Of the 70 women interviewed, 12 were grandmothers (currently living with grandchildren and possibly other extended family members), 50 were mothers (currently living with children and possibly other extended family members such as in-laws and daughter-in-laws), and 8 households had no children under age 20. The average age of these women was 51 years. The *ejiditarias* I spoke to (women with access and rights to land) comprised 14 percent (n=10) of the participants in the study. Slightly fewer, 11 percent (n=8), were *posesionarias* (women with land but no rights) and 39 percent (n=27) were *avencindadas* (landless). Women married to male *ejiditarios* make up the remaining 36 percent (n=25) of the participants.

participants. Other times, I used this opportunity to include kids in the family to which they delighted at drawing and demonstrating their lives in two-dimensional form. Together, we used arrows to demonstrate the flow of networks, kinship or other social resources on which the household depends. Each resource was coded according to gender and three categories of use: control (the ability to make decisions regarding a particular resource), labor (physical effort to maintain a resource), and responsibility (general maintenance of a resource) (Slocum et al. 1995).

Findings

Quelites, gendered responsibilities, and material realities[7]

Results from the resource maps support existing literature that women's labor in the fields is also a significant aspect of their material lives, and as such, it is also a critical factor in the contribution to household food security. This fact remains, regardless of whether or not women have legal rights to the land in question. In male-headed households with land (e.g. ejiditario and posesionario) where women did not have land of their own, women were mainly responsible for planting, weeding up to three times a growing season, and helping with the harvest. However, the results of this study also draw attention to less obvious role women play in the production and provision of food through the more mundane labor they perform the fields and in and around their homes: weeding. To weed the field, or desquelitar, is central to household food security because during the process, women gather the quelites, or edible wild plants growing between the maize and bean plants, and take them home to eat. The role of quelites in complimenting diets during times of deficit in food production is well-documented by scholars, although the majority of studies mask the role of women in the supply of the edible plants (Bye 2000; Casas et al. 1987; Van Dussel 2000; Basurto et al. 1998).

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[7] *Quelites* are tender edible plants that grow in the *milpa*. The word comes from indigenous Nahautl word *quilit*, a generic term to describe plants whose foliage is edible (Vázquez García et al. 2004).

Quelites can also be found in the space in and around the home and so also become an important source of food, especially for families without access to cultivated parcels. As women are culturally responsible for feeding their families, they look to quelites as an emergency source of food and nutrition, when no other food or money is available (Vázquez García 2008; Vázquez García et al. 2004; Vizcarra 2001). In the ejido of La Cuadrilla, Azucena's situation provides an example of this.

Azucena's family had been hit particularly hard by the drought and the economic crisis. "My husband is not an ejiditario because we have not been able to fill out the paperwork for his father's fields, so we do not have PROCAMPO, " she explained. And while one son was working in construction, another had been unemployed for over six months so was helping his father and mother in the fields. Azucena estimated that they had lost their entire crop, except for the leftover rastrojo, or the stalks and leaves, which can be consumed by livestock. As a consequence, they sold one of their sheep in order to have a little more money. Her husband also made freseras, or baskets for holding strawberries that are sold to an individual who then transports them to the southern part of the state and sells them to strawberry farmers there. Sometimes, they can also sell these baskets in a nearby tourist town. But the money from the freseras was hardly enough. The quelites, therefore, were a vital source of nutrition and sustenance that did not require economic sacrifice. "We love quelites. They are such an important part of our diet. Even when we do not have our maize, we have quelites. My daughter helps me gather them". She took me out near the house to show me an example of the plants. "You have to pick them at the right time, before they flower, or they sting when you pick them and they do not taste as good."

Both feminist standpoint theory and feminist environmentalism draw our attention to how Azucena's responsibility for gathering and preparing the quelites shape her practices and views of food security in the face of drought. Although the maize did not grow, both her productive (gathering and preparing) and reproductive (passing this knowledge to her daughter) roles contribute to the availability of an important source of nutrition during the drought. And as picking quelites is not relegated to the space of the cultivated parcel, but also took place in the space in and around the home, quelites were a resource that was available to all women who had acquired knowledge about where and how to pick them, regardless of land tenure arrangements. Men also gathered quelites, but consistent with other findings (Vazquez García et al. 2004), they

did so less often than women as this activity was directly related to women's responsibilities and labor, which were shaped by gender relations. Yet as I show below, and as feminist theories of knowledge and gender-environment relations suggests, as women's views and strategies to secure food resources for their families are not only shaped by social relations of gender, but also by the broader political and economic contexts within which women's lives in rural Mexico are embedded.

Material lives and the persistence of maize and beans

Over the course of my research, it became apparent that a life without maize was unacceptable to the women of La Cuadrilla and La Colorada. The quote included in the title of this paper is a telling example of how the *campesinas* I worked with for nine months valued tortillas, and maize in general. This quote, "*Si no comemos tortilla, no vivimos*" (If we do not eat tortillas, we die), arose during a conversation with a group of women about the drought and the rising price of consumables. In response to a question I asked about maize from the US versus local varieties of maize, Karen who is in her mid-forties and farms a one-hectare parcel with her husband and children that another *ejiditario* has given them permission to work in exchange for part of the harvest, made the comment that it is rural families who suffer the most from the fluctuation in the price of the foods they eat the most, especially maize: [8]

> Karen: "We live by the tortilla. If we do not eat tortillas, we do not live."
> Lupe: "And beans, if there are no beans, there is nothing to eat."
> Karen: "When there are no more tortillas, there will be nothing to eat."
> Montze: "It is the foundation of our diet: tortillas, beans and maybe one other thing."
> Lupe: "Like soup".
> Montze: "Yes, because a rich person does not eat tortillas, they eat bread, pasta, salads."
> Elizabeth: "They do not have time for tortillas."
> Karen: "It is because what we eat fills us up."

[8] 1 hectare≈2.5 acres

Montze: “They have protein.”

Karen: “The beans, that is. The maize in the tortillas has calcium and the beans have iron.”

Montze: “Yep, that is the basics for us: beans and tortillas.”

Karen: “That is why they almost always say that men and women are made of maize, because if we do not eat tortillas, we are not anything”

This conversation makes clear, as do so many other conversations that took place over the course of this study, that women’s experiences with the current drought raise serious concerns regarding the availability of maize and beans. Although the above conversation among Karen, Montze, Lupe, and Elizabeth does not center on the quality or type of maize, it does demonstrate as feminist standpoint theory emphasizes, how women’s lived experiences in rural central Mexico, shape their knowledge and views of maize and beans as central to their food security and the food security of their families.

This knowledge also reflects the persistence of maize as a subsistence crop, even in the face of adverse conditions such as drought and neoliberal policies. In response to a farming family who had asked me if I thought the future holds drier years, I told them that the difficulty with climate change is that we do not know; however, several experts have predicted that this area will no longer be suitable for rainfed maize. Their response was anger and disbelief. To them, a life without the possibility of subsistence farming was unfathomable, and who are these “experts” to say that they will not be able to do it anyhow? For them, seasonal rain-fed farming was a risky endeavor, and had been so long before the concept of global warming or climate change ever entered their vocabulary. Their knowledge was also one of climate variation. Many women told me that as far back as they could remember, for every “bad” year or harvest there was also a “good” year, even though it seems that lately there had been more “bad” years than “good”. So the threat of decreased precipitation over the long-term did not deter them from continuing to grow and consume rain-fed maize and beans. Nor, as other studies have shown, did outside, “expert” opinions about future climates which were not seen to be valid because they contradicted local, embodied knowledge (e.g. Naess 2013; Vogel et al. 2007). Yet as the comments above, and as other studies have shown, this is to be expected given the centrality of maize in the lives of rural Mexicans. As I will demonstrate in the following section, everyday

activities and material realities also produce a particular knowledge and attitudes about GM maize.

Maíz mejorado and embodied knowledge

Concerns over maize and other sources of food security throughout Mexico are often reflected in the strenuous public opposition to GM maize, which has been ongoing since the inception of the North Atlantic Free Trade Aagreement in 1994. Outside of Mexico, agricultural biotechnology and GM seeds are viewed as a means of potential adaptation to climate risk (Evenson 1999). During the course of the interviews, several women in La Colorada expressed concerns about a program sponsored by the Municipal government to test maíz mejorado – (improved maize) by distributing it to local farmers, without cost, to plant in their fields. A few farmers in their community had been approached by municipal officials and asked to plant the maize and while some refused, others accepted. These women were suspicious that maíz mejorado was in fact GM maize.

This group of women expressed their concern based on their knowledge of Monsanto, patents, and the terminator gene (which causes second generation seeds to be sterile) and were alarmed that something of that nature could be growing in fields so close to their own. This knowledge was produced through participating in workshops and various events sponsored by a local non-governmental organization that had been working with the ejido since its inception. The Center for Agricultural Development (CEDESA by its Spanish acronym), has been a part of the National Network in Defense of Maize (Red en Defensa del Maiz) for several years and has taken strides to educate campesinos in northern Guanajuato about GM maize. One of the directors of CEDESA expressed to me, "GM maize is available in Guanajuato and we teach campesinos about the dangers and how important it is to know the history of the seeds that they plant in their fields. GM seeds contaminate, create debt, and create a dangerous dependence for campesinos. We support a dignified and sustainable life for campesinos in northern Guanajuato and GM corn is neither dignified nor sustainable. We promote knowledge exchange and capacity building so that campesinos can build a sustainable and dignified life for themselves. Part of this

is working to support food security by recuperating cultural traditions and community values in what people eat and consume daily."

However, when I talked with the director of the state climate change program, he informed me that the maíz mejorado program was a new program that used native maize seeds. Researchers at the National Institute for Forest, Agriculture, and Fisheries Research (INIFAP by its Spanish acronym) had discovered that specific types of native maize was more drought resistant than any other varieties they had tested before, so they teamed up with municipal governments across the state to seek farmers who were willing to test the seeds in their own plots. Yet the women in La Colorada who mentioned the program told me that their suspicion was based on the fact that farmers who had been approached were told that they needed to irrigate the experimental seeds. As Claudia expressed, "If these are native seeds that are drought resistant, then why irrigate? I've always heard that transgenic (GM) seeds need to be irrigated. And if they are native, why do they call them "improved maize" instead of "native"?" Other documents put out by INIFAP and the Secretary of Agriculture, Livestock, Rural Development, Fisheries, and Food (SAGARPA by its Spanish acronym) indicate that maíz mejorado are hybrid varieties (Arellano-Vázquez 2010; Espinosa et al. 2002). However, given the women's concerns, this fact seems to have been lost in the program's efforts to communicate this not only to male farmers, but to their wives and other women farmers as well. As a consequence, the women who worked with CEDESA remained skeptical of the government-sponsored program. Although not a sentiment directly expressed by the participants of this study, the deep skepticism they felt could also be a consequence of the continuing alienation of women agriculturalists by extension agents in Mexico as well as the social construction of men as "farmers" and women as "housewives" (Radel 2011).

Despite what might be seen as a miscommunication or misinformation about the maize mejorado program, Maria Luisa was adamant that it didn't matter. For tortillas, she prefers criollo maize from her husband's land because of it's taste and consistency when cooking. "The tortillas from the maize mejorado are dry and the masa falls apart in my hands when I'm trying to make tortillas. I really don't like the nixtamal it makes. The maize from our own parcel sticks to the cal (calcium hydroxide which makes the corn easier to digest) better and it makes the tortillas taste better." Maria Luisa's preference for criollo maize is directly derived from her role in preparing tortillas—a role assigned to her by the gender division of labor—and her personal

preference for taste and texture, which has been shown elsewhere to influence women's preferences for maize varieties (Rimaracín Cabrera et al. 2001).

The broad concerns over the maíz mejorado program reflect also both these involvement with CEDESA as well as the transfer of knowledge between CEDESA and the women who participated in this study. It is a clear example of how women's material realities, in this case, both their involvement with CEDESA and with agriculture in general, shape their ideas about what kinds of foods they should be growing. As other studies have shown, membership in agricultural organizations provides critical networks to support and influence women's preference for certain practices over others (Barbercheck et al. 2012). Therefore, organizations like CEDESA play an important role in the co-production of knowledge, not just about GM maize, but about adaptation options in general. Understanding the social, economic, and political contexts that shape decision-making around food security is a key to enhancing the capacity for rural families to adapt to a changing climate. Putting feminist standpoint theory and feminist environmentalism in conversation with concepts of adaptation and food security is one means to accomplish this understanding.

Discussion and conclusions

As the above examples highlight, the material realities of the women from La Cuadrilla and La Colorada shape their knowledge, perceptions, and strategies for maintaining food security in a changing climate. Gender and the lived experience of women in subsistence agriculture is therefore a critical factor in not only understanding food security, but also in understanding the opportunities and challenges to maintaining food security in a changing climate. These opportunities and challenges are an important aspect to consider in developing effective policies and programs aimed at addressing food security.

Although this study is limited in that it did not directly interview men and include their voices, a focus on the material realities of women is only one means by which to highlight the role of gender in the production and reproduction of knowledge and resources that shape the capacity for individuals and households to adapt to climate change. For example, the gender resource maps highlight how women contribute to household food security through the gathering

of *quelites* during the drought. Drawing on knowledge produced by their daily activities in the field and in and around the home, women are able to identify and provide these wild edible plants to their families in times of crisis. In the case of Azucena, feminist standpoint theory draws our attention to how this work and the spaces over which she is responsible for is shaped by gendered social relations and what is considered to be "women's work". In other words, Azucena and women like her are often left out of programs and policies that seek to enhance the ability of smallholders to adapt because they do not have land of their own and are therefore not considered to be "farmers" (Radel 2011). Yet, in spite of this, women were able to actively help their families to cope with the drought by gathering *quelites,* based upon embodied knowledge derived from activities and spaces that are regulated by gender norms. What was less clear, however, was how this food resource was distributed among family members. Given that women are often "shock absorbers" (Brown et al., 1995) during times of crisis, this is important to consider.

Azucena and women like her are active agents in knowledge production and decision-making in the context of uncertainty. Such knowledge and agency is vital to the provision and maintenance of household food security. Questions of food security weighed heavily on the minds of the research participants in the context of the drought. As the conversation among Karen, Montze, Lupe, and Elizabeth demonstrates, life without maize and beans is unfathomable. For these women, their subjectivity as *campesinas* is intimately intertwined with the availability of maize and beans, and without it, they might as well cease to exist. Despite strong economic incentives to do otherwise, subsistence activities around maize remain an important source of food security for farm families. And these women's knowledge of climate in the region, derived from their own experiences with "good" and "bad" climates, influences their willingness to trust climate models. Now, as an increasingly unpredictable climate serves to amplify an already risky livelihood, it seems as though women in farming families are not willing, nor able to consider giving up subsistence farming altogether. However, we should not assume that the value of maize for the women of La Colorada and La Cuadrilla inherently necessitates particular attitudes about GM maize as well.

While this research highlights one group of women's anti-GM maize attitudes, feminist environmentalism and standpoint theory reminds us that women`s subjectivities and the production of knowledge are embedded and embodied within their local socio-political,

environmental, and economic contexts. Therefore, while one group of women may ultimately be opposed to GM seeds, it is entirely possible that another group would favor it. We should therefore in no way interpret these results to imply that women are more likely to oppose GM seeds that men or other groups of women. The women in La Colorada who expressed concern over GM maize had been active members of CEDESA for years. Through their participation in this group, these women produced and reproduced the idea that GM maize is "neither sustainable nor dignified". While some women's subjectivity includes a life free of GM seeds, given the fact that several families were already participating in the *maiz mejorado* program, it is likely that other families are willing to adopt any means necessary to maintain this livelihood.

This question remains unanswered because GM maize was not an explicit question I asked during my interviews. Instead, it was a topic that arose out of conversations and broad questions about agriculture, the drought and changing climates. Consequently, some women were vocal in expressing distrust and disbelief, while others never even mentioned it. However, given the national controversies over hybrid and GM maize, no one expressed overt support for it either. At the same time, an increasingly variable climate and the promotion of programs such as *maize mejorado* and other potential "transgenic adaptation strategies" (Mercer et al. 2012), may also put women's ability to gather *quelites* at risk.

It is important to point out that the ability to harvest *quelites* in the fields and around the home is a direct result of the lack of herbicides used in these two communities. This was because no one had the capital to invest in such inputs, not even those who received a government subsidy at the beginning of each growing cycle. The application of herbicides will kill the edible plants. As agro-chemicals are often included in technological packages promoted by SAGARPA (Vázquez García et al. 2004), there is a concern that the promotion of *maize mejorado* will increase the use of herbicides, thus threatening the availability of an inexpensive supplement to family diets in times of drought. However, Vázquez Garcia et al. (2004) have shown that families are still willing to apply herbicides even though they know that it harms *quelites*. This was particularly true among older men who are unable to put in the amount of work required without the use of agrochemicals, and particularly among men whose wives (or they themselves) are no longer to do the work themselves and see agrochemicals as a fast and efficient alternative to paying someone (Vázquez García et al. 2004). On the other hand, some of these families saw

the ability of women to gather *quelites* around the home as an adequate substitute for *quelites* lost in the field.

This points to the need to not only consider women's knowledge about food security, but to also understand the material contexts within which women's lives are embedded if we desire policies and programs that are responsive to the needs of marginalized groups. In contrast to literature which suggests that women are either more vulnerable (Denton 2002) or are more likely to adopt sustainable environmental practices in the face of climate change (Aguilar 2009), the women in the particular case presented here are neither victims of climate change nor can we say that they are virtuous environmentalists who oppose GM maize and will do absolutely everything to protect *quelites*. The livelihoods, choices, and preferences of the women of La Colorada and La Cuadrilla are in fact circumscribed by their gendered, socio-political, environmental, and economic contexts. Such understandings have implications for understanding why or under what circumstances transgenic adaptation strategies may or may not be adopted.

Clearly gender plays a major role in food security, especially in the context of socio-ecological uncertainty. At the same time, gender intersects with local socio-political, environmental, and economic contexts, which produces knowledge and attitudes about food security that are not universal for all women. By utilizing feminist theories of knowledge production and the environment to analyze climate change adaptation and food security, this paper highlights how women's material lives produce knowledge that shapes the utilization, access, and availability of food as well as attitudes about it.

References

Adger et al. 2007. Assessment of adaptation practices, options, constraints and capacity. In: Parry et al (eds) Climate change 2007: impacts, adaptation and vulnerability. Cambridge, UK: Cambridge University Press, pp 717–743

Adger, N.W., N.W. Arnell, E.L. Tompkins. 2005. Successful adaptation to climate change across scales. Global Environmental Change, 15: 77–86.

Adger, N.W., I. Lorenzoni, K.L. O'Brien, eds. 2009. Adapting to Climate Change: Thresholds, Values, Governance. Cambridge, UK: Cambridge University Press.

Adger, N.W., H. Eakin, and A. Winkels. 2008. Nested and teleconnected vulnerabilities to environmental change. Frontiers in Ecology and the Environment 7: 150-157.

Agarwal, B. 1992. Gender relations and food security: Coping with seasonality, drought, and famine in South Asia. In Unequal burden: Economic crises, persistent poverty, and women's works, eds. Shelley Feldman, and Lourdes Beneria. Boulder: Westview Press.

Aguilar, L. 2010. Establishing the linkages between gender and climate change adaptation and mitigation. In Irene Dankelman (ed) Gender and climate change: An introduction. London: Earthscan, 173-193.

Alston, M., and Whittenbury, K. eds. 2013. Research, action, and policy: Addressing the gendered impacts of climate change. New York: Springer.

Appendini, K., and Torres-Mazuera, G., eds. 2008. ¿Ruralidad sin agricultura? Ciudad de México: Colegio de México.

Appendini, K., R. García, and B. de la Tejera. 2003. Seguridad alimentaria y 'calidad' de los alimentos: ¿una estrategia campesina? Revista Europea de Estudios Latinoamericanos y del Caribe 75: 65-83.

Appendini, K. and D. Liverman. 1994. Agricultural policy, climate change and food security in Mexico. Food Policy 19:149-164.

Arellano-Vázquez, J.L. 2010. Crea el INIFAP nuevo maíz de calidad para las industrias de la masa-tortilla. http://www.inforural.com.mx/spip.php?article58859. Accessed January 31 2014.

Arora-Jonsson, S. 2011. Virtue and vulnerability: Discourses on women, gender and climate change. Global Environmental Change 21: 744–751.

Barbercheck, M., K. Brasier, N.E. Kiernan, C. Sachs, and A. Trauger. 2012. Use of conservation practices by women farmers in the Northeastern United States. Renewable Agriculture and Food Systems, 1: 1-18.

Basurto, P.F., M. Martínez Alfaro, and G. Villalobos Contreras. 1998. Los quelites de la Sierra Norte de Puebla, Mexico: Inventario y formas de preparacion. Boletín de la Sociedad Botánica de México 62 (49-62).

Bee, B. 2013. Who reaps what is sown? A feminist inquiry into climate change adaptation in two Mexican ejidos. ACME: An E-Journal for Critical Geographies 12: 131-154.

Bohle, H.G., T.F. Downing, and M.J. Watts. 1994. Climate change and social vulnerability: Toward a sociology and geography of food insecurity. Global Environmental Change 4: 37-48.

Brown, L.R., H.S. Feldstein, L. Haddad, C. Peña, and A.R. Quisumbing. 1995. Generating food security in the year 2020: Women as producers, gatekeepers, and shock absorbers. Washington, DC: International Food Policy Research Institute.

Brush, S. and M. Chauvet. 2004. Assessment of Social and Cultural Effects Associated with Transgenic Maize Production. In Maize and Biodiversity: The Effects of Transgenic Maize in Mexico Commission for Environmental Cooperation of North America (eds): Montreál, Canada, 49 pgs.

Butt, T.A., B.A. McCarl, and J. Angerer. 2005. The economic and food security implications of climate change in Mali. Climatic Change 68: 355-378.

Bye, R. A. Jr. 2000. Quelites-Ethnoecologyof edible greens-Past, present, and future. In Ethnobotany, ed. P. Minnis. Norman: University of Oklahoma Press.

Camarena, S. 2009. El Niño provoca sequía en México. El País. August 22, 2009.

Carr, E.R. 2008. Between structure and agency: Livelihoods and adaptation in Ghana's central region. Global Environmental Change 18: 689-699.

Casas, A. , J. L. Viveros, E. Katz, and J. Caballero. 1987. Las plantas en la alimentción mixteca: Una aproximación etnobotánica. América Indígena 47 (2):317-343.

Chambers, K.J., and J.H. Momsen. 2007. From the Kitchen and the Field: gender and maize diversity in Mexico. Special issue of the Singapore Journal of Tropical Geography on Gender and Agriculture 28: 39-56.

Conde, C., R. Ferrer, C. Gay, V. Magaña, J.L. Pérez, T. Morales, and S. Orozco. 1999. El Niño y la agricultura. In Los impactos de El Niño en México, ed. V. Magaña, 229. México: Centro de Ciencias de la Atmósfera, Universidad Nacional Autónoma de México.

Conde, C., R. Ferrer, and D. Liverman. 2000. Estudio de la vulnerabilidad de la agricultura de maíz de temporal mediante el modelo CERES-MAIZE. In México: una visión hacia el siglo XXI. El cambio climático en México, ed. Carlos Gay, 93-110. Distrito Federal: Centro de Ciencias Atmósferas-UNAM.

Conde, C. 2003. Cambio y variabilidad climáticos: Dos estudios de caso en Mexico. UNAM, Ciudad Mexico.

Conde, C., R.M. Ferrer, C. Gay, and R. Araujo. 2004. Impactos del cambio climático en la agricultura en México. In Cambio climático: una visión desde México., eds. Julia Martínez, Adrián Fernández Bremauntz, and Patricia Osnaya, 525. Ciudad de México: Instituto Nacional de Ecología.

Corbett, J. 1988. Famine and Household Coping Strategies. World Development 19: 1099-1112.

Cubasch, U., and G.A. Meehl. 2001. Projections of future climate change. In Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), eds. J. T. Houghton, Y. Ding, D. J. Griggs, M. Noguer, P. J. van der Linden, and D. Xiaosu. Cambridge: Cambridge University Press.

Dankelman, I. (ed) 2010. Gender and climate change: An introduction. London: Earthscan.

Deere, C.D. 2005. The feminization of agriculture? Economic restructuring in rural Latin America. In Gender Equality: Striving for Justice in an Unequal World. Geneva: United Nations Research Insitute for Social Development (UNRISD).

Denton, F. 2002. Climate change vulnerabilty, impacts and adaptation: Why does gender matter? Gender and Development 10: 10-21.

Devereux, S. and J. Edwards. 2004. Climate change and food security. IDS Bulletin 35.3: 22-30.

Eakin, H. 2006. Weathering risk in rural Mexico: climatic, institutional, and economic change. Tucson: University of Arizona Press.

Eakin, H. and M.C. Lemos. 2010. Institutions and change: The challenge of building adaptive capacity in Latin America. Global Environmental Change 20: 1-3.

Endfield, G.H. 2008. Climate and society in colonial Mexico. Oxford, UK: Blackwell Publishing.

Ericksen, P.J. 2008a. Conceptualizing food systems for global environmental change research. Global Environmental Change 18: 234-245.

Ericksen, P.J. 2008b. What is the vulnerability of a food system to global environmental change? Ecology and Society 13: 14.

Ericksen, P.J., J.S.I Ingram, and D.M. Liverman. 2009. Food security and global environmental change: Emerging challenges. Environmental Science & Policy 12: 373-377.

Eriksen, S., P. Aldunce, C. Bahinipati, R. Martins, J. Molefe, C. Nhemachena, K. O'Brien. 2011. When not every response to climate change is a good one: Identifying principles for sustainable adaptation. Climate and Development, 3: 7-20.

Espinosa, A., M.S. Macías, and N.G. Montiel. 2002. Producción y tecnología de semillas mejoradas de maíz por el INIFAP en el escenario sin la PRONASE. Agronomía Mesoamericana 14: 117-121.

Evenson, R.E. 1999. Global and local implications of biotechnology and climate change for future food supplies. Procedings of the National Academy of Sciences 96: 5921-5928.

FAO. 1996. Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit 13-17 November 1996. Rome.

Fitting, E. 2010. The struggle for maize: Campesinos, workers, and transgenic corn in the Mexican countryside. Durham: Duke University Press.

Gladwin, C.H., A.M. Thomson, J.S. Peterson, and A.S. Anderson. 2001. Addressing food security in Africa via multiple livelihood strategies of women farmers. Food Policy 26: 177-207.

González, R.J. 2001. Zapotec science: Farming and food in the northern sierra of Oaxaca. Austin: University of Texas Press.

Gregory, P.J, J.S.I Ingram, and M. Brklacich. 2005. Climate change and food security. Philosophical Transactions of the Royal Society B: Biological Sciences 360: 2139-2148.

Haraway, D. 1988. Situated knowledges: The science question in feminism and the priviledge of partial perspective. Feminist Studies 14.

Harding, S. 1991. Whose science? Whose knowledge?: Thinking from women's lives. Ithaca, NY: Cornell University Press.

Hawkins, R., Ojeda, D. (eds.), 2011. A discussion: gender and Environment: critical tradition and new challenges. Environment and Planning D: Society and Space, 29: 237–256.

Howden, M.S., J.F. Soussana, F.N. Tubiello, N. Chhetri, M. Dunlop, and H. Meinke. 2007. Adapting agriculture to climate change. Procedings of the National Academy of Sciences 104: 19691-19696.

Ingram, J., P. Ericksen, and D. Liverman. 2010. Food security and global environmental change. Washington DC: Earthscan.

Kabeer, N. 1990. Women, household food security and coping strategies. In Women and nutrition-Nutrition policy discussion paper no. 6, ed. ACC/SCN. New York: United Nations.

Lerner, A. and K. Appendini. 2011. Dimensions of peri-urban maize production in the Toluca-Atlacomulco Valley, Mexico. Journal of Latin American Geography 10: 87-106.

Liverman, D. 1990. Drought impacts in Mexico: Climate, agriculture, technology and land tenure in Sonora and Puebla. Annals of the Association of American Geographers I: 49-72.

Liverman, D. 1999. Adaptation to drought in Mexico. Natural Resources Journal 39: 99-115.

Liverman, D.M. 2001. Vulnerability to drought and climate change in rural Mexico. In Global Environmental Risk, eds. Jeanne X. Kasperson, and Roger E. Kasperson, 201-216. New York: Earthscan.

Long, N., and M. Villarreal. 1998. Small product, big issues: value contestations and cultural identities in cross-border commodity networks Development and Change 29: 725-750.

Magaña, V., C. Conde, O. Sánchez, and C. Gay. 1997. Assessment of current and future regional climate scenarios. Climate Research 9: 107-114.

Magaña, V., C. Conde, O. Sánchez, and C. Gay. 2000. Evaluación de escenarios regionales de clima actual y de cambio climático futuro para México. In México: una visión hacia el siglo XXI. El cambio climático en México, ed. Carlos Gay, 1-24. Distrito Federal: Centro de Ciencias Atmósferas-UNAM.

Magaña, V., T. Morales, J. L. Pérez, and S. Orozco. 1998. El Niño y La Niña en el estado de Tlaxcala, ed. A. C. Fundación Produce: SEMARNAP, CONACyT.

Masika, R. 2002. Gender, development, and climate change. Gender and Development, vol. 2. Oxford: Oxfam GB.

McAfee, K. 2008. Beyond techno-science: Transgenic maize in the fight over Mexico's future. Geoforum 39: 148-160.

McCarthy, J.J., O.F. Canziani, N.A. Leary, D.J. Dokken, and K. S. White. 2001. Impacts, Adaptation and Vulnerability. In Working Group II, Intergovernmental Panel on Climate Change. Geneva, Switzerland.

Mercer, K.L., H.R. Perales, and J.D. Wainwright. 2012. Climate change and the transgenic adaptation strategy: Smallholder livelihoods, climate justice, and maize landraces in Mexico. Global Environmental Change 22: 495-504.

Morton, J.F. 2007. The impact of climate change on smallholder and subsistence agriculture. Procedings of the National Academy of Sciences 104: 19680-19685.

Naess, L. O. 2013. The role of local knowledge in adaptation to climate change. Wiley Interdisciplinary Reviews: Climate Change. 4: 99-106.

Nelson, V. and T. Stathers. 2009. Resilience, power, culture and climate: A case study from semi-arid Tanzania and new research directions. Gender and Development 17.

Nightingale, A. 2009. Warming up the climate change debate: A challenge to policy based on adaptation. Journal of Forest and Livelihood 8: 84-89.

O'Brien, K.L., and R.M. Leichenko. 2000. Double exposure: assessing the impacts of climate change within the context of economic globalization. Global Environmental Change 10: 221-232.

Omari, K. 2010. Gender and climate change: Botswana case study: Heinrich Boll Foundation Southern Africa.

Omwoha, J.N. 2007. Gender contribution and constrains to rural agriculture and household food security in Kenya: Case of Western Province. Paper presented at the 2nd International Conference of the African Association of Agricultural Economists, Ghana.

Ortíz Gomez, A.S., V. Vázquez García, and M. Montes Estrada. 2005. La alimentación en México: Enfoques y visión a futuro. Estudios Sociales 13: 7-34.

Parry, M., C. Rosenzweig, A. Iglesias, G. Fischer, and M. Livermore. 1999. Climate change and world food security: A new assessment. Global Environmental Change 9: S51-S67.

Parry, M., C. Rosenzweig, A. Iglesias, M. Livermore, and G. Fischer. 2004. Effects of climate change on global food production under SRES emissions and socio-economic scenarios. Global Environmental Change 14: 53-67.

Pielke, R.A. Jr., Prins, G., Rayner, S., Sarewitz, D. 2007. Lifting the taboo on adaptation. Nature 445: 597–598.

Preibisch, K.L., G. Riviera Herrejón, and S.L. Wiggins. 2002. Defending food security in a free-market economy: The gender dimensions of restructuring in rural Mexico. Human Organization 61: 68-79.

Quist, D. and I.H. Chapela. 2001. Transgenic DNA introgressed into traditional maize landraces in Oaxaca, Mexico. Nature 414: 541–543.

Quisumbing, A.R., L.R. Brown, H.S. Feldstein, L. Haddad, and C. Peña. 1995. Women: the key to food security. Washington, DC: International Food Policy Research Institute.

Radel, C., 2005. Women's Community-Based Organizations, Conservation Projects, and Effective Land Control in Southern Mexico. Journal of Latin American Geography, 4: 9–36.

Radel, C., 2011. Becoming Farmers: Opening Spaces for Women's Resource Control in Calakmul, Mexico. Latin American Research Review, 46: 29–54.

Reed, M. G. 2000. Taking Stands: a feminist perspective on other women's activism in forestry communities of northern Vancouver Island. Gender, Place & Culture 7: 363 - 387.

Resurreccion, B.P. 2011. The gender and climate change debate: more of the same or new pathways of thinking and doing? Asia security initiative policy series,10. RSIS Centre for Non-Traditional Security Studies, Singapore.

Rimarachín Cabrera, I., E. Zapata Martelo, and V. Vázquez García. 2001. Gender, rural households, and biodiversity in native Mexico. Agriculture and Human Values 18: 85-93.

Rossi, A. and Y. Lambrou. 2008. Gender and equity issues in liquid biofuels production: Minimizing the risks, to maximize the opportunities. Rome: Food and Agriculture Organization of the United Nations.

Sachs, C. 1996. Gendered fields: Rural women, agriculture, and environment. Edited by L. J. Beaulieu, Rural Studies Series of the Rural Sociological Society. Boulder: Westview Press.

Sauer, C. 1971. Sixteenth Century North America: The Land and People as Seen by European. Berkley: University of California Press.

SDA. 2007. Anuario Estadístico de la Producción Agrícola. Celaya: Secretaria de Desarrollo Agropecuario, Oficina Estadatal de Información OEIDRUS.

Segnestam, L. 2009. Division of capitals: What role does it playfor gender-differentiated vulnerability to drought in Nicaragua? Community Development 40: 154-176.

Slocum, R., L. Wichhart, D. Rocheleau, and B. Thomas-Slayter eds. 1995. Power, process, and participation: Tools for change. London: Intermediate Technology Publication

SMN. 2009. La disminución de precipitaciones en los meses de julio y agosto origin a sequía en algunas regiones del país. Distrito Federal: Servicio Meteorológico Nacional.

Solís, F. 1998. La Cultura de Maíz. Mexico, D.F.: Editorial Clio.

Tandon, N. 2007. Biopolitics, climate change and water security: impact, vulnerability and adaptation issues for women. Agenda 27: 4-20.

Tuana N. and C.J. Cuomo. 2014. Climate change: Editor's introduction. Hypatia 29.

Van Dussel, E.M. 2000. In situ conservation of crop genetic resources in the Mexican milpa system. University of California Davis, Davis.

Vázquez García, V. 2002. ¿Quién cosecha lo sembrado? Relaciones de género en un área natural protegida mexicana. Plaza y Valdés, S.A. de C.V.: México.

Vázquez García, V. 2008. Gender, ethnicity, and economic status in plant management: Uncultivated edible plants among the Nahuas and Popolucas of Veracruz, Mexico. Agriculture and Human Values 25:65-77.

Vázquez García, V., L. Godínez Guevera, M. Montes Estrada, and A.S. Ortíz Gomez. 2004. Los quelites de Ixhuapan, Veracruz: Disponibilidad, abastacimiento, y consumo. Agrociencia 38: 445-455.

Vizcarra, I.B. 2001. ...Y la lucha sigue entre sombreros y rebozos. Historia de una tierra de subsistencia "marginal" mazahua. Estudios Agrarios 7: 9-73.

Vogel C., Moser S.C., Kasperson R.E., Dabelko G.D. 2007. Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships. Global Environmental Change 17: 349-364.

Washington, R. and T.E. Downing. 1999. Seasonal forcasting of African rainfall: Predictions, responses, and household food security. The Geographical Journal 165: 255-274.

Whitehead, A. 1990. Rural women and food production in Sub-Saharan Africa. In The political economy of hunger, eds. A. Sen, and J. Dreze. Oxford: Clarendon Press.

Ziervogel, G. and P.J. Ericksen. 2010. Adapting to climate change to sustain food security. WIREs Climate Change 1: 525-540.

Ziervogel, G., A. Nyong, B. Osman, C. Conde, S. Cortés, and T. Downing. 2006. Climate variabiity and change: Implications for household food security. In AIACC Working Paper No. 20. Washington, DC.

Appendix: Tables and Figures

Table 1: Percent of adults in study areas involved in paid and non-paid activities.

	La Colorada		La Cuadrilla	
Activity type	Women	Men	Women	Men
Self-employed farming	9.4%	36.8%	3.5%	21.8%
Agricultural laborer	9.4%	40.4%	0.0%	21.8%
Construction laborer	0.0%	12.3%	0.0%	36.4%
Commercial/small business	7.1%	7.0%	12.3%	0%
Other salaried activity	5.9%	3.5%	0.0%	1.8%
Non-paid community work	7.1%	0.0%	0.0%	0.0%
Paid domestic work	4.7%	0.0%	3.5%	0.0%
Non-paid domestic work	88.2%	0.0%	80.7%	0.0%
Unemployed	0.0%	1.8%	0.0%	14.5%

Source: Author interviews.

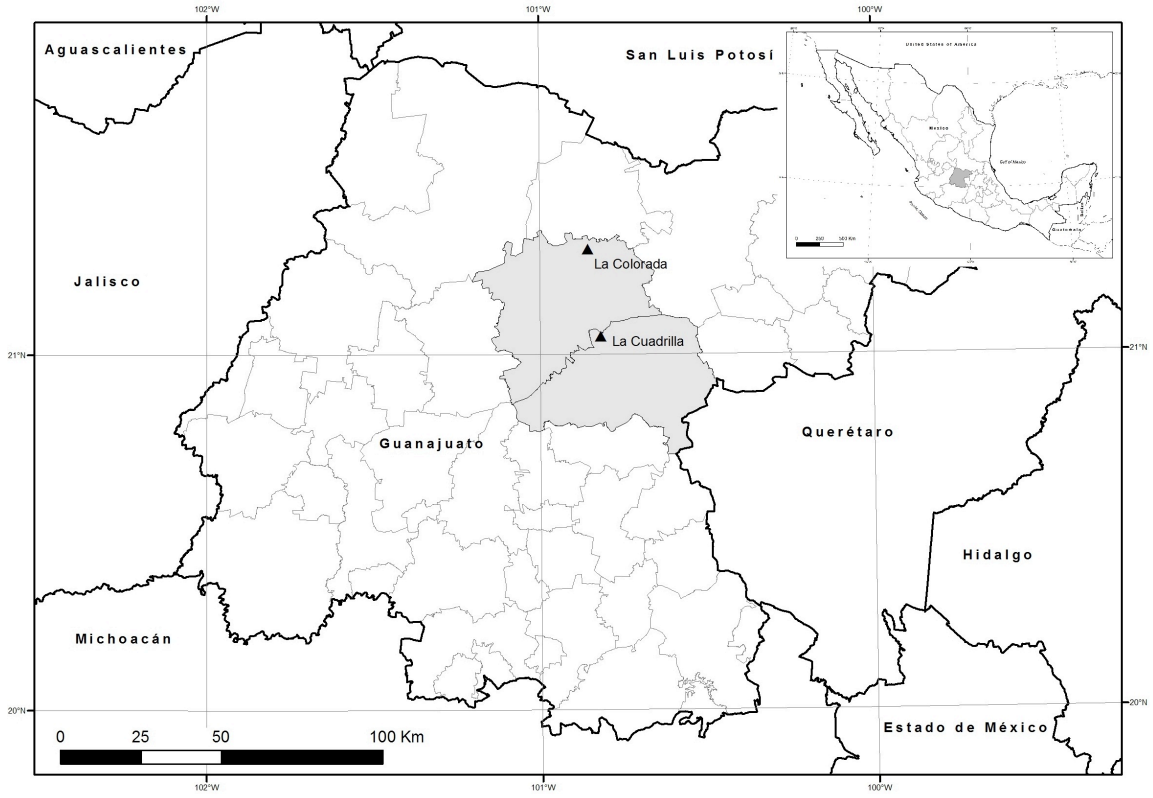

Fig. 1. Location of study areas, La Colorada, and La Cuadrilla, Mexico.

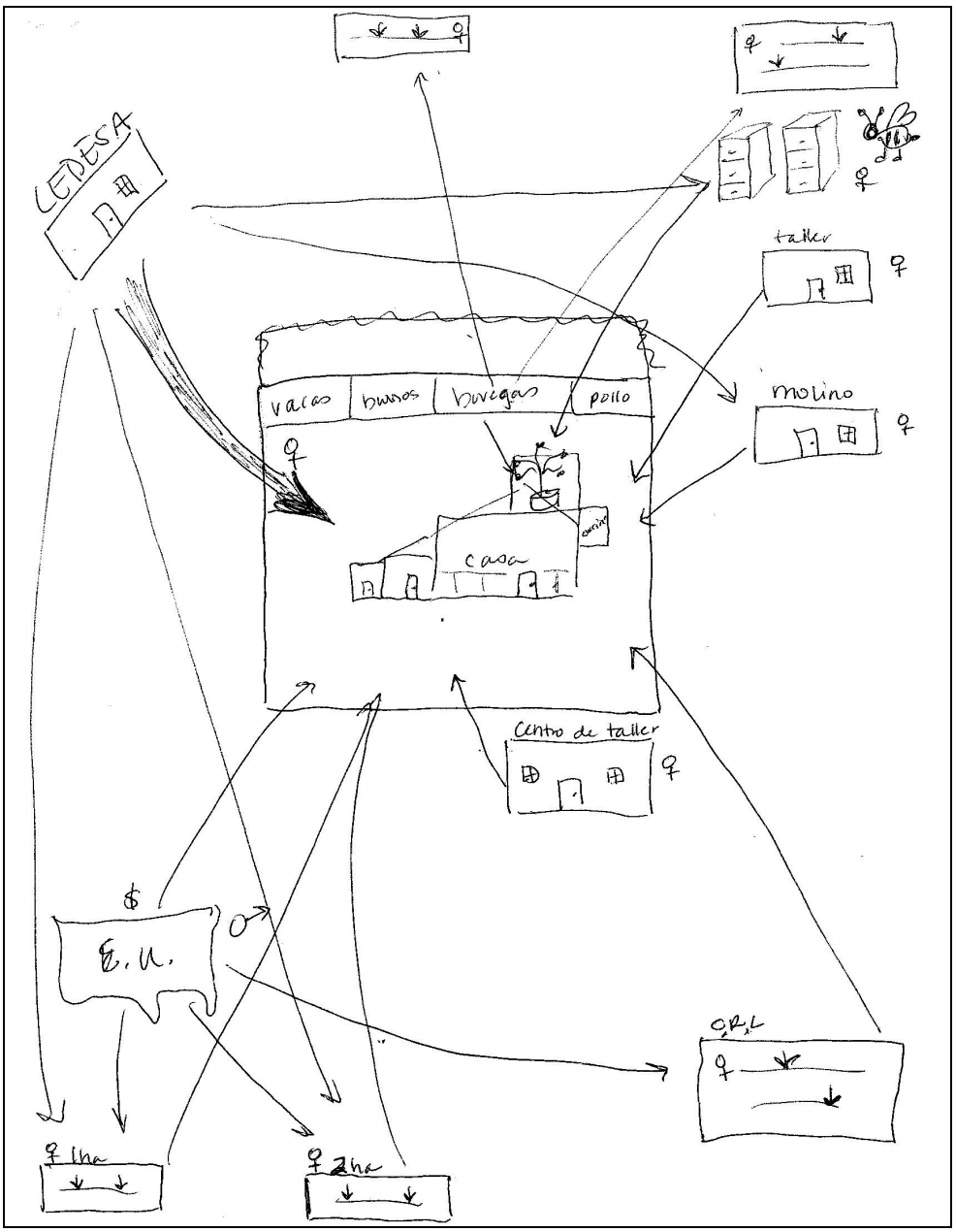

Fig. 2: Sample gender resource map.