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GENDER AND CLIMATE CHANGE ADAPTATION IN AGRARIAN SETTINGS

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GENDER AND CLIMATE CHANGE ADAPTATION IN AGRARIAN SETTINGS

Prepared by:

Edward R. Carr
Society, Environment, Economy Group, LLC
Columbia, SC 29201
and
Department of Geography
University of South Carolina
Columbia, SC 29208
and
Mary C. Thompson
Department of Geography
University of South Carolina
Columbia, SC 29208
and
Bioversity International/BC3. Basque Center for Climate Change
Alameda Urquijo 4 , 4ª
48008 Bilbao Bizkaia – Spain

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ACRONYMS

CMDT	Compagnie Malienne du Développement des Textiles
CSPW	Cape Saint Paul Wilt Disease
FEWS-NET	Famine Early Warning System Network
GCOS	Global Climate Observation System
GPCC	Global Precipitation Climatology Centre
IER	Institut d'Economie Rural
LYD	Lethal yellowing disease
MMFR	Mount Mulanje Forest Reserve
NFE	Non-farm employment
WCRP	World Climate Research Program

INTRODUCTION

The impacts of climate variability and change on the rural poor in the Global South become more pronounced with each passing year. While entire communities and regions will be exposed to the same changing temperatures and precipitation, the ways in which they are vulnerable to these changes will vary greatly. As the contemporary literature on adaptation now acknowledges, the patterns of vulnerability to climate change impacts we see today are largely, if not principally, shaped by social factors ranging from gender roles to class to ethnicity. These social factors shape access to livelihoods resources (i.e., who controls access to land?), roles in markets (i.e., who sells what, and to whom?), and political structures (i.e., who arbitrates disputes?). In short, these social factors have broad ramifications for the ways in which people experience and address the impacts of climate variability and change in their lives.

This complex framing of the vulnerability of the rural poor to climate variability and change builds on decades of feminist scholarship on agriculture and rural development in the Global South (a very partial list includes Barrientos et al. 2005; Barry and Yoder 2002; Bassett 2002; Bhuyan and Tripathy 1988; Boserup 1970; Bryceson 1995; Carney 1996; Carr 2005; Chikwendu and Arokoyo 1997; Creevey 1986; Dixon 1982; Egharevba and Iweze 2004; Feldman and Welsh 1995; Ferguson 1994; Gairola and Todaria 1997; Goebel 2002; Goheen 1988; Grier 1992; Harrison 2001; Harriss-White 1998; Jackson 1993, 1998a; Jha 2004; Leach and Fairhead 1995; Mama 2005; Mbata and Amadi 1993; Moser 1993; Peters 1995; Riley and Krogman 1993; Rocheleau, Thomas-Slayter, and Wangari 1996; Radel 2011; Angeles and Hill 2009; Shahra Razavi 2009; Koopman 2009; Oakley and Momsen 2007). Much of this literature focuses on gender as the principal social cleavage around which both differentiated vulnerabilities (where different members of a population experience and/or respond to the impacts of the same event or trend differently) and distinct vulnerabilities (where different members of a population are exposed to distinct events and trends) emerge, as gender is a central consideration in determining the roles and resources available to individuals in particular places. Historically, this literature has framed its analyses around a straightforward, binary comparison of men's and women's challenges and opportunities, producing a compelling case for the inclusion of gender analysis in the design and evaluation of programs and projects aimed at addressing vulnerability to climate variability and change in agrarian settings. The these efforts have resulted in several broad themes and lessons, which we summarize below (for details, see Appendix 1):

1. In agrarian communities in the Global South, access to land is often marked by significant gendered inequalities.

2. In many parts of the Global South, gendered activities and crops are important parts of agricultural practice. In such settings, the different crops grown by men and women often present distinct challenges and opportunities in the context of particular environments and economies.

3. In some agrarian settings promising adaptation strategies unique to women have been identified. In these cases, women can and do utilize their unique roles in their households and communities to create new strategies for dealing with situations of drought, flooding, uncertainty, and other climate change-related stressors.

4. More often than not, development and extension programs fail to identify women's activities as appropriate targets.

5. There exists a broad, pervasive (if not universal), and enduring lack of women's inclusion in agricultural decision-making at scales and settings ranging from the household to agricultural development programs and projects, to climate negotiations. This is particularly troubling given the lessons in points 1-3 above.

In recent years the literature on agriculture, rural development, and gender in the Global South has started to shift away from a focus on gender as *the* central factor in the production of distinct and differentiated vulnerabilities in particular places. This emerging literature understands gender as itself a complicated social categorization made up of different identities, roles, and responsibilities. These cross-cutting identities come together in the individual, tying them to roles and responsibilities that are specific to that intersection of identities. Extending the observations of previous binary gender analyses, this literature notes that these more complex identities shape access to livelihoods resources and opportunities, and therefore produce distinct and/or differential vulnerability to climate change impacts. In short, the literature is moving from the narrow duality of man versus women to a consideration of the ways in which "man" and "woman" contain a large number of distinct identities that might not always be best grouped by gender if we seek to understand the range of vulnerabilities to climate change impacts in particular places.

The literature on gender and adaptation to climate change makes some reference to the newer perspectives on gender in the development literature. However, most of the gender and adaptation literature remains largely marked by a "man vs. woman" framing of gender analysis that many now argue is no longer the most effective tool for understanding and addressing challenges associated with gendered aspects of adaptation to climate change (Carr, 2008a; Dankelman, 2002; Demetriades & Esplen, 2008; Djoudi & Brockhaus, 2011; McGregor, 2009; Skinner, 2011). A small but growing body of literature in the adaptation literature (see, for example, Arora-Jonsson, 2011; Carr, 2008a; Harris, 2006) argues that gender should not be seen as an isolated, or necessarily primary, cause of vulnerability. This emerging literature offers several important lessons of its own (for details, see Appendix I):

1. When attempting to understand varying vulnerabilities within agrarian communities and households, a narrowly framed binary gender analysis of vulnerability to climate change impacts in agrarian settings might not be as productive as a wider effort to understand the range of locally specific identities and activities that intersect to produce observed vulnerabilities. Major cross-cutting identities and activities identified in the literature as impacting gendered vulnerability to the impacts of climate change and variability include age, class/livelihoods roles, caste, and ethnicity.

2. Gender roles are defined within households and communities, with reference to other social categories, forms of labor, and social expectations that transcend the household or community. For example, gender roles are not only defined by things like the division of household labor, but also historical expectations (i.e., as expressed by more senior members of society) and the expectations of one's class (i.e., varying expectations of motherhood and family size at different socioeconomic levels) to which men and women answer in their everyday lives.

3. Framing vulnerability analysis around gender in an *a priori* manner risks overlooking other social differences that might be equally or even more important determinants of vulnerability to climate variability and change in a particular context.

In the report that follows, we present three case studies that illustrate the importance of this contemporary approach to gender when applied to climate change adaptation in rural, agrarian settings. In each case, we demonstrate that in studies predicated on simple gender categories, the particular challenges and vulnerabilities of a significant portion of the population in question become difficult to identify. This inadvertent oversimplification of the range of vulnerabilities to climate change impacts at work in households, communities, and countries makes it difficult, if not impossible, to productively design interventions that address these vulnerabilities.

GENDER AND ADAPTATION: CASE STUDIES

The three case studies presented here are all drawn from primary research conducted by the authors in different parts of sub-Saharan Africa. These cases cross different scales of analysis (from detailed, long-term ethnographic work in small communities to shorter, broader assessments of livelihoods and vulnerability across dozens of communities) and settings (including the Sahel, coastal West Africa, and Southern Africa). We selected these cases because they are all supported by extensive empirical evidence on the intersection of gender, livelihoods, and vulnerability to the impacts of climate variability and change.

Each case study begins with a brief description of the study area, with special attention to the vulnerability context of the residents. The vulnerability context is a formal term in livelihoods studies that refers to the economic, environmental, and social trends that might affect the residents and their livelihoods, potential shocks in each of these realms, and any seasonality that might characterize the local environment and economy. The cases also describe the relevant aspects of livelihoods impacted by the vulnerability context, which might shape distinct and/or differential vulnerabilities to climate impacts. Finally, each case, using comparisons of empirical data, makes a case for vulnerability analyses that rest on the consideration not merely of gendered impacts of climate variability and change, but the consideration of at least one new set of identities created when we examine the intersection of gender identity with other identities salient to each case. The point here is not merely to nuance gender by adding another layer to gender analysis, but to recognize that these intersections of identity can produce entirely distinct identities with different rights, roles, and responsibilities. This is how it is possible, for example, that in a given setting a senior woman's vulnerability to the impacts of climate variability and/or change might have more in common with that of a senior man than with any other woman in the village – in short, we show how gender might become one of several determinants of patterns of vulnerability in a given setting without disappearing from analysis entirely.

GHANA

GHANA CASE SUMMARY

In Ghana's Central Region, residents of two villages address an uncertain environment and economy through different livelihoods strategies. The climate of the area is marked by a steady decline in annual precipitation, changing seasonality of precipitation as the minor rainy season slowly disappears, and ongoing variability with regard to the start of the rainy season, annual total precipitation, and the number of precipitation events in a season. Agriculture, which makes up roughly 65% of household income in these villages, is characterized by significant gendered patterns, such as men's control over tree crops that are relatively resistant to fluctuations in precipitation versus women's emphasis on vegetable crops that are very susceptible to variable precipitation. However, gender disaggregation alone does not capture the most significant roles and responsibilities that emerge in the context of agricultural livelihoods in these villages. It is only when gender is understood in the context of distinct household situations and livelihoods strategies that clear patterns of vulnerability emerge not only across, but *within* traditional gender categories. Not only are these "intra-gender" vulnerabilities impossible to identify in a binary gender analysis, an examination of these intra-gender differences demonstrates that binary gender analysis would, in these villages, produce potentially skewed understandings of vulnerability. For example, among women in these villages, the challenges and opportunities of the poorest 60% are lost in the aggregation of binary gender analysis, which might lead to the underestimation and misidentification of women's vulnerabilities to the impacts of climate variability and change. On the other hand, the situation of men in the wealthiest households becomes harder to assess, potentially producing vulnerability analyses that overestimate and misidentify men's vulnerabilities to these impacts.

Introduction

Dominase and Ponkrum (Figure 1) are two villages that, while politically independent, comprise a single community with two settlement loci. Located 500 meters apart along a road that leads to the coastal town of Elmina eight kilometers to the southeast, the approximately 250 residents of these villages address a challenging vulnerability context with income and other livelihoods resources accumulated through both agricultural and non-farm sources. In Dominase and Ponkrum, the vulnerability context hinges on economic and environmental change and uncertainty, exacerbated by social structures that shape and limit potential adaptive responses to these stresses. The Ghanaian economy to which these two villages belong is heavily predicated on the harvest and export of natural resources – primarily gold, cocoa, and most recently crude petroleum. The country's status as an exporter of raw materials for global markets has left it vulnerable to market swings for these materials, or the products that are made from these materials. For example, in a period of months spanning 1999 and 2000, the Ghanaian currency lost roughly half its value against the dollar and many other major currencies as a direct outcome of panic in global cocoa markets when the European Union questioned the need to include cocoa in products labeled as chocolate. This event manifested itself in Dominase and Ponkrum through a dramatic rise in prices of nearly all consumer goods. Imported materials denominated in other currencies became inaccessible, which cascaded into higher prices for domestically produced materials. These price increases were not matched by increases in farm-gate prices for the agricultural products of the farms in Dominase and Ponkrum, and residents had to shift away from market engagement for their crops, instead subsisting on their produce. While everyone in these villages was able to eat, incomes across the community were severely compromised, limiting the ability of households to pay for such things as school fees and uniforms, protein (in the form of fish, usually purchased at Elmina), and building materials (for discussion, see Carr, 2011).

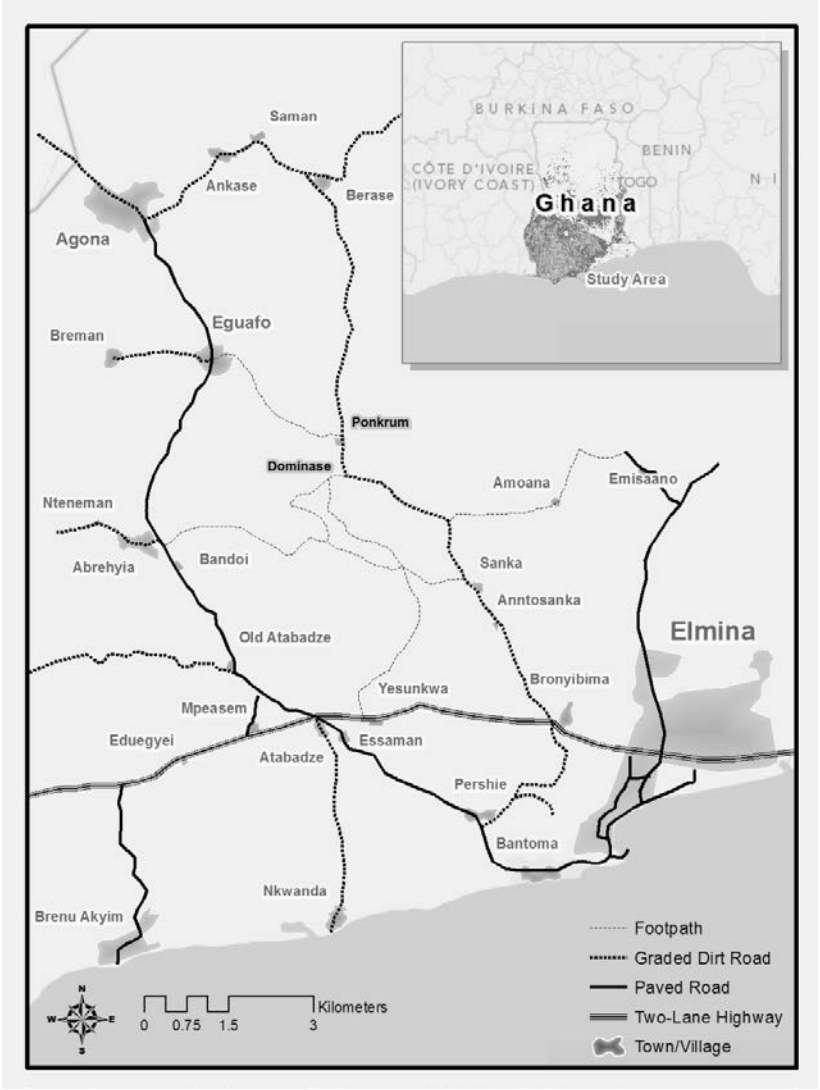

Figure 1: Locator map of Dominase and Ponkrum, the two villages covered by this case study

The economic uncertainty that characterizes life in these villages is compounded by environmental change and uncertainty. Climate-related stresses include a well-documented long-term decline in precipitation (for example, Lamb & Peppler, 1992; Nicholson, Some, & Kone, 2000; Wagner & DaSilva, 1994) as well as a more recently discovered shift in seasonality, where the minor rainy season appears to be declining into a long damp period that might compromise the second harvest in these villages (Owusu & Waylen, 2009; Waylen & Owusu, 2007). It is not clear if farmers in Dominase and Ponkrum distinguish this changing seasonality from the overall decline in annual precipitation, but they are aware that a changing precipitation regime is challenging their ability to earn reliable incomes. While these long-term trends are quite serious, there is also significant year-to-year variability in the timing and quantity of precipitation during the agricultural season. In 1998, for example, the monsoon failed and there was effectively no major rainy season, which resulted in some food shortages and major household income losses. On the other hand, in 2005, unusually heavy rains fell, wiping out farms as the runoff flooded long-dry streambeds and low-lying fields. This variability is ingrained in local agricultural strategy such that farmers disaggregate their plots to capture different situations (tops, sides, and bottoms of hills) to ensure that at least some of their farmed land receives adequate (but not excessive) water. Finally, there are various ecological stresses, such as major outbreaks of Cape Saint Paul

Wilt Disease (CSPW), a lethal yellowing disease (LYD) that attacks and kills coconut trees. CSPW first came to the Central Region in 1983. Since then, outbreaks of CSPW have periodically claimed the coconut trees in and around Dominase and Ponkrum, forcing complete replanting of the trees and causing years of lost income.

While everyone in these villages is exposed to these same uncertainties, their impact is felt in different ways within the community, and indeed within individual households. On a superficial level, the household livelihoods seen in Dominase and Ponkrum are broadly similar. Agriculture makes up 65% of the average household income, with informal and often irregular non-farm employment (NFE) accounting for the remaining 35%. The single most critical livelihoods resource in these villages is agricultural land, which households access through the clan lineage of the male head of household. Once the male head has secured land for the upcoming season, he distributes it to the other members of his household who actively farm. Typically, this would be his wife, as all but two married households in these villages are monogamous. Men tend to allocate their wives about 20% of the total household allotment, assigning the remaining 80% to themselves. This particular system of land tenure presents particular challenges to female-headed households, who, while making up 25% of all households in this area, lack any direct access to land. While they could rent agricultural land, rents run between a third and a half of total farm output. These households are severely labor-challenged, making this sort of rent unsustainable. As a result, most women heading households in these villages are dependent on their fathers or uncles for access to land. As these men must take these allotments out of their own household land allocation, women heading households tend to receive between 0.3 and 0.5 hectares of land, about half as much land as women in monogamous households, and roughly 10% that of a monogamous household taken as a whole.

In 2005, when the data for the case study below were gathered, there were two major livelihoods strategies[1] at play in Dominase and Ponkrum. In one, which has been termed the "market" strategy (see Carr, 2008a, 2011 for a discussion of the naming of these strategies), men and women both orient their agricultural production toward market sale, seeking to maximize income with which they can buy household needs. The other, called the "diversified" strategy, is marked by clearly gendered production roles. Under this strategy, men produce for market sale, while women produce for household subsistence. These strategies result in different household income profiles. Diversified households report annual earnings roughly 30% of those reported by market households. Female-headed households are at the low extreme for income in these villages, reporting annual totals amounting to 5% those in market households. While this reporting underestimates diversified household and female-headed household earnings somewhat, as it does not include the value of crops consumed for subsistence in the household, it is clear that market households are by far the wealthiest in these villages. These strategies and their outcomes are not reflections of differential access to land, as households operating under the diversified strategy cultivate farms roughly 90% the size of those associated with market strategy households (3.6 hectares to 4.1 hectares, respectively). Instead, these strategies reflect different views of how to manage the challenges of the vulnerability context in these villages, views that can change over time, resulting in shifts to overall patterns of livelihoods in these villages (Carr, 2011, 2013).

The existence of different strategies and household situations (monogamous vs. female-headed) suggests that while everyone in these villages is exposed to the same vulnerability context, its impact is felt in different ways within the community. By exploring some aspects of agricultural practice employed by the residents of Dominase and Ponkrum under these strategies and household situations, we can see how different framings of gender present rather different understandings of who is vulnerable to what.

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[1] It is important to note that in any given year, up to 40% of the households in the village are not operating under either of these strategies because the woman is pregnant or has just given birth. Under these conditions, households appear to shift into a very conservative, subsistence-first strategy until the woman is able to work again, at which point they return to their usual strategy. We do not explore this temporary strategy here, as it does not reflect a long-term outlook or planning framework for these households.

Gender, Agricultural Practice, and Vulnerability in Dominase and Ponkrum

The livelihoods of those living in Dominase and Ponkrum have been explored in great detail elsewhere (for example, Carr, 2008a, 2008b, 2011, 2013). For the purposes of illustrating how different framings of gender enable different understandings of vulnerability within communities and households, the focus here is on the agricultural components of those livelihoods. This analysis looks at a sample of adult residents (n=33, 14 men, 19 women), excluding those households where the woman was pregnant, as such situations create a temporary shift in livelihoods practice and agricultural strategy that is not representative of the household's long-term focus (Carr, 2011).

The agricultural makeup of livelihoods in these villages incorporates the cultivation of several types of crop, ranging from tree crops to vegetables to agroforestry products (*acacia polyacantha* and a single farmer cultivating a few trees to sell as electrical poles). Table 1 shows all of the crops grown in the village in 2005, and the percentage of the sample growing that crop. Figure 2 then places this into the context of agricultural strategy. Here, each crop is labeled according to its intended use, and sorted from most commonly grown to least commonly grown. The intended use of the crop was gathered from farmers on an ordinal scale, where 1= eat all, 2 = eat more than sell, 3 = eat and sell equally, 4 = sell more than eat, and 5 = sell all. The intended use in Figure 2 represents an interpretation of the average score for the crop on this ordinal scale. Note that the list of crops in Figure 2 is shorter than that in Table 1 because the figure only contains those crops raised by two or more farmers to control for potential idiosyncratic interpretations of crop use.

Table 1: All crops grown in Dominase and Ponkrum in 2005, by percentage of farmers reporting raising each crop

	n=	%
Cassava	33	100.00%
Maize	32	96.97%
Pepper	25	75.76%
Garden Egg	20	60.61%
Tomato	19	57.58%
Palm	16	48.48%
Acacia	15	45.45%
Orange	11	33.33%
Plantain	9	27.27%
Pineapple	8	24.24%
Coconut	4	12.12%
Water yam	4	12.12%
Cashews	2	6.06%
Papaya	2	6.06%
Banana	1	3.03%
Beans	1	3.03%
Cocoyam	1	3.03%
Lightpole	1	3.03%
Okra	1	3.03%
Sugarcane	1	3.03%

Taken together, Table 1 and Figure 2 reflect a fairly conservative agricultural strategy, with each farm containing an average of 6.3 crops, heavily weighted toward those that are eaten and sold in similar quantities. Such crops are useful in the face of economic and environmental uncertainty, as they can be eaten in years of hardship, or sold in years of surplus. Garden eggs lean a bit toward the subsistence side of this strategy, before we see a series of tree crops (as well as pineapples) that derive most, if not all, of their value from market sale. These appear to be less important parts of agricultural strategy, as they make up less than half as many occurrences as the crops that can be both eaten and sold. As we come to the end of this list, we see a mixed set of uses, but these crops are grown by relatively few farmers and therefore are not of tremendous importance to the community as a whole.

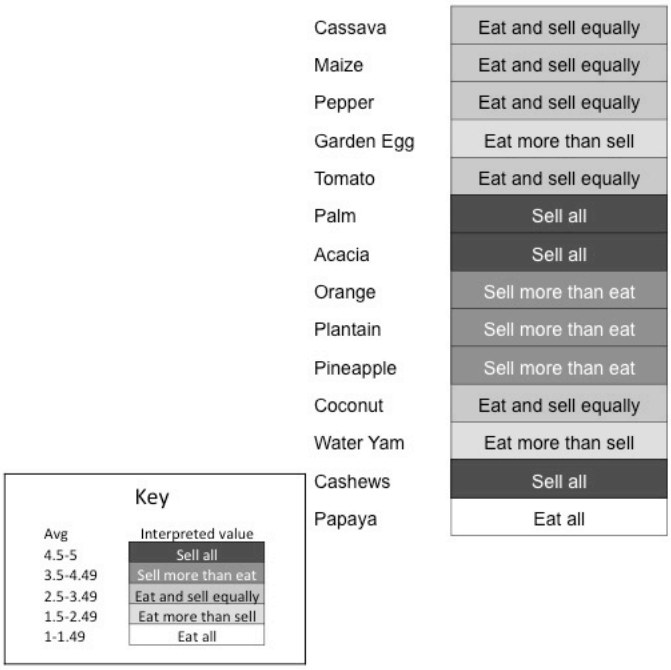


Figure 2: The average intended use of all crops grown by two or more farmers in Dominase and Ponkrum in 2005

On the surface, then, it seems that the residents of these villages have strongly hedged their production against both economic and environmental instability by planting crops that can be used for either market sale or consumption, with added hedging against an uncertain climate represented by an investment in tree crops that tend to be more resistant to fluctuations in precipitation than other crops, but much more vulnerable to market swings. This weighting of crops in this strategy suggests the residents of this village are more concerned with building resilience to environmental uncertainty than market instability.

In Dominase and Ponkrum, however, a household level analysis of agricultural practice is inappropriate, because men and women of the same household are, at least in ideal terms, autonomous agricultural producers living in the same social unit. While male heads of household are responsible for procuring land for their household from their clan lineage, once they allocate that land to the members of their household (typically between themselves and their wives, as nearly all households in these villages, and all households in the sample discussed here, are monogamous) they lose control over that land (Carr, 2008a, 2011, 2013). Once allotted land, women can decide what to plant, how to plant, when to plant, when and how to harvest, when and where to sell the crops and at what prices, and what to do with the proceeds without interference from their husbands. Given this intrahousehold autonomy in agricultural production, it is worth exploring

gendered patterns of agricultural practice to identify differences that might produce distinct and/or differential vulnerabilities within the community and its households.

Table 2: All crops grown by men and women in Dominase and Ponkrum in 2005

	Women		Men	
	n=	%	n=	%
Cassava	19	100.00%	14	100.00%
Maize	19	100.00%	12	85.71%
Pepper	16	84.21%	9	64.29%
Garden Egg	14	73.68%	6	42.86%
Tomato	13	68.42%	6	42.86%
Acacia	3	15.79%	12	85.71%
Orange	3	15.79%	8	57.14%
Palm	3	15.79%	13	92.86%
Plantain	3	15.79%	6	42.86%
Pineapple	2	10.53%	6	42.86%
Water yam	2	10.53%	2	14.29%
Banana	1	5.26%	0	0.00%
Beans	1	5.26%	0	0.00%
Cocoyam	1	5.26%	0	0.00%
Papaya	1	5.26%	1	7.14%
Cashews	0	0.00%	2	14.29%
Coconut	0	0.00%	4	28.57%
Lightpole	0	0.00%	1	7.14%
Okra	0	0.00%	1	7.14%
Sugarcane	0	0.00%	1	7.14%

Significant differences in men's and women's agricultural production and agricultural strategies immediately emerge from such examination. First, men grow an average of 7.5 crops on their farms compared to women's 5.2. It is perhaps unsurprising that Table 2 shows that men and women grow different crops in different frequencies. While nearly everyone is engaged in the production of key staples such as cassava and maize, men are substantially more engaged with the tending of tree crops (acacia, coconut, orange, palm, plantain) than are women. Where women grow noticeably larger amounts of crops, they are focused on vegetable production (garden eggs, tomatoes). This immediately points to differential climate vulnerability between men and women, since although the crops of men and women are exposed to the same climate stresses and shocks, tree crops are more resistant to fluctuations in precipitation, while vegetable crops are very sensitive to these fluctuations. Variable annual rainfall is therefore likely to be more of a challenge for women on their farms than it is for men. When we turn to agricultural strategy in Figure 3,[2] a set of *distinct* vulnerabilities becomes clear. Where men are clearly heavily oriented toward market production, with 70% of total crop occurrences focused on those that are for sale more than consumption and no occurrences of crops that are for consumption more than sale, women appear to be much more conservative. Their farms are dominated by crops that they eat and sell in nearly equal measure (66% of all crop occurrences), with only one (pepper) of the five most commonly-produced crops for sale more than consumption. Tree crops grown for market

[2] Again, note that Figure 3 lists fewer crops than Table 2, as all crops in Figure 3 had to be grown by two or more men *and* women to provide at least a measure of control for individual idiosyncrasy.

sale make up only 12% of the total crop occurrences on women's farms. Where women appear to be very conservatively hedged against both market and climate uncertainty, men are highly exposed to market shifts in that their strategy is heavily weighted toward growing crops for sale at market. Should events in the markets take a turn as they did in 1999-2000, when farm-gate prices failed to keep up with a sudden inflation event, they will not be able to earn expected incomes, and perhaps be unable to provide for the members of their households. Women's hedging is not without vulnerability, however, as three of their five most important crops are vegetables that are very sensitive to fluctuations in precipitation, and their farms contain few, if any, tree crops that can endure such fluctuations.

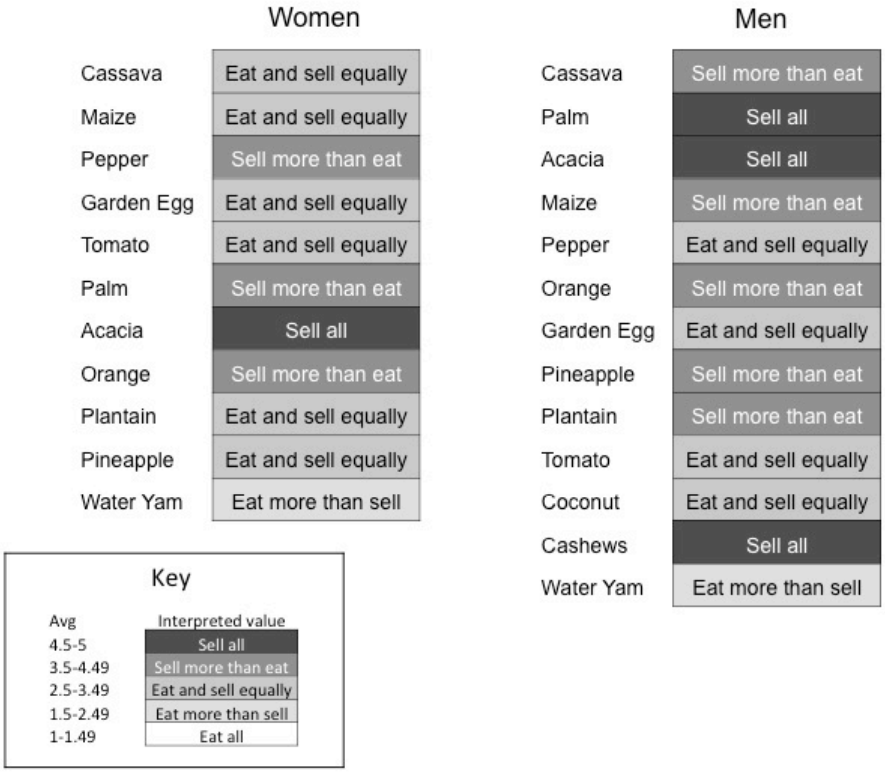


Figure 3: The intended uses of all crops grown by at least two men or women, ranked by occurrence (top to bottom)

While the identification of gendered vulnerabilities is an important step toward productively grasping potential sources of vulnerability in these communities, to stop at this point presumes that gender is not merely a key social cleavage shaping vulnerability and livelihoods outcomes, but that it is *the* key cleavage. As recent work in the gender and development literature suggests, however, gender itself takes form in the context of other social differences. If we further divide our gender analysis to capture the different roles that women play under the different livelihoods strategies in these villages, and across monogamous and female-headed households, we can see further divergence in patterns of vulnerability in these villages that require attention in the context of adaptation programming.

Table 3: All crops grown by men and women in diversified households in 2005

	Women		Men	
	N=	%	N=	%
Cassava	7	100.00%	7	100.00%
Maize	7	100.00%	5	71.43%
Pepper	6	85.71%	2	28.57%
Tomato	6	85.71%	1	14.29%
Garden Egg	5	71.43%	2	28.57%
Banana	1	14.29%	0	0.00%
Orange	1	14.29%	4	57.14%
Palm	1	14.29%	6	85.71%
Papaya	1	14.29%	0	0.00%
Plantain	1	14.29%	3	42.86%
Water yam	1	14.29%	0	0.00%
Coconut	0	0.00%	2	28.57%
Acacia	0	0.00%	5	71.43%
Pineapple	0	0.00%	4	57.14%
Sugarcane	0	0.00%	1	14.29%

In households operating under the diversified strategy, the distinct roles played by men and women produce both unique household and gendered vulnerabilities. In Table 3, we can see the same gendered pattern of crop emphasis as seen in the village as a whole, with men controlling tree crops and women largely focused on vegetable production. Figure 4 shows that, overall, these households address the instability and uncertainty of the vulnerability context by distributing their efforts across subsistence and market production, with much of the subsistence production being focused on crops that, if a surplus is produced, could be marketed for additional income. However, it is important to recall that in these villages, men and women, even of the same household, are autonomous producers. Thus, in adopting this strategy, women choose a role that is more vulnerable to shifts in the environment, as they are reliant on that environment to meet the subsistence needs of the household. Men, on the other hand, occupy a role much more exposed to shifts in markets, where events such as the currency collapse in 1999-2000 could result in price increases for needed items, such as construction materials and even fish, that greatly outstrip any increase in farm-gate price for their crops. Nearly 48% of crop occurrences on men's farms in these households are tree crops that, while well-suited to the management of unpredictable precipitation, take all or nearly all of their value from sale at market. Should markets turn against them, these men would lose a substantial amount of income, though it is worth noting that their remaining crops can be eaten by members of the household should serious market issues prevent their sale.

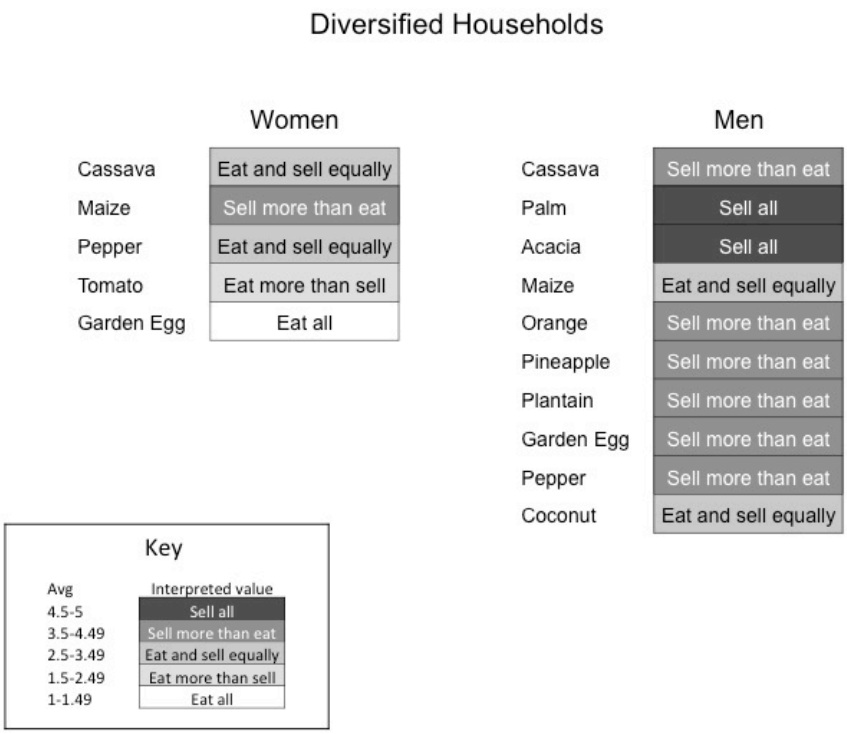


Figure 4: The intended uses of all crops grown by at least two men or women in diversified households, ranked by occurrence (top to bottom)

Households that employ the market strategy have a similar resilience to variable precipitation. As Table 4 shows, there remains a highly gendered control over tree crops in these households, with men growing nearly all such crops. While tree crops comprise 40% of all crops mentioned by men in market households, they make up only 14% of all crops mentioned by women in these households. Thus, the agricultural production of men in market households is more buffered against variable precipitation than that of their wives. However, both men and women in these households are focused on production for market sale, which exposes them to market instability. While in times of environmental stress this can play out in a positive manner by making their production more valuable in local markets, in the event of a currency crisis or other shock that triggers rapid inflation, these households' purchasing power can suddenly collapse. As Figure 5 shows, this is not an evenly distributed stress. While men and women are focused heavily on market sale, only about 24% of all crop occurrences are crops that derive all, or nearly all, of their value from market sale. This concentration is somewhat higher on men's farms (30%). The balance of the crops on these farms is comprised of vegetables and staples that can be either sold or eaten, depending on market conditions.

Table 4: All crops grown by men and women in market households in 2005

	Women		Men	
	N=	%	N=	%
Cassava	7	100.00%	7	100.00%
Maize	7	100.00%	7	100.00%
Pepper	6	85.71%	7	100.00%
Garden Egg	5	71.43%	4	57.14%
Tomato	4	57.14%	5	71.43%
Acacia	2	28.57%	7	100.00%
Orange	1	14.29%	4	57.14%
Palm	1	14.29%	7	100.00%
Plantain	1	14.29%	3	42.86%
Water yam	1	14.29%	2	28.57%
Cashews	0	0	2	28.57%
Coconut	0	0	2	28.57%
Lightpole	0	0	1	14.29%
Okra	0	0	1	14.29%
Papaya	0	0	1	14.29%
Pineapple	0	0	2	28.57%

In short, this analysis demonstrates that while ***woman*** is a social category marked by a responsibility to sustain the household through her agricultural and other labor (Carr, 2013), when we look at gender roles under different livelihoods strategies *distinct identities* emerge. Women operating under the diversified strategy have a different set of roles (subsistence producer) in meeting their broad, gendered responsibilities than do women in market households (market producer). One focus of women's labor is legitimate under one strategy, while another is legitimate under the other. As a result, the livelihoods and well-being of women living under these different strategies have both differentiated and distinct vulnerabilities to the same vulnerability context. The vulnerability of women in diversified households to weather and climate events and trends are differentiated from those of women in market households in that diversified household women have a greater emphasis on agricultural production for the direct benefit of their households, and somewhat reduced access to tree crops. Therefore, their livelihoods are more directly impacted by climate and weather events than women in market households. Women in diversified households have differentiated vulnerabilities from women in market households in that market shifts trickle to women in diversified households mostly in terms of impacts on their husband's incomes, while women in market households must constantly and directly contend with fluctuations in local and national markets both for their crops and for the items they seek to purchase with their agricultural income, and thus have to strategize in a manner that directly addresses both stresses.

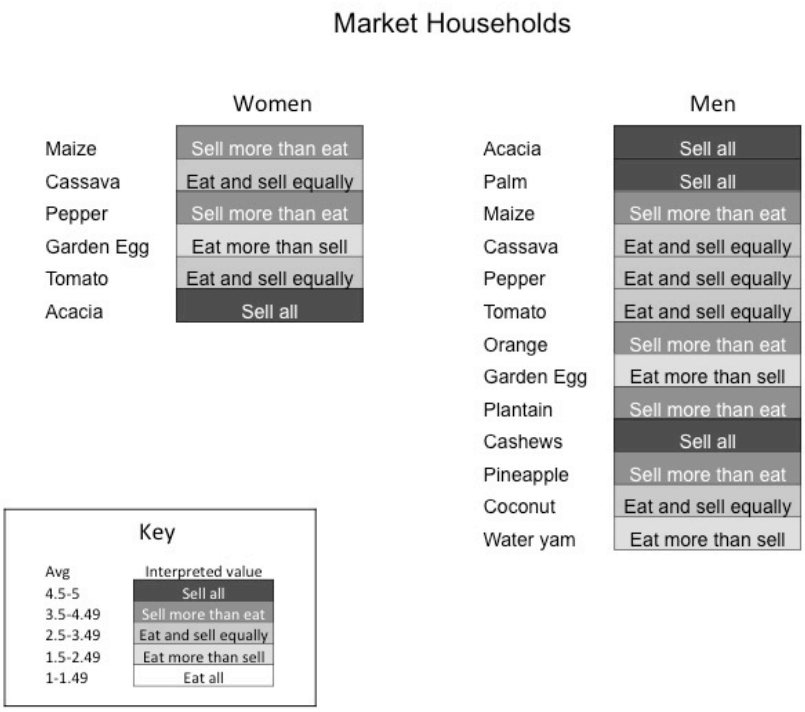


Figure 5: The intended uses of all crops grown by at least two men or women in diversified households, ranked by occurrence (top to bottom)

Women heading households, long a subject of attention in rural and agricultural development, are the final household category in these villages that requires attention in its own right. These households farm tiny plots of land that they usually obtain via their uncle or father, as without husbands the women heading these households have no direct means of accessing land for agriculture. As Table 5 shows, these women do not plant tree crops, as they lack the stable land tenure required to tend such trees to maturity. As a result, these households are more sensitive to fluctuations in precipitation than any others in these villages because a significant amount of household production is dedicated to precipitation-sensitive vegetables.[3] They have few, if any, financial resources with which to manage shocks, and clearly structure their farms to ensure a supply of food for the household while preserving the ability to pivot toward market engagement should they produce a surplus or market conditions make this a profitable focus (Figure 6). This, then, is a third agricultural role played by women in these villages, and clearly represents an identity distinct from the women in monogamous households. Where women in monogamous households are expected to raise the food and money needed to meet basic household needs, women heading households cannot possibly do this without assistance. These women have an expectation of support because they cannot meet these needs, producing a different role and set of responsibilities than that seen with women in monogamous households. In this case, the particular situation of women heading households makes them differently vulnerable to climate variability and change, weather, and economic stresses and shocks than other women in these villages, because they contend not only with the environment and the economy, but with unusually constrained access to land that reduces their livelihoods opportunities and their options for managing shocks and stresses.

[3] There is no practice of irrigated gardening, or indeed irrigated agriculture of any sort, in these villages.

Table 5: All crops grown by women heading households in 2005

	N=	%
Acacia	1	20%
Beans	1	20%
Cassava	5	100%
Cocoyam	1	20%
Maize	5	100%
Garden Egg	4	80%
Orange	1	20%
Pepper	4	80%
Pineapple	2	40%
Plantain	2	40%
Tomato	3	60%
Water yam	1	20%

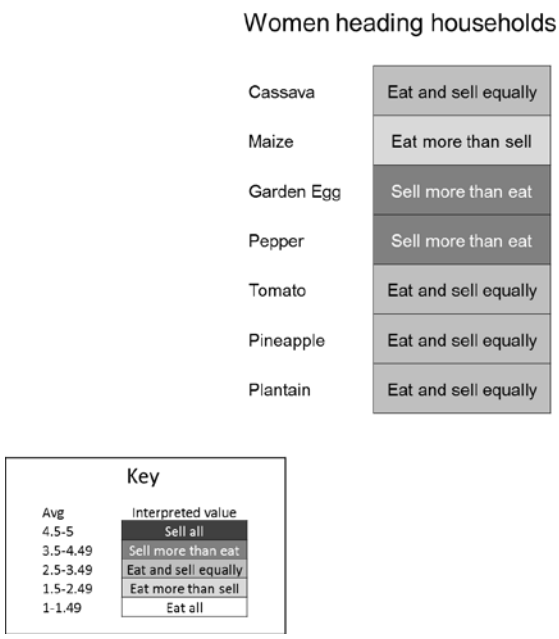


Figure 6 : The intended uses of all crops grown by at least two women heading households, ranked by occurrence (top to bottom)

Placing women's production (Table 6) and strategies (Figure 7) side-by-side highlights the importance of extending our vulnerability analysis to different roles and even identities within genders. In terms of composition and strategy, an aggregated assessment of women's agricultural strategy results in something that most closely resembles the situation experienced by women in market households. These are the wealthiest, most secure women in the village. The aggregation of the different situations of women into a single analysis makes it difficult to see the particular vulnerabilities of over 60% of women in this sample – the poorest 60%, living in diversified households or heading their own households. If we cannot see these differences, we cannot identify and address the distinct or differentiated vulnerabilities that arise from them. Further, we risk implementing interventions that compromise these more vulnerable households and women.

Table 6: Comparison of all crops grown by women, disaggregated by livelihoods strategy and household situation

	Diversified Household Women	Market Household women	Women heading households
Acacia	0.00%	28.57%	14.29%
Banana	14.29%	0.00%	0.00%
Beans	0.00%	0.00%	14.29%
Cassava	100.00%	100.00%	71.43%
Cocoyam	0.00%	0.00%	14.29%
Maize	100.00%	100.00%	71.43%
Garden Egg	71.43%	71.43%	57.14%
Orange	14.29%	14.29%	14.29%
Palm	14.29%	14.29%	0.00%
Papaya	14.29%	0.00%	0.00%
Pepper	85.71%	85.71%	57.14%
Pineapple	0.00%	0.00%	28.57%
Plantain	14.29%	14.29%	28.57%
Tomato	85.71%	57.14%	42.86%
Water yam	14.29%	14.29%	14.29%

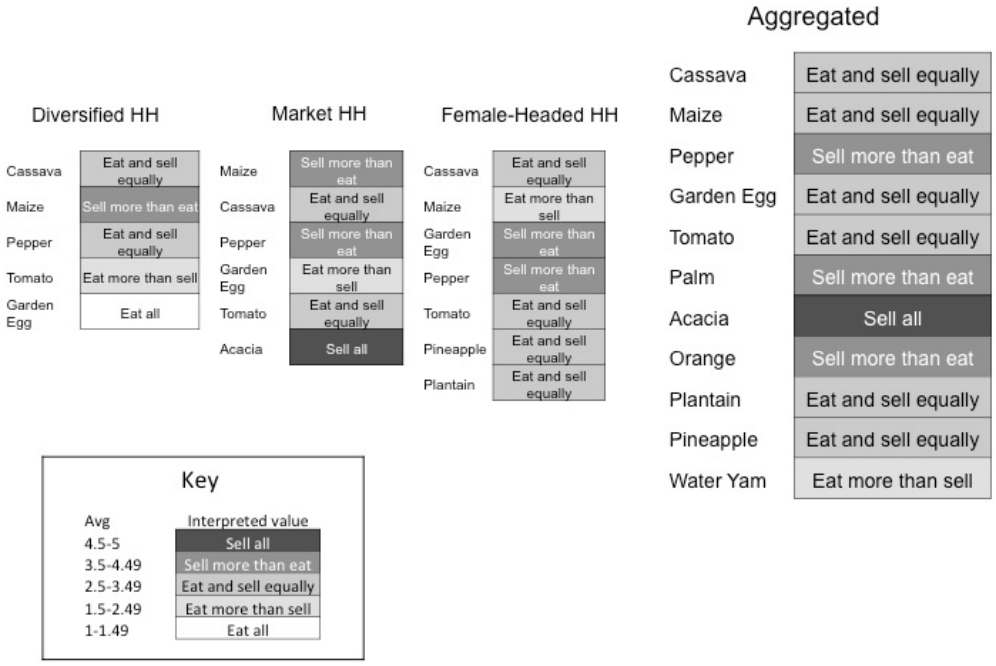


Figure 7: A comparison of the perceived uses of crops grown by two or more women, disaggregated by livelihoods strategy and household situation

On the other hand, the polarization of strategy by gender in diversified households leads men in these households to push their production very heavily toward market production, even more so than their counterparts in market households. This is true both in terms of their very high concentration of effort in tree crops with little local value, and in the fact they view nearly all of their crops as for sale before consumption. Thus, as individuals, these men are slightly more exposed to market fluctuations than their counterparts in market households. Further, men in diversified households grow fewer crops across which to spread market and environmental risk. At the same time, they live in households where their wives undertake significant subsistence production, thus providing some balance to the agricultural component of their livelihoods portfolio.[4] In market households, as there is no such gendered balance, men in market households are absorbing some of that risk themselves by raising more crops, and dedicating more crops to both sale and consumption. As Figure 8 clearly illustrates, an aggregated assessment of "men's" production makes it difficult to see the small but significant differences in men's production strategies between market and diversified households. Thus, potential differences in vulnerability to economic and environmental pressures and shocks are difficult to identify and address.

[4] There is some sharing of livelihoods resources and incomes within households in these villages, but the process by which this happens is complex and varies. This issue is explored in detail in Carr (2013).

Figure 8: A comparison of the perceived uses of crops grown by two or more men, disaggregated by livelihoods strategy and household situation

In Dominase and Ponkrum gender is a critical social cleavage shaping access to livelihoods resources and the decisions individuals make about how to use those resources in the context of an uncertain economy and environment. However, it is not until gender is interpreted in the context of the different incomes/livelihood strategies and household situations in these villages that we can see the most relevant patterns of vulnerability to climate variability and change. Binary gender analysis fails to highlight the particular vulnerabilities and challenges associated with the poorest women in these villages. Similarly, binary gender analysis obscures the different challenges faced by men depending on their livelihoods strategy, and might result in a vulnerability analysis that focuses on the vulnerabilities and challenges associated with men in market households, even though these are the wealthiest members of the community. Thus, while a binary gender analysis serves to highlight important differences between men and women in the community, it at the same time obscures the particular situations and challenges of the poorest members of the community, thus likely resulting in programming recommendations that inadequately address the sources and impacts of vulnerability in these communities.

Critical Summary Points: Ghana

- While all residents of these villages are exposed to the same climate, environmental, and economic challenges, they experience distinct *and* differential vulnerabilities to those challenges depending on the livelihoods roles they play and the household structures in which they find themselves.

- Binary gender analysis of livelihoods in Dominase and Ponkrum reveals important gendered differences in vulnerability to climate variability and change in these villages.

- Limiting gender analysis to simple comparisons of the situations of men and women, however, overlooks significant differential and distinct vulnerabilities to climate variability and change within these categories and obscures the challenges facing the poorest members of the community.

- A careful consideration of how gender roles are informed by the livelihoods strategies adopted by individuals presents a more meaningful assessment of the social differences that shape vulnerability to climate variability and change, presenting a more complex but more productively actionable set of challenges to be addressed by development and adaptation interventions.

MALI

MALI CASE SUMMARY

This case takes a broad look at the livelihoods of residents of three villages across one of Mali's livelihood zones. The zone is marked by a prolonged dry season, a hungry season when family cereal stocks have largely run out and the new harvest has not yet matured, variable rainfall, and political instability both within Mali and in neighboring countries that has, at times, limited migration for non-farm employment and cross-border agricultural trade. Further, the vulnerability context is marked by climate variability and change. Since the beginning of the 20th Century, overall annual precipitation in this area has declined significantly, most steeply between the mid-1950s and the early 1980s. These trends reflect growing instability around the May-June start of the rainy season, and declining precipitation in the August-September end of the season. Since the early 1980s, annual precipitation totals have recovered somewhat, though at a level well below that of the 1950s, but this recovery is not coming in terms of the number of days of rain. Instead, more rain is being delivered in the same, greatly reduced, number of events. The implications of this trend for agriculture in the study area remain unclear. Existing models and understandings of Sahelian precipitation trends under climate change remain uncertain due to uncertainty about the relative heating of the North Atlantic and oceans in the tropics, but generally point to greater variability in the future, and a likely delay in the start of the rainy season.

A binary gender analysis of these livelihoods shows clear patterns of gendered agricultural, pastoral, and trade activities. These patterns speak to important gendered differences in livelihoods vulnerability in rural communities in this livelihoods zone. For example, men's focus on rain-fed agriculture makes them more vulnerable to fluctuations in precipitation than their wives, who focus on hand-irrigated garden plots. However, when we move beyond simple binary gender categories to consider the identities, roles, and responsibilities that exist at the intersection of gender and seniority, we find different activities, access to resources, and perceptions of risk. For example, the livelihoods of junior men are more dependent on raising a surplus of rain-fed crops for market sale than are those of senior men. This renders junior men somewhat more vulnerable to variable precipitation, a fact visible in junior men's greatly heightened concerns over variability relative to their senior counterparts. Similarly, while both junior and senior women focus their agricultural activities on the cultivation of hand-irrigated garden crops, senior women count on generating a marketable surplus of rain-fed peanuts to complement the sale of their garden crops, while junior women raise peanuts only for subsistence. As a result, the livelihoods of senior women are more vulnerable to fluctuations in precipitation, a fact expressed in their heightened concern for variable precipitation relative to junior women.

Introduction

In 2012, USAID's Office of Global Climate Change commissioned an assessment of Mali's Agrometeorological Program in response to growing demand for similar programs in other parts of the Sahel. The program, which delivers climate and agricultural advisories to Malian farmers in an effort to boost yields, has long been viewed as a successful example of the application of climate services to a development challenge (Diarra & Kangah, 2007; Hellmuth, Diarra, Vaughan, & Cousin, 2011). A research team comprised of members from the University of South Carolina, the Climate Change, Agriculture and Food Security cross-cutting theme of the CGIAR (CCAFS), and Mali's Institut d'Economie Rural (IER) designed and implemented 720 interviews and 144 focus groups in 36 villages across the regions of Kayes, Koulikoro, Segou, and Sikasso in an effort to explore livelihoods, challenges to local well-being, local perceptions of economic and environmental change, and uses of the program to assess its impact. Initially, 18 villages were selected for their participation in the program. The other 18 were controls – non-participating villages paired with a participating village on the basis of proximity and size. After conducting fieldwork, however, the team found that several villages thought to be participating in the program, as well as some that were thought to be control villages, had initially been part of the program, and then stopped participating. Further, four villages

were found to have an ambiguous relationship with the program, and were excluded from analysis. In the end, the assessment covered 10 villages that were participating in the program, seven that were formerly part of the program, and 17 that had never participated in the program.

In each village, the research team conducted four focus groups, disaggregated by gender and seniority (Figure 9), exploring general issues of livelihoods and local challenges to well-being. After completing the focus groups, team members conducted five or six highly detailed individual interviews with members of the same cohort as the focus group. These interviews went into much greater detail than the focus groups, and included discussion of the agrometeorological program. Some interviews were conducted with participants in the focus group while others were not. While the selection of focus group participants and interviewees was therefore not random (and likely too small to be representative, even if it was), having two different, partially-overlapping sources of information allowed the team to triangulate results. Where focus group and interview responses coincided, even with different samples, there is some evidence for validity in the data.

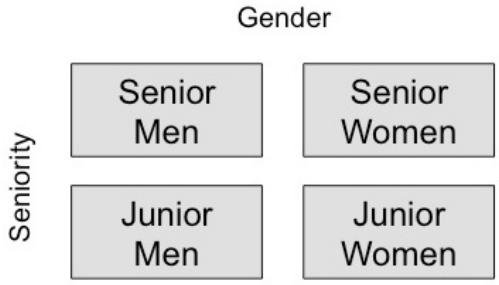


Figure 9: Focus group and interview disaggregation strategy.
Note: the division between junior and senior was locally defined, and tended to fluctuate between ages 35 and 45, depending on the characteristics of the individual and the community in question

While this project had extensive contact with rural communities in Mali regarding their livelihoods and vulnerability to the impacts of climate variability and change, the overall project design was aimed at evaluating an existing climate services project. The information gathered during fieldwork was constrained by that project goal. The existing data does not illuminate intra-household dynamics, such as the extent to which incomes and other resources are pooled or disaggregated in households, the specific character of gender roles and responsibilities within different households in the communities examined, or any intra-household hierarchies of access or entitlement to livelihoods resources (especially in polygamous households). Planned future fieldwork will explore these issues, and deepen the analysis of the data presented here. However, this case, drawn from a very small subset of these villages and the data collected from residents, serves to illustrate the ways in which gender, while an important consideration in the assessment of vulnerability to the impacts of climate variability and change, is incomplete without further considerations of variable vulnerability within gender categories.

This case focuses on three villages: Batimakana (pop. 1503) in the Kayes region, and Diondougou (pop. 916) and Ngaradougou (pop. 1776) in the Koulikoro region (Figure 10). For the purposes of this case study, this cluster only includes villages participating in the agrometeorological program to avoid confounding the analysis with differences between participating, formerly participating, and control villages. These villages represent a cluster of communities marked by close similarities in livelihoods and agricultural practice (the most important part of livelihoods in the cluster, in which 98.33% of all interviewees [n=60] participate). These villages, while geographically disparate, were found to be very similar with regard to the crops emphasized under agricultural practice in a clustering exercise undertaken by team members at the University of South Carolina. This clustering is confirmed by the fact are all located in the same broad livelihoods zone,

which the Famine Early Warning System Network (FEWS-NET) calls the "South maize, cotton, and fruits zone" (S. Dixon & Holt, 2010). This zone is broadly characterized as one of rain-fed agriculture, sedentary livestock rearing, and some gathering and other exploitation of forest resources. FEWS-NET describes cotton as the main cash crop in the zone, with maize, sorghum, and millet as significant food crops. Dixon and Holt (2010, p.101) note that maize is the second most important crop in the zone, and that it is becoming increasingly important due to stresses on cotton producers that include declining yields, high input costs that limit the offset of declining productivity, lower prices that limit access to needed inputs, and the slow and unreliable payment of cultivators by the state cotton buyer *Compagnie Malienne du Développement des Textiles* (CMDT). Market gardening of vegetables, typically through hand-irrigated gardens, is a significant activity, except in the poorest households. According to the FEWS-NET profile, the majority of households in the zone engage in sedentary livestock rearing, with cattle, sheep, and goats being the main species (Dixon & Holt, 2010, p.101). The sample of villages presented here largely conforms to this description, though we note that maize does not appear to be the second-most important crop in the four villages presented here. Instead, peanuts were more common , with cowpeas, sorghum and rice equally common (see Table 7).

Figure 10: Three villages covered by this case study: Batimakana in the Kayes region, and Diondougou and Ngaradougou in the Koulikoro region (Map source: Google Maps)

Among the farmers of the Bambara ethnicity who predominate this livelihoods zone, agricultural labor is today largely organized by the household, which is often defined as the eldest man, his brothers, and their wives and children (Benjaminsen, 2010; W J Grigsby, 1996). The Bambara operate what Becker (1990, p.315) calls a patrilineal gerontocracy, where the most senior member of a lineage, which in smaller villages may be the village chief, apportions the land of the lineage to the different households of the men of that lineage. Women cannot own land, but can obtain land for cropping from their husbands, from their husbands' lineages, or even other lineages in the community (Akeredolu, Asinobi, & Ilesanmi, 2007). Because they do not own land, women have very insecure land tenure. This prevents them from improving fields, planting

long-term crops such as tree crops, and may even push them to raise fast-maturing crops lest the landowners re-appropriate the land and crops before the harvest (Akeredolu et al., 2007; W J Grigsby, 1996). Polygamous marriage is allowed by the Bambara, and Grigsby (1996, p.95) argues that this arrangement confers a degree of economic independence on at least some wives. For example, women have the right to gather fruits such as *nere* (*parkia biglobosa*) or shea from fields cultivated by their husbands or their husbands' lineages, and can gather from any uncultivated fallow field. In practice, however, they often cannot farm extensive plots or spend a majority of their time gathering because, generally speaking, women are under heavy obligation to provide labor for collective grain cultivation (Grigsby, 1996, p.96). Indeed, while family (household or lineage) fields are seen as important by the Bambara, the growing focus on individual farms sometimes leads Bambara men to devote one of their wives entirely to the cultivation of the family field, leaving her little, if any, time for her own cultivation (Akeredolu et al., 2007).

The vulnerability context of this livelihoods zone is currently marked by highly seasonal rainfall. The zone receives an annual average of 1,000-1,300mm of rainfall, but nearly all of this falls between May and September (Dixon & Holt, 2010, p.101-103). The prolonged dry season, with relatively little crop production (except through largely hand-irrigated gardening), produces pronounced difficulties for households as the rains start in May. At this point the previous year's stock of food begins to run out and the new harvest has not yet started, creating a hungry season that can significantly stress individuals and households. Because of the timing of food supplies, it is not surprising that farmers in this zone report late starts to the rainy season as a significant challenge (Dixon and Holt, 2010, p 107). They also note inadequate rainfall during the planting of seeds, and poorly distributed rainfall (both in space and time) as other climate-related challenges to their livelihoods. Lurking in the background of the vulnerability context are significant historical trends in the amount and timing of rainfall (Figure 11). Since 1901, the Global Precipitation Climatology Centre's (GPCC) analysis of the World Climate Research Program (WCRP) Global Climate Observation System (GCOS) precipitation records[5] has identified clear declines in annual precipitation for Mali, especially in the period from the late 1950s to the early 1980s. Since the low point in the early 1980s, precipitation has recovered somewhat, but only to roughly 85% of the 1901-1960 average. As a result of this incomplete recovery in precipitation, contemporary farmers receive an average of roughly 150mm/year less rainfall than those who farmed between 1901 and 1960. Further, this dataset suggests that the onset of the season in May (in slow decline since the 1930s) and June (significant declines since the mid 1960s) has become less reliable. Also, the end of the season in August and September has become much drier, especially since the 1970s. Current understandings of the drivers of precipitation in the Sahel make future projections uncertain, as they rely on inconclusive understandings of the relative heating of the North Atlantic and the tropics. However, it seems clear that trends toward variable precipitation will continue, and models suggest that the onset of the rainy season will continue to be delayed (for discussion, see Biasutti & Sobel, 2009; Giannini et al., 2013; Lodoun et al., 2013).

The bulk of other shocks and stresses reported by farmers focus on crop-eating or damaging pests, the high price of fertilizer, and inadequate sources of water for their livestock (Dixon & Holt, 2010, p.107). Dixon and Holt (2010, p.102) note that communities in this zone have long had strong connections to Cote d'Ivoire, especially as a destination for labor migration. The political situation in Cote d'Ivoire has, over the past several years, introduced several situations where such migration became impossible, thus challenging household incomes. The impact of current political instability in Mali on the livelihoods of those in these villages is unclear, as the data was gathered in the immediate aftermath of the 2012 coup before the impacts of embargoes and the security situation in the north of the country had time to filter through the wider economy and reach these rural communities.

[5] WCRP GCOS GPCC data is accessible via the International Research Institute for Climate and Society's Data Library: http://iridl.ldeo.columbia.edu

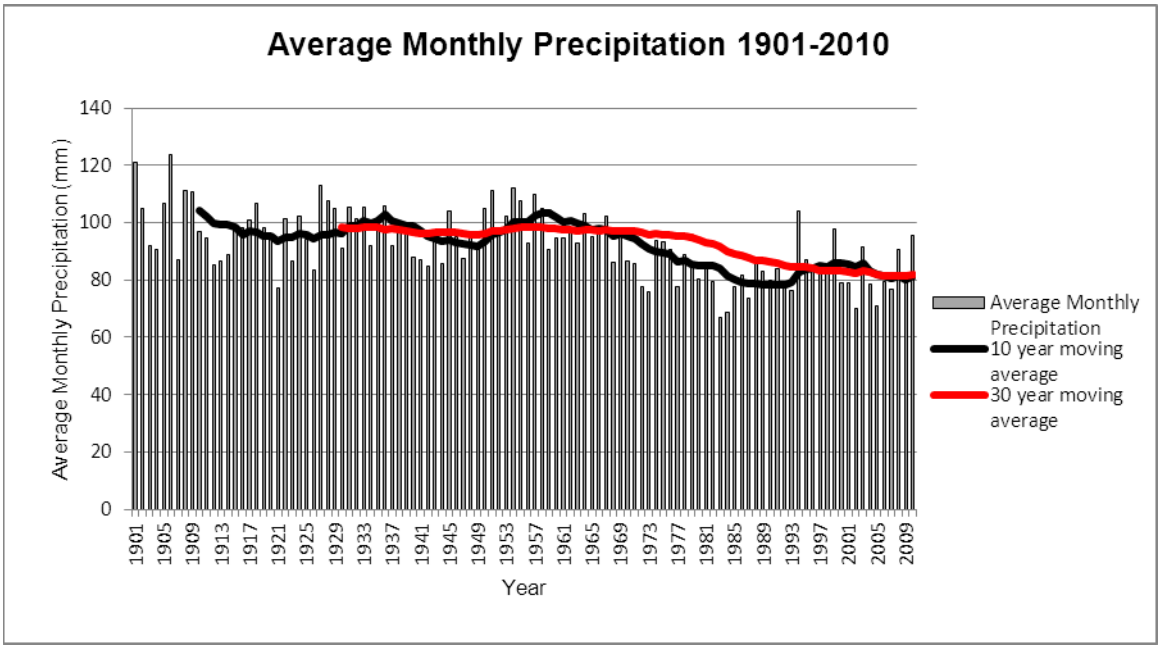


Figure 11: Average monthly precipitation across Kayes, Koulikoro, Segou, and Sikasso in Mali from 1901-2010. The 10-year moving average trend shows short-term patterns in precipitation, while the 30-year moving average suggests an overall shift in the climate regime to precipitation levels about 83% those pre-1960

(Source: mean WCRP GCOS GPCC FDP version6 0p5 prcp, accessed at http://iridl.ldeo.columbia.edu/expert/SOURCES/.WCRP/.GCOS/.GPCC/.FDP/.version6/.0p5/.prcp/T/12/0.0/runningAverage/T/12/STEP/Y/%2814%29%2810%29RANGEEDGES/X/%28-12%29%28-4%29RANGEEDGES%5BX/Y%5Daverage/figviewer.html?plottype=line&my.help=more+options on 6 June 2013).

To illustrate the ways in which different constructions of gender produce different understandings of vulnerability to the particular shocks and stresses of this vulnerability context, this discussion will focus on agriculture. Reference to the broader livelihoods context is necessary, however, to help explain some of the patterns we see in this cluster of villages. At the level of the cluster (or livelihoods zone), agriculture is the most commonly conducted livelihoods activity (98.33% of interviewees reported participation), and regarded by the population, regardless of village of residence or gender, as the most important livelihoods activity in these villages. When we examine agricultural practice in this cluster of villages (Table 7 and Figure 12), we see that agricultural strategy is dominated by the production of crops that are eaten more than they are sold (seven of the eight most commonly farmed crops, and 70% of all crops mentioned, are classified in this manner by residents). The major exception here is cotton, grown by 50% of the population, and grown almost entirely for sale at market. On the whole, though, crops that are sold more than they are eaten make up 19% of all crop mentions. At a glance, the agricultural practice in this set of villages suggests a cash crop economy centered on cotton production, with a very strong subsistence base around that production. Such a setup is strongly hedged for market instability (and given the history of cotton markets, this is not surprising), and production is distributed across the year and with varying exposure to changes in precipitation. Crops such as cotton, millet, maize, sorghum, and rice are all farmed during the rainy season, and are almost entirely dependent on rainfall for necessary water. On the other hand, onion, okra, lettuce, and African Eggplant are all gardened crops that are grown year-round, but especially during the dry season. In the dry season, they are hand irrigated with water drawn from wells dug to subsurface supplies. Aside from the recharge of water tables for the wells, these garden crops have little dependence on rainfall patterns. These gardened crops tend to be eaten and sold in similar measures, if not to be sold more than eaten.

Table 7: All crops grown in the cluster of villages

	N=	%
Peanut	50	83.33%
Cowpeas	35	58.33%
Sorghum	32	53.33%
Cotton	30	50.00%
Maize	30	50.00%
Rice	30	50.00%
Okra	24	40.00%
Onion	21	35.00%
Lettuce	17	28.33%
Millet	17	28.33%
Fonio	12	20.00%
Chili pepper	9	15.00%
Tomato	7	11.67%
Bambara nuts	6	10.00%
Hibiscus	6	10.00%
Eggplant	5	8.33%
Sesame	4	6.67%
Bell Pepper	2	3.33%
Cabbage	2	3.33%
Sweet potato	2	3.33%
Mint	1	1.67%

In short, at the level of this cluster of villages, there appears to be in place a robust agricultural system set up to address both economic and environmental shocks. Severe extended drought would, of course, compromise all crops in the area, but putting aside that extreme outcome, agricultural livelihoods in this cluster are likely to persist under most market or environmental conditions. The pattern of agricultural production suggests an important seasonality to livelihoods. The bulk of agricultural production takes place between May and December, taking advantage of the rainy season. However, gardening can run year-round, most importantly through the dry season from December to May. Rainy season production can be compromised by variability in the timing and amount of rainfall, while most gardening is hand-irrigated from wells that are dug to groundwater. Unless climate trends are so significant as to effect the recharge rate of the aquifers on which this production relies, gardening is much more resilient to variability in rainfall within and between seasons.

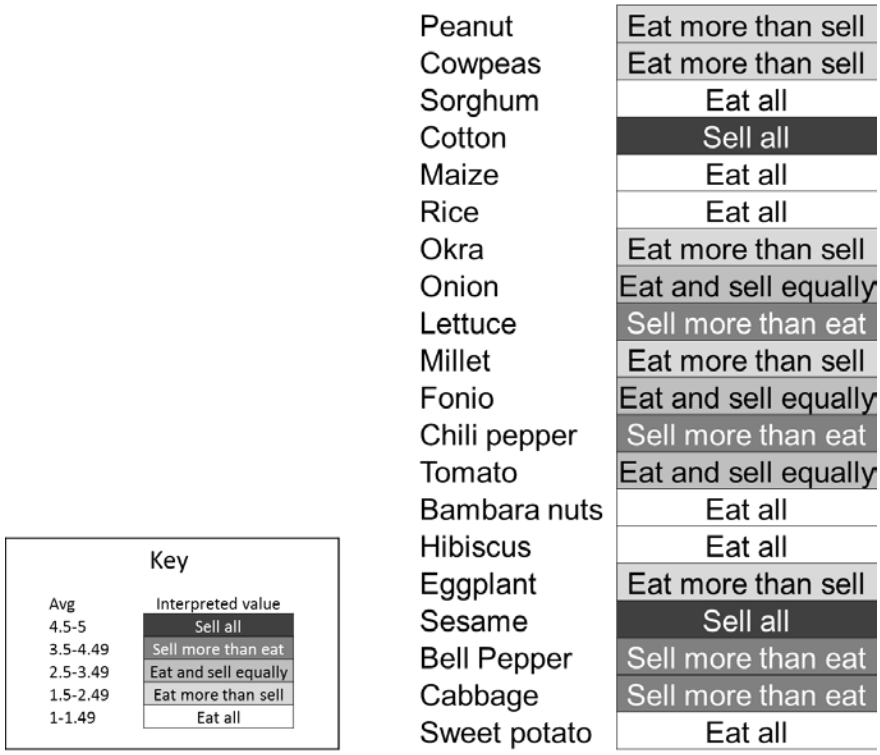


Figure 12: The average intended use of all crops grown by two or more farmers in the cluster

Table 8: All crops grown by men and by women in the cluster

	Men		Women	
	N=	%	N=	%
Sorghum	30	100.00%	2	6.67%
Cotton	30	100.00%	0	0.00%
Maize	26	86.67%	4	13.33%
Peanut	21	70.00%	29	96.67%
Cowpeas	20	66.67%	15	50.00%
Millet	16	53.33%	1	3.33%
Rice	6	20.00%	24	80.00%
Fonio	4	13.33%	8	26.67%
Sesame	4	13.33%	0	0.00%
Sweet potato	2	6.67%	0	0.00%
Okra	0	0.00%	24	80.00%
Onion	0	0.00%	21	70.00%
Lettuce	0	0.00%	17	56.67%
Chili pepper	0	0.00%	9	30.00%
Tomato	0	0.00%	7	23.33%
Bambara nuts	0	0.00%	6	20.00%
Hibiscus	0	0.00%	6	20.00%
Eggplant	0	0.00%	5	16.67%
Bell Pepper	0	0.00%	2	6.67%
Cabbage	0	0.00%	2	6.67%
Mint	0	0.00%	1	3.33%

However, this overarching picture of the agricultural livelihoods in these villages overlooks significant variation in agricultural practice. By parsing our sample into men and women, we can see immediate differences in practice (Table 8) and perception (Figure 13). Men and women emphasize very different crops in this cluster, with peanuts and cowpeas being somewhat shared points of emphasis. Otherwise, men emphasize grains and cash crops like cotton, while women emphasize vegetable crops and do not raise cotton at all (women's production of rice being the exception to this trend). The differences in men's and women's production becomes sharper when we look at the intended function of a given crop. Men are very clearly focused on growing cotton, dabbling a bit in other crops for market sale, with all other crops playing a supporting subsistence role. While only 21% of the total crops mentioned by men were intended for sale at least as much as for consumption, cotton is a significant source of income. Women, on the other hand, take a much more diversified approach to agricultural production, spreading their effort across crops. Thirty-six percent of crops mentioned by women were intended for sale as much as for consumption, if not more for sale than consumption. However, women lack a single large cash crop as their focus. Instead, women's focus appears to be in gardening vegetables for market sale. All of the crops women mentioned as being for sale as much as, if not more than, for household consumption are gardened crops. Thus, the seasonality of agriculture practice in this cluster of villages is also gendered. Men dominate rain-fed agriculture, while women dominate irrigated gardening. This makes men's agricultural production much more vulnerable to climate variability than that of their wives. On their own, women's production is rather robust. With regard to climate, they are perhaps most vulnerable to fluctuations in their husband's incomes, but this is not clear in the current dataset. The potential relative robustness of their production in the context of climate stresses, however, challenges the dominant narrative that women's agriculture is usually, if not always, more vulnerable to the impacts of climate variability and change than men's.

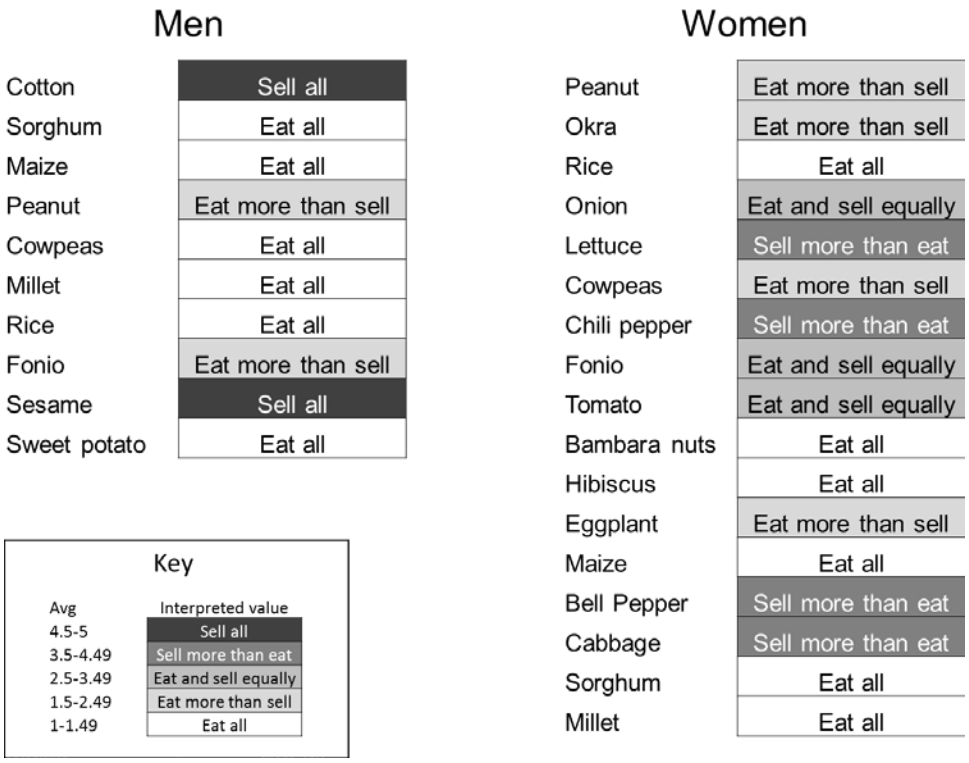


Figure 13: The intended uses of all crops grown by at least two men or women, ranked by occurrence (top to bottom)

Agricultural strategy is also heavily informed by pastoral components to these livelihoods. If women dominate garden production, men dominate the raising of livestock by a similar percentage. Eighty-six percent of men, versus only 43% of women, raise livestock. Further, men are far more likely to own cattle than women, with "junior" men having the highest rate of cattle ownership. Donkey ownership is exclusively men's, and sheep ownership tilts heavily to men. Goats are owned by a large percentage of both men and women, and women dominate the ownership of poultry. Men who own livestock generally see this as the second most important livelihoods activity they undertake after agriculture. Seen as such, men's focus on cash cropping with some subsistence farming is complemented by a heavy focus on livestock which serve both as stocks of wealth and, in some cases, sources of farm labor.

Using focus group data gathered in these villages, we can see evidence for this highly differentiated vulnerability of men and women via their perceptions of the vulnerability context. The biggest difference between men and women is that women see water scarcity as a problem much more often than men (see Table 11). This makes sense, as women dominate the two activities most directly related to collecting water: market gardening, which typically requires manual irrigation, and household activities like washing and cooking. Women would therefore be much more aware of and affected by water availability than their husbands, who direct the majority of their effort at rain-fed agriculture. Also, while men and women see rainfall scarcity and distribution as significant problems, women are far less concerned with the distribution of rainfall than men, again reflecting their relatively lesser dependence on rainfall for their agricultural production.

Separating the population of this cluster of villages into men and women highlights important gendered differences in agricultural and livelihoods practice and perceptions of vulnerability that produce gendered vulnerabilities to different impacts of climate variability and change such as climate variability. However, if we stop our analysis at this point, we miss key differences *among* men and women that produce other, different, vulnerabilities.

In the design of the assessment, the research team used expert judgment to include the issue of seniority as a social difference with the potential to impact livelihoods and vulnerability to the impacts of climate variability and change.[6] In addressing seniority, the team focused on the social status marked by being a "senior" or "junior" member of the community. This was not tied to a specific age, but instead was defined by each community (in the dataset, the break between junior and senior seemed to range between 35 and 45 years old in different communities). There are three reasons to consider seniority in these communities. First, senior members of the community, especially senior men, command a great deal of authority over those in their families in terms of agricultural strategy. If more junior men in their families wish to start planting new or different crops, very often they have to clear this with the senior men. Second, senior members of the community are often old enough to have a diminished capacity for the physical labor associated with agricultural production in this part of Mali. Third, older members of the communities in this cluster have different memories and experiences of the climate in this region. The oldest members can remember the downward trend in Sahelian precipitation that reached its nadir in the early 1980s. Junior members of the community have only farmed in a climate that, with regard to total annual rainfall, has been either improving or at least steady. Such differences in experience can greatly condition the events and trends which one guards against through livelihoods and agricultural practices.

When we subdivide men and women into junior and senior categories, we see new patterns of agricultural and livelihoods activities. Subdividing men and women by seniority does not appear to reveal any new patterns of agricultural production, either with regard to what is being farmed (Table 9) or why (Figure 14). However, the broader livelihoods activities associated with each of these groups complicate this picture (Table 10).

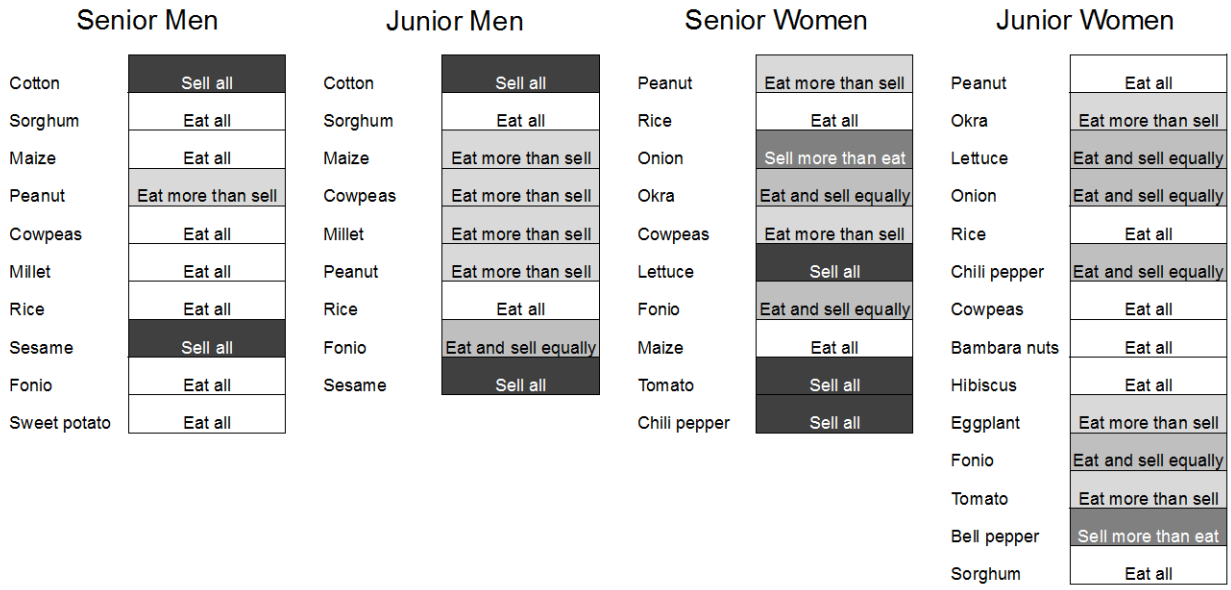
[6] Note that Akeredolu, et al. (2007, p.11) also observe that among the Bambara, after gender, age is the most significant social categorization that impacts an individual's capacity to make decisions about their agricultural practice.

Table 9: All crops grown in the cluster, disaggregated by gender/seniority

	Senior Woman	Junior Woman	Senior Man	Junior Man
Peanut	93.33%	100.00%	66.67%	73.33%
Rice	93.33%	66.67%	20.00%	20.00%
Onion	73.33%	66.67%	0.00%	0.00%
Okra	66.67%	93.33%	0.00%	0.00%
Cowpeas	60.00%	40.00%	60.00%	73.33%
Lettuce	46.67%	66.67%	0.00%	0.00%
Fonio	26.67%	26.67%	13.33%	13.33%
Maize	26.67%	0.00%	86.67%	86.67%
Tomato	20.00%	26.67%	0.00%	0.00%
Chili pepper	13.33%	46.67%	0.00%	0.00%
Bambara nuts	6.67%	33.33%	0.00%	0.00%
Hibiscus	6.67%	33.33%	0.00%	0.00%
Eggplant	6.67%	26.67%	0.00%	0.00%
Cabbage	6.67%	6.67%	0.00%	0.00%
Mint	6.67%	0.00%	0.00%	0.00%
Sorghum	0.00%	13.33%	100.00%	100.00%
Bell Pepper	0.00%	13.33%	0.00%	0.00%
Millet	0.00%	6.67%	33.33%	73.33%
Cotton	0.00%	0.00%	100.00%	100.00%
Sesame	0.00%	0.00%	20.00%	6.67%
Sweet potato	0.00%	0.00%	13.33%	0.00%

First, differentiated agricultural vulnerabilities emerge *within* the genders. Junior men are slightly more market-oriented in their agricultural production than their senior counterparts. While the agricultural selection of junior men is structurally similar to that of senior men, and all men are exposed to effectively the same climate stresses, the agricultural livelihoods of junior men are counting on a surplus beyond household subsistence for more rain-fed crops than senior men. This makes the agricultural livelihoods of junior men somewhat more vulnerable to climate variability. This differential exposure is confirmed by the perceived vulnerabilities of junior men, who rank variable precipitation as one of their most important challenges. Senior men, on the other hand, do not express any concern for variable precipitation. Senior women are more market-oriented than junior women, though all women structure their agricultural activities around the cultivation of gardened crops, with subsistence provided by rain-fed peanuts and rice. Senior women, however, expect to raise a marketable surplus of peanuts to sell alongside their gardened crops, rendering them more vulnerable to fluctuations in precipitation than junior women. This slightly differential vulnerability is confirmed in the fact that some senior women mention variable precipitation as a minor problem, while no junior women mention variable precipitation as a challenge.

Second, senior women's agriculture is much more oriented toward market sale than their junior counterparts, while junior women are twice as likely as senior women to be engaged in some form of trading. It appears that market sale of crops is not gendered here, but instead emerges in association with identities at the intersection of gender and seniority. At the same time, trading is not clearly gendered to women either, as senior women seem to be disengaged from it. It is clear that while their agricultural roles (a heavy focus on gardening along with general agriculture) are very similar, junior and senior women have different identities that result in different livelihoods roles and responsibilities, reflected in their different emphases in agriculture and trading.



Key	
Avg	Interpreted value
4.5-5	Sell all
3.5-4.49	Sell more than eat
2.5-3.49	Eat and sell equally
1.5-2.49	Eat more than sell
1-1.49	Eat all

Figure 14: All uses of crops, disaggregated by gender and seniority, for which more than two farmers in each cohort reported a use

Table 10: Livelihoods in the cluster, disaggregated by gender and seniority. Livelihoods are ranked by average importance (as identified by interviewees) in each cohort

Senior Men

	N=	%
Agriculture	15	100.00%
Livestock	15	100.00%
Gardening	3	20.00%
Masonry	1	6.67%

Junior Men

	N=	%
Agriculture	15	100.00%
Livestock	12	80.00%
Trade	4	26.67%
Agroforestry	2	13.33%
Gardening	2	13.33%
Craft-making	1	6.67%
Secretary	1	6.67%

Senior Women

	N=	%
Agriculture	14	93.33%
Gathering	14	93.33%
Trade	10	66.67%
Gardening	9	60.00%
Livestock	8	53.33%
Craft-making	5	33.33%
Firewood	2	13.33%

Junior Women

	N=	%
Agriculture	15	100.00%
Gathering	15	100.00%
Trade	13	86.67%
Gardening	10	66.67%
Livestock	4	26.67%

Finally, there are important differences in animal husbandry across these groups. Figure 15 shows that, among men, livestock husbandry is, alongside agriculture, the most important livelihoods activity. Senior men have the highest rates of livestock ownership, and therefore are the cohort most vulnerable to changes in the amount or quality of pastureland. Junior men experience a similar vulnerability but to a somewhat lesser extent. The differential exposure of senior and junior men to the loss of adequate pasturage is reflected in senior men's elevation of access to pasture land to a significant challenge, while junior men view it as a relatively minor problem. Among women, livestock husbandry is the fourth or fifth most commonly mentioned livelihoods activity. They appear to treat livestock as another component of a fairly diverse set of activities nearly evenly distributed across the spectrum from market production to subsistence production. That said, senior women are about twice as engaged in raising livestock as junior women, probably because they have had more time to accumulate these assets. This suggests that, in this cluster, pastoral livelihoods activities are not simply gendered male, but instead associated with both seniority and gender. This renders senior women somewhat more exposed to livestock market fluctuations than junior women. Interestingly, we would expect outright water shortage to be a larger issue for senior women than junior women, for while gardens of all women would be impacted by such shortage, senior women would also have trouble watering their livestock, thus putting significant livelihoods assets at risk. However, junior women were highly concerned about water shortage, while senior women did not express any concern over it. It is possible that senior women simply conflated a concern for rainfall scarcity with overall water scarcity, but even in this case somewhat fewer senior women demonstrated concern. This divergence from expectations raises two issues. First, the differences in potential vulnerability described here remain provisional pending greater understanding of intra-household dynamics in these communities, as household pooling of agricultural production or income more broadly might pool climate risk at the level of the household, which might contain enough diverse activities to buffer against these impacts.

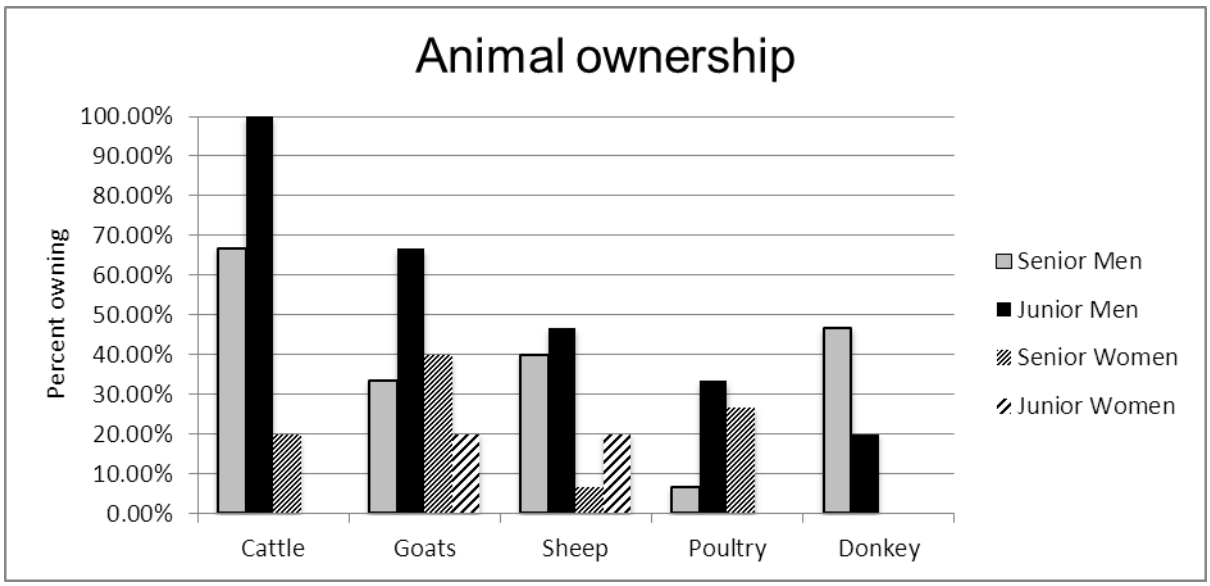


Figure 15: Rates of animal ownership across the different gender/seniority cohorts in the study villages

Second, the different identities that arise at the intersection of gender and seniority in this cluster of villages are reflected in the different perceived vulnerabilities among these groups (Table 11). As noted above, junior men tend to see variable rainfall as a major challenge to their well-being, without making any mention of a concern for rainfall scarcity. Senior men rarely mention variability, instead focusing their concerns on rainfall scarcity. While this reflects junior men's greater focus on generating marketable surpluses of rain-fed grains in their agricultural strategies, in cases where variability presents a significant risk to production, these two groups also have differing historical experiences. The senior men lived through the low point of precipitation in the early 1980s, and see this as a worst-case scenario. Junior men have farmed in an era of significant inter-annual variability. They have not, however, lived with steeply declining precipitation closely linked catastrophic agricultural outcomes. This issue becomes even more pronounced when we look at the differences between junior and senior women. Here, junior women do not discuss rainfall scarcity or distribution at all, likely because such a large percentage of their effort goes to irrigated gardening for the purposes of household consumption, and because they lack significant holdings in livestock. Senior women, on the other hand, see rainfall scarcity as a significant challenge, and, like senior men, view variability as a relatively minor problem. This difference in the perceptions of junior and senior women is difficult to explain without the consideration of gender and seniority, since without understanding their historical experiences, their shared focus on gardening and raising livestock suggest that they should view water scarcity in the same way. It seems likely, then, that as in the case of junior and senior men, this difference is also perceptual, driven by the same experiences that produce the different perceptions of precipitation we see between junior and senior men. By disaggregating the genders on the basis of seniority, we can identify significant differences in the perception of the local environment that shape livelihoods decisions and therefore vulnerability to the impacts of climate variability and change.

Table 11: Perceived vulnerabilities, as recorded in focus groups in the study villages

Senior Men	% foc grp	Avg Importance
Soil infertility	66.67%	1.50
Lack of grazing area	66.67%	2.00
Water scarcity	33.33%	2.00
Lack of ploughing tools and farming material	66.67%	3.00
Crop damage by livestock	33.33%	3.00
Pests	33.33%	3.00
Livestock disease	66.67%	4.00
Lack of high yield seeds	33.33%	4.00
Rainfall scarcity	33.33%	4.00
Cotton payment delayed	33.33%	5.00

Junior Men	% foc grp	Avg Importance
Variable rainfall	66.67%	1.50
Lack of ploughing tools and farming material	100.00%	1.67
High cost of agricultural inputs	66.67%	2.00
Rainfall scarcity	33.33%	3.00
Soil infertility	66.67%	3.50
Lack of fodder for livestock	66.67%	4.50
Lack of grazing area	66.67%	5.00
Livestock disease	66.67%	5.00
Cotton payment delayed	33.33%	6.00
Lost animals	33.33%	6.00

Senior Women	% foc grp	Avg Importance
Rainfall scarcity	66.67%	1.00
Lack of ploughing tools and farming material	100.00%	2.00
Livestock disease	33.33%	2.00
Pests	33.33%	2.00
Crop damage by livestock	33.33%	3.00
High cost of agricultural inputs	33.33%	3.00
Variable rainfall	33.33%	4.00
Lack of grazing area	33.33%	4.00
Lack of high yield seeds	33.33%	4.00
Food shortage	33.33%	5.00

Junior Women	% foc grp	Avg Importance
Lack of ploughing tools and farming material	66.67%	1.50
Water scarcity	100.00%	2.00
Pests	33.33%	2.00
High cost of agricultural inputs	66.67%	3.00
Lack of space for gardening	33.33%	3.00
Livestock disease	33.33%	3.00
Lack of fodder for livestock	33.33%	5.00

As this case demonstrates, there are gendered roles, and therefore vulnerabilities, at play in this Malian livelihoods zone. However, a vulnerability analysis framed around binary gender categories fails to note the ways in which different livelihoods activities become more or less acceptable *within* particular genders depending on seniority. Without this information, it is difficult to identify likely patterns of activities under a changing and uncertain climate, both now and in the future. For example, a binary analysis of gender might lead the investigator to assume that gardening is largely a women's activity, thus obscuring the fact that senior men appear to adopt this activity as they age, therefore leading the investigator to misunderstand the particular vulnerabilities and opportunities of senior men in these communities. Further, it is at the intersection of gender and seniority that perceptions of the vulnerability context emerge as a product of historical experience and the opportunities (time to acquire livestock assets) and challenges (greater difficulties raising grains in large fields) that come with advancing age. These perceptions, which are impossible to see in a binary gender analysis, will likely shape the indigenous adaptation pathways that different members of these communities adopt, and the likelihood that particular members of the community will adopt new development and adaptation interventions.

Critical Summary Points: Mali

An assessment of the impact of Mali's Agrometeorological Program demonstrates that across four regions in Mali with shared climates, agroecologies and social structures, there exist gendered vulnerabilities to climate variability and change.

Binary gender analysis highlights the different roles played by men and women in the rural livelihoods of the four villages highlighted in this case study. These roles produce distinct vulnerabilities to climate variability and change, as well as to economic change.

Limiting gender analysis to simple comparisons of the situations of men and women, however, overlooks significant differential and distinct vulnerabilities to climate variability and change that emerge at the intersection of seniority and gender. For example, as men become more senior they are clearly more able to adopt gardening as a livelihoods activity. This changes their vulnerability to climate variability and change, as gardening is an irrigated activity, while rain-fed agriculture is more susceptible to fluctuations in the amount and timing of annual rainfall.

The examination of identities that emerge at the intersection of gender and seniority reveals different livelihoods activities that are differently vulnerable to climate vulnerability, climate change, and economic change. Further, these identities reveal critical differences in perception of the vulnerability context that shape different decisions about current and future livelihoods activities and adaptation pathways.

MALAWI

MALAWI CASE SUMMARY

At the edge of the Mount Mulanje Forest Reserve in Malawi's Mulanje District, residents of two villages earn their livings in the context of pronounced seasonality, unstable and variable precipitation, increasing pressure on arable land, and an uncertain political economy of agricultural inputs. In this case, while gendered livelihoods activities experience different impacts from climate variability and change, local agricultural practices and household economics translate these differences into vulnerability that is shared at the household level. There are distinct vulnerabilities to climate variability and change in this study area, but they take shape around the different livelihoods options open to residents depending on the village in which they live, and the presence or absence of a male head in their household. Thus, this case illustrates why we cannot assume that women, as a general category, are more vulnerable than men to the impacts of climate variability and change, or that gender is necessarily the key differentiation shaping vulnerabilities in rural parts of the Global South.

Muhuyo and Monjomo are two villages located near the edge of the Mount Mulanje Forest Reserve (MMFR) in Malawi's Mulanje District (Figure 16). The MMFR covers most of the Mulanje Massif, a collection of granite peaks that reach 9,824 ft. at the highest point (NASA, 2002). Broadly speaking, the vulnerability context of those living in the Mulanje District is shaped by variable precipitation, pronounced seasonality of precipitation, and high population density that limits access to farmland. The climate is marked by two distinct seasons, a wet season from November to April and a dry season from May through October. From June to August the area experiences intermittent fog and light rain, a phenomenon called *chiperoni,* that allows for the late growth of crops, especially tea.

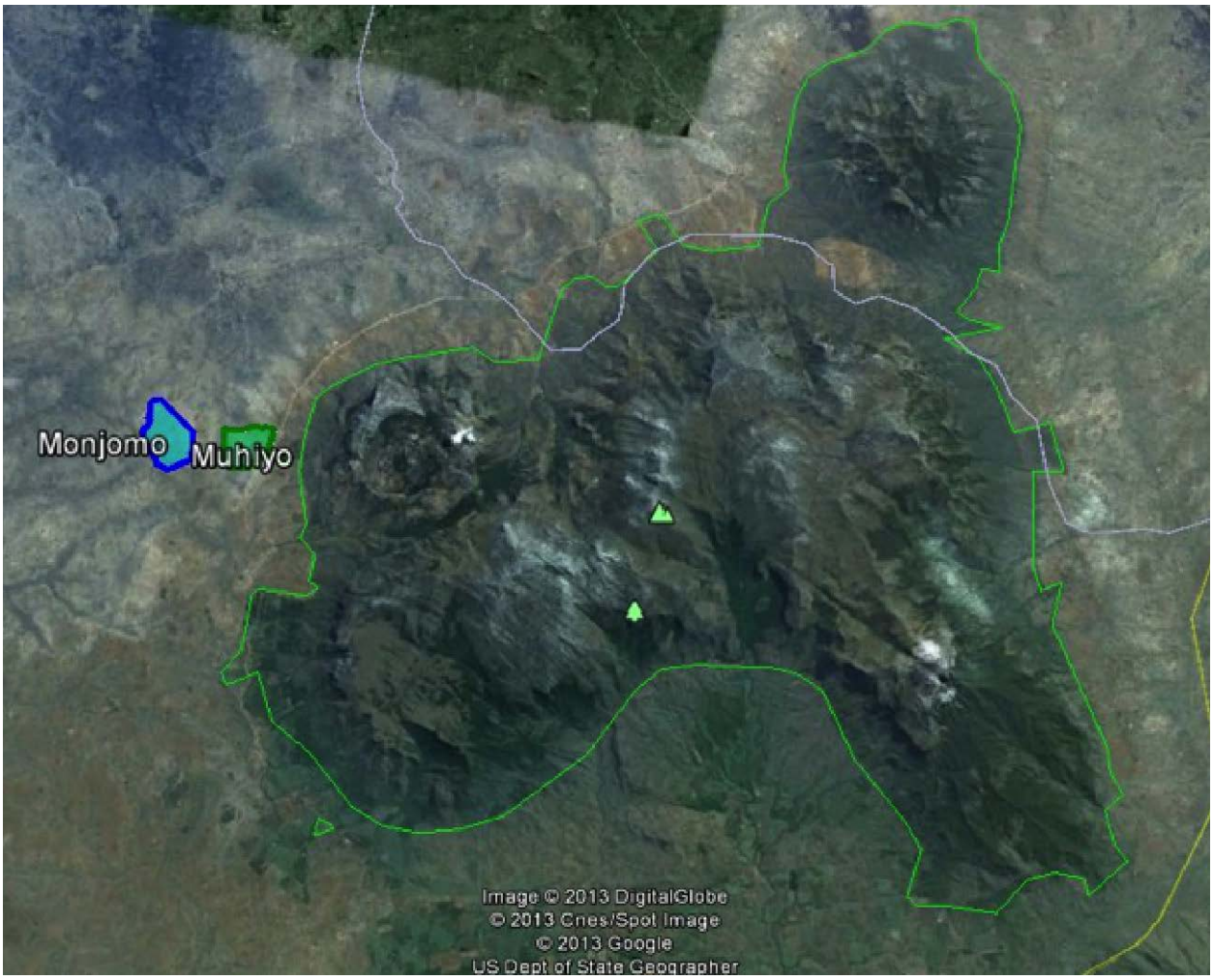


Figure 16: Locator map of Muhiyo and Monjomo, at the base of the MMFR (Basemap source: Google Maps)

The climate of the Mulanje District is marked by significant variability in annual precipitation, as well as a slight trend toward reduced precipitation over the past century (Figure 17). Historically, the district's rainfall has been characterized by short, alternating cycles of above-average and below-average years. Between the mid-1950s and the early 1970s, the District saw a 10% decline in average annual precipitation, from which it has not recovered. The district experienced a series of very dry years from the mid-1980s to the mid-1990s. Since then, the district has not experienced similar rainfall deficits, though average annual precipitation remains 10% below pre-1950 averages.

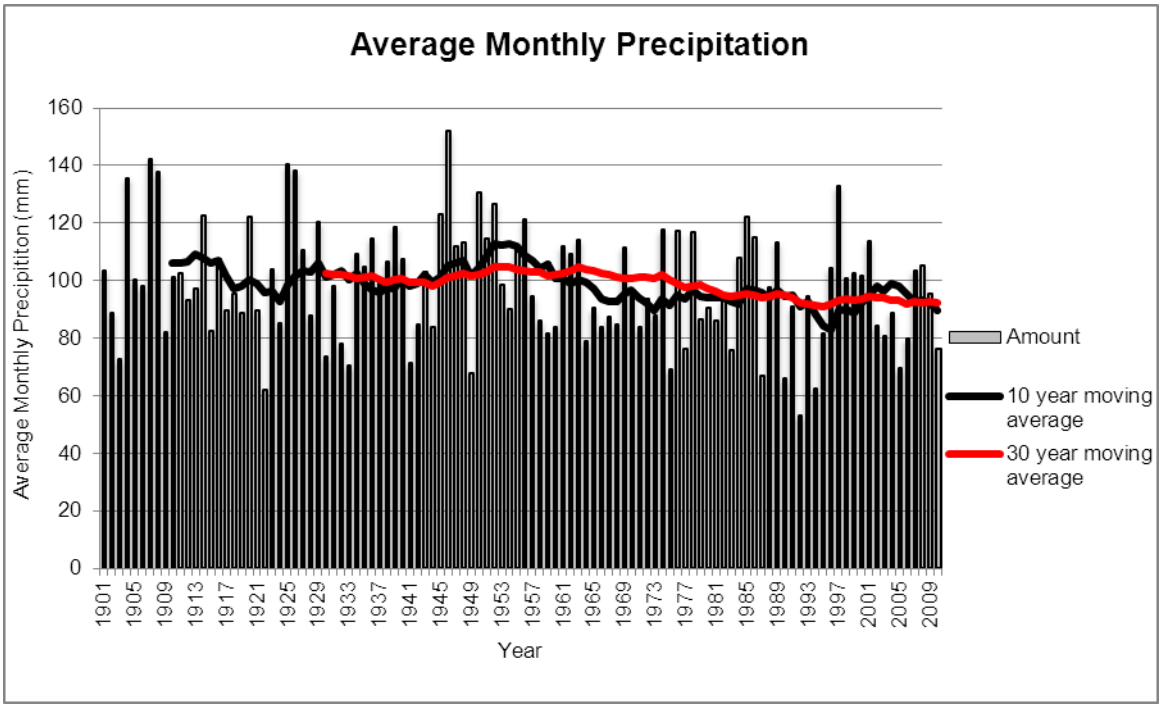


Figure 17: Historical precipitation patterns in the Mulanje District, 1901-2010

(Source: mean WCRP GCOS GPCC FDP version6 0p5 prcp, accessed at http://iridl.ldeo.columbia.edu/SOURCES/.WCRP/.GCOS/.GPCC/.FDP/.version6/.0p5/.prcp/T/12/0.0/runningAverage/T/12/STEP/Y/%2816%29%2810%29RANGEEDGES/X/%28-13%29%28-4%29RANGEEDGES/%5BX+Y+%5Daverage/figviewer.html?plottype=line on 6 June 2013)

While decline and instability mark the overall trend in precipitation for the region, it is difficult to translate this concretely into livelihoods outcomes around Mt. Mulanje due to the complexity of this context. First, while agriculture is the foundation of most livelihoods in the Mulanje district, individual efforts to make a living are a complex mixture of one or more of the following: agriculture, temporary (*ganyu*) labor, formal employment on tea and tobacco plantations as well as in the tourism sector, participation in small businesses and trading, government employment, livestock-raising, small-scale mining, and small fishery production. Second, Mt. Mulanje is tall enough to provoke orographic precipitation, which then filters back down to surrounding communities via several rivers. Third, population density is a major challenge in the district that might overwhelm all other stressors. Mulanje District is home to approximately 600,000 people. While the district contains plains with fertile soils,[7] 25% of the district is covered by the MMFR and therefore excluded from agricultural use. As a result, the district's population density is nearly 390 people per square kilometer of arable land. Household landholding in the district averages 0.6 hectares. Densities are somewhat higher in the southern part of the district and around the base of the mountain. Fourth, without the option of extensification, the residents of the district are dependent on agricultural inputs to achieve the yields necessary to meet basic household needs. Input access varies, since in some years the government heavily subsidizes fertilizers, while in others it does not (Ellis, Kutengule, & Nyasulu, 2003; Harrigan, 2003, 2008; Jayne, Govereh, Mwanaumo, Nyoro, & Chapoto, 2002; Orr & Mwale, 2001). This makes agriculture and livelihoods planning difficult, as the absence of subsidies can severely curtail access to inputs and therefore farm production for the poorest households.

[7] Some northern parts of the district can flood during the rainy season (called *dombo* land), which limits their agricultural productivity.

From October, 2010 to May, 2011 193 semi-structured interviews were conducted with individuals in Muhiyo and Monjomo. These interviews were distributed between men (n=71) and women (n=121), the latter including the situations of women heading households (n=23). This study was aimed at identifying how different communities, and different members of particular communities, are affected by and interact with the MMFR. Therefore, the study did not attempt to randomize its sample, but instead purposively sampled a range of actors in these two villages to capture a broad range of experiences. While the underlying data lacks randomization, the large number of interviews across a wide range of residents, as well as seven months of participant observation in and around these villages, provided opportunities to cross-check interview data and strongly suggest that the data presented here are representative of the actions and perceptions of at least a sizable majority of the populations of these villages.

In Muhiyo and Monjomo, the general trends that mark the vulnerability context of the Mulanje District are manifest in increasingly uncertain timing of annual rains, high costs of farm inputs, limited farmland availability, and lack of jobs and infrastructure. Subsistence agriculture is the core of most livelihoods in these villages. Local farmers grow a variety of crops (Table 12), which they both eat and sell. Families sell produce to make money for school fees, doctor visits, seed, fertilizer, and other expenses. Residents also participate in a range of nonfarm activities (Table 13). These include irregular informal labor, but also (for a few) government employment, and teaching. About 20% of individuals in the sample participate in petty trading, or own small shops where people can buy goods such as sugar, salt, soap, and sweets if they can afford them (Table 13).

Table 12: Crops raised in Muhiyo and Monjomo

	N	%
Maize	178	93%
Pigeon Peas	160	83%
Sorghum	117	61%
Rice	105	55%
Cassava	51	27%
Other	46	24%
Ground Nuts	43	22%
Beans	38	20%
Sweet Potatoes	33	17%
Tobacco	17	9%
Sugar Cane	14	7%

Table 13: Livelihoods reported in Muhiyo and Monjomo

	N=	%
Farming	214	99.53%
Sell produce	85	39.72%
Ganyu	61	28.22%
Business	45	21.12%
Sawyer	23	10.82%
Other	21	9.72%
Sell firewood	17	7.68%
Employed by MMCT or FD	3	1.38%

Broadly speaking, the livelihoods of those living in Muhiyo and Monjomo are vulnerable to a range of stressors, including climate variability and change; the shifting political economy of agricultural subsidies; the condition of the Malawian economy and the economy of the Mulanje District, in which petty traders and business owners draw customers; and changing access to the forest resources of the MMFR.

If we disaggregate livelihoods activities by gender to search for differentiated vulnerabilities in these villages, an interesting pattern emerges. In agriculture, there is almost no difference between the crop selections of men and women (Table 14). This is explained by the fact that, around the base of Mt. Mulanje, most husbands and wives farm together, with the husband making most decisions about what to plant. There is a slight trend in some instances toward women reporting more of a given crop in the data – this is less a reflection of women's agricultural choices in the household than a reflection of the fact that women tend to dominate actual planting activities on the family farm. They therefore know more than their husbands about exactly what crops are on the farm at any given time, and in what quantities. We note here that an analysis of the data did not reveal any age-differentiated activities within or between households that would reflect the importance of seniority as a cross-cutting identity influencing gender-related vulnerabilities to the impacts of climate variability and change.

Table 14: Crops by gender in Muhiyo and Monjomo

	Men		Women	
	N=	%	N=	%
Maize	65	91.55%	135	93.75%
Nandolo/ Pigeon Peas	53	74.65%	128	88.89%
Rice	38	53.52%	79	54.86%
Sorghum	37	52.11%	96	66.67%
Cassava	17	23.94%	38	26.39%
Other	14	19.72%	38	26.39%
Sweet Potatoes	13	18.31%	24	16.67%
Ground Nuts	12	16.90%	34	23.61%
Tobacco	11	15.49%	6	4.17%
Beans	10	14.08%	34	23.61%
Sugar Cane	6	8.45%	9	6.25%

Table 15: Livelihoods by gender in Muhiyo and Monjomo

	Men		Women	
	N=	%	N=	%
Agriculture	70	98.59%	144	100.00%
Sell produce	24	33.80%	61	42.64%
Business	20	28.17%	25	17.65%
Ganyu	17	23.94%	44	30.33%
Sawyer	16	22.54%	7	5.04%
Other	9	12.68%	12	8.26%
Livestock (chickens, pigs, goats, doves)	5	7.04%	3	2.08%
Employed by MMCT or FD	2	2.82%	1	0.67%
Sell firewood	0	0.00%	17	11.47%

Livelihoods in these villages are marked by several gendered activities. Because these activities are vulnerable to different stressors, it appears that there are gendered livelihoods vulnerabilities in these villages. Because of the range of activities open to them, men often have more diversified livelihoods activities than their wives. Their activities include jobs as loggers at MMFR or in other parts of Malawi, government or local NGO employees, bicycle mechanics, masons, timber sawyers, teachers, or running a small business. The income from these activities can be significant, surpassing agricultural incomes. However, men who are heavily engaged in work for the government or in their own business are exposed to shifts in the Malawian economy that might constrain government or consumer expenditures. Men involved in sawyer activities often migrate to other areas of Malawi (especially around Mzuzu in the north) due to timber restrictions at MMFR. These men are therefore particularly exposed to shifts in timber markets and further changes in resource regulation at forests around the country.

Many women in these households also participate in livelihoods activities beyond the household farm, such as working in small shops and brewing beer, but the bulk of their livelihoods are still based in agriculture, either

through selling their labor to other farmers, or selling the produce from their farms at market. As most women are more directly responsible for agricultural outcomes in their households than their husbands, their activities are more directly exposed to weather and input price shocks. Further, wives of migrating sawyers find themselves solely responsible for all household and farm activities at certain times of year, which can increase the vulnerability of their agricultural activities due to a decrease in household labor availability. Men and women are differentially exposed to changing regimes of forest management. Just as men's forest-related employment opportunities, both legal and extralegal, can change in the face of changing forest policy and state capacity to enforce such policies, women are exposed to shifts in access brought on by changing enforcement and management regimes that might curtail their capacity to collect firewood for sale and household use.

In this part of Malawi, however, the livelihoods of husbands and wives are linked in a manner that both exacerbates and mitigates gendered livelihoods vulnerability. There is no evidence for separate agricultural incomes, such as those seen in the Ghana case, in the households of Muhiyo and Mojomo. Therefore, both husband and wife are dependent on the same farm for food and income, spreading the risks posed by an uncertain climate and input regime from the realm of women's production throughout the household. Further, there is little evidence that men's and/or women's non-farm earnings are treated as somehow independent of household earnings, at least among the study sample, exposing women to shifts in markets that affect consumer demand, government employment, and therefore the livelihoods of their husbands. In short, local gendered expectations, practices of land tenure, and household economics, while dividing up livelihoods tasks and roles within the household, bring the proceeds of these activities together in a manner that smoothes out the distinct and differential vulnerabilities associated with both men's and women's activities across the entire household.

Because women heading households are the only subgroup in these villages likely to be making autonomous decisions about what to plant as well as what non-farm activities to undertake, and because they often have no other member of the household with whom to build a livelihood, we further disaggregate the data to compare their situations with those of married men and women. As Figure 18 illustrates, this disaggregation further supports the idea of largely homogenous agricultural strategy in these communities, as it shows little difference between men, women, and women heading households. We find slightly higher rates of reporting on several crops for women heading households. However, women in female-headed households do not participate in businesses or formal employment at all, making farming (on their own land, or others' farms on which they participate in *ganyu* labor) and informal selling of produce their only sources of livelihood (Figure 19). It therefore makes sense that we would see these households as raising a slightly elevated level of staple crops like maize, pigeon peas, beans, and sorghum when compared to those living in married households. This suggests that, while women heading households do have access to land in these villages, they lack labor power and access to the capital necessary to run businesses or otherwise diversify their livelihoods. Therefore, their agricultural incomes are vulnerable to shifts in the local agricultural labor market, especially with regard to local and national demand for the vegetables they grow and sell. Their livelihoods are also highly vulnerable to fluctuations in precipitation and changes in state sponsorship for input regimes. The livelihoods of women heading households in Monjomo are even less diversified, as they lack access to the forest products that allow their counterparts in Muhiyo to incorporate selling firewood into their livelihoods.

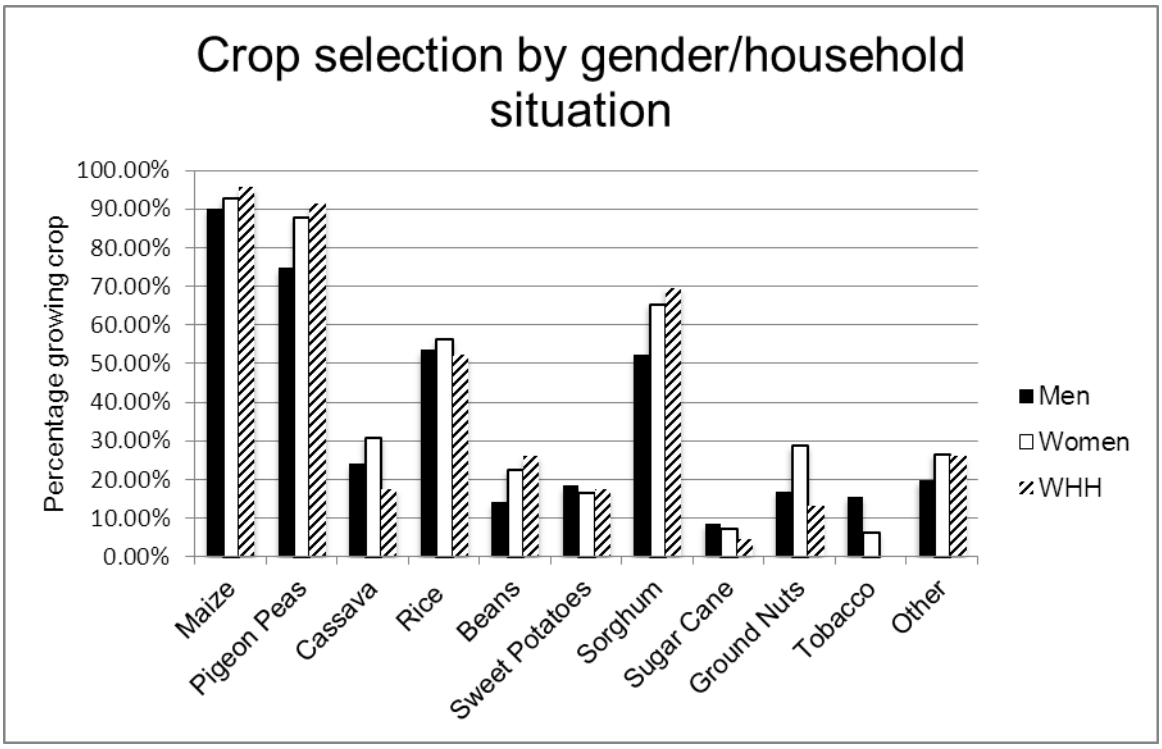


Figure 18: Who plants what in the study area, decomposed by men and women in mixed households, and women heading households

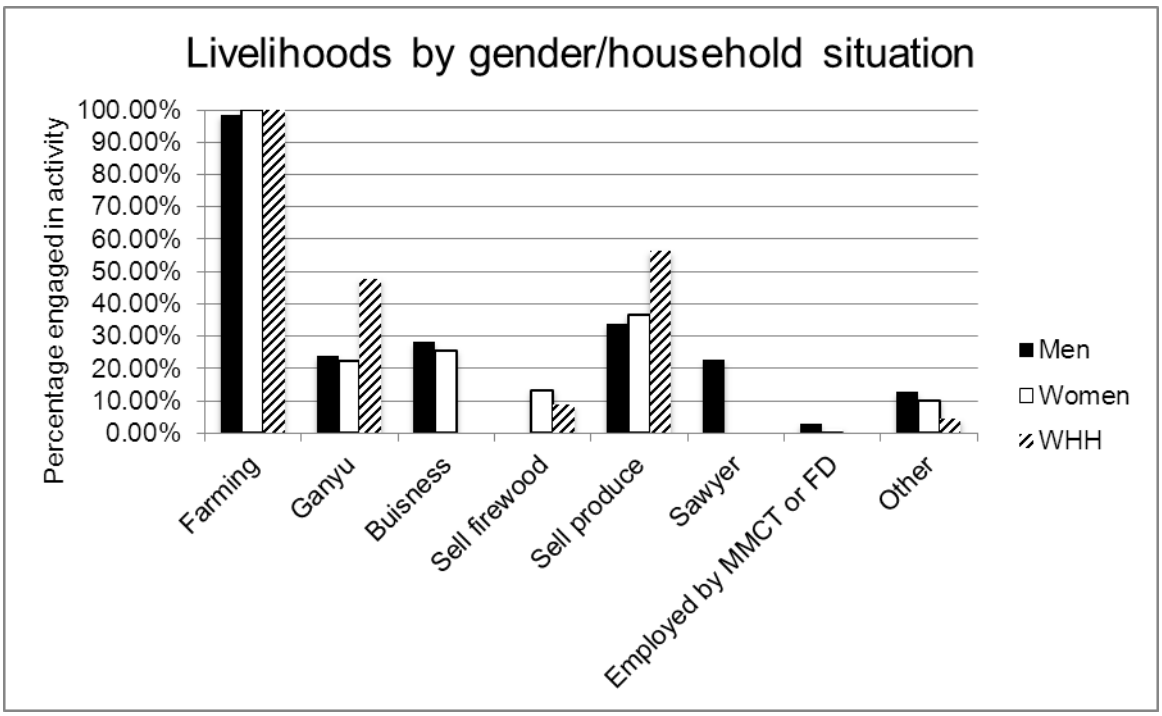


Figure 19: Livelihoods in the study area, decomposed by men and women in mixed households, and women heading households

The absence of clearly gendered vulnerabilities to the impacts of climate variability and change in Monjomo and Muhiyo does *not* mean that vulnerability is uniform across the district. Recent work in livelihoods studies in this district has suggested that livelihoods are spatialized; that is, there are clear spatial clusters and patterns of livelihoods around Mt. Mulanje (McCusker & Conley, n.d.). As Muhiyo is adjacent to the MMFR, and Monjomo is further away, it is worth considering our social breakout by village of residence. Figure 20 demonstrates that there is little to differentiate these villages agriculturally, either in terms of crops grown or the patterns of reporting among men, women, and women heading households. However, Figure 21 shows that livelihoods are differentiated across these two villages. In Muhiyo, men's non-farm labor is concentrated in migration for sawyer work in other parts of Malawi and cutting invasive pine trees for MMCT at MMFR. In Monjomo, where access to the reserve is more limited and men are less skilled in sawyer work, the focus is on business. It is also clear that women sell firewood if they are near the reserve, but do not if they are even one village away. Clearly, access to the MMFR creates formal and informal livelihoods opportunities that produce distinct vulnerabilities in the district. Women's livelihoods in Muhiyo are directly exposed to changing forest access, while women in Monjomo would see few effects on their incomes *or* the incomes of their husbands. Men in Muhiyo are highly vulnerable to changing levels of exclusion from the reserve as well as to national timber policies, while their counterparts in Monjomo are those most impacted by changes to the Malawian economy that might impact consumer spending. Further, these vulnerabilities likely track in opposite directions. When the economy is bad, and government revenues are down, the government is likely to lower staff levels and resources, reducing its capacity to enforce exclusion from the MMFR as well as providing incentives to increase the exploitation of forest reserves in other parts of the country. Thus, while businesses in Monjomo suffer from a lack of consumer demand, timber cutters and firewood sellers in Muhiyo likely enjoy greater access to the MMFR or other forests in Malawi. The reverse of this pattern is likely true as well.. This further highlights the formation of differentiated vulnerabilities in response to village-specific livelihoods and the household situation of the person in question, as opposed to gender.

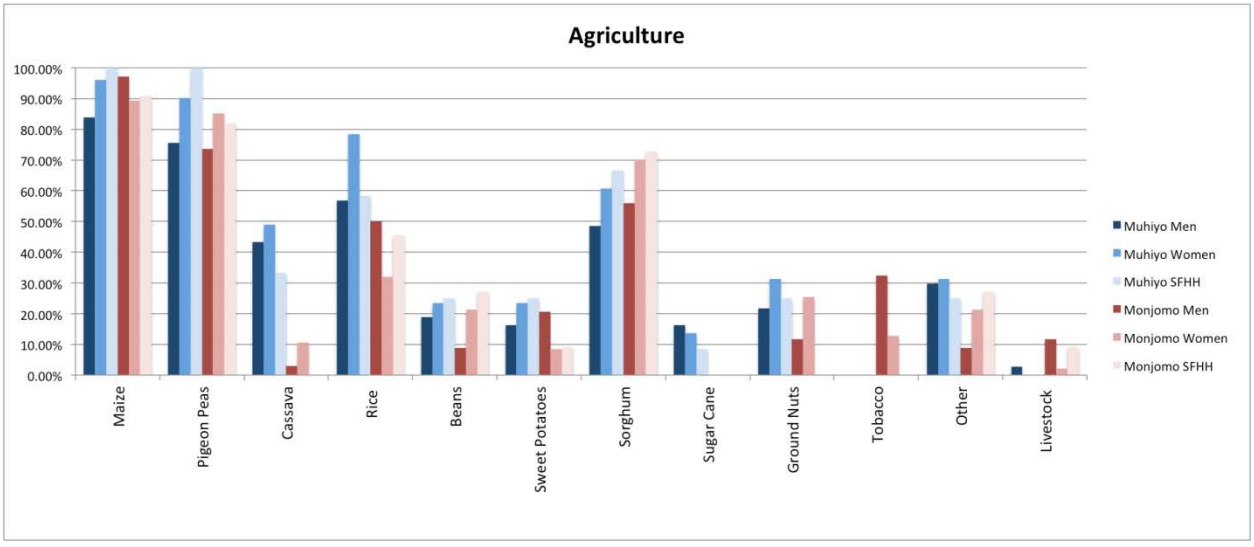


Figure 20: Agriculture, differentiated by village and social grouping

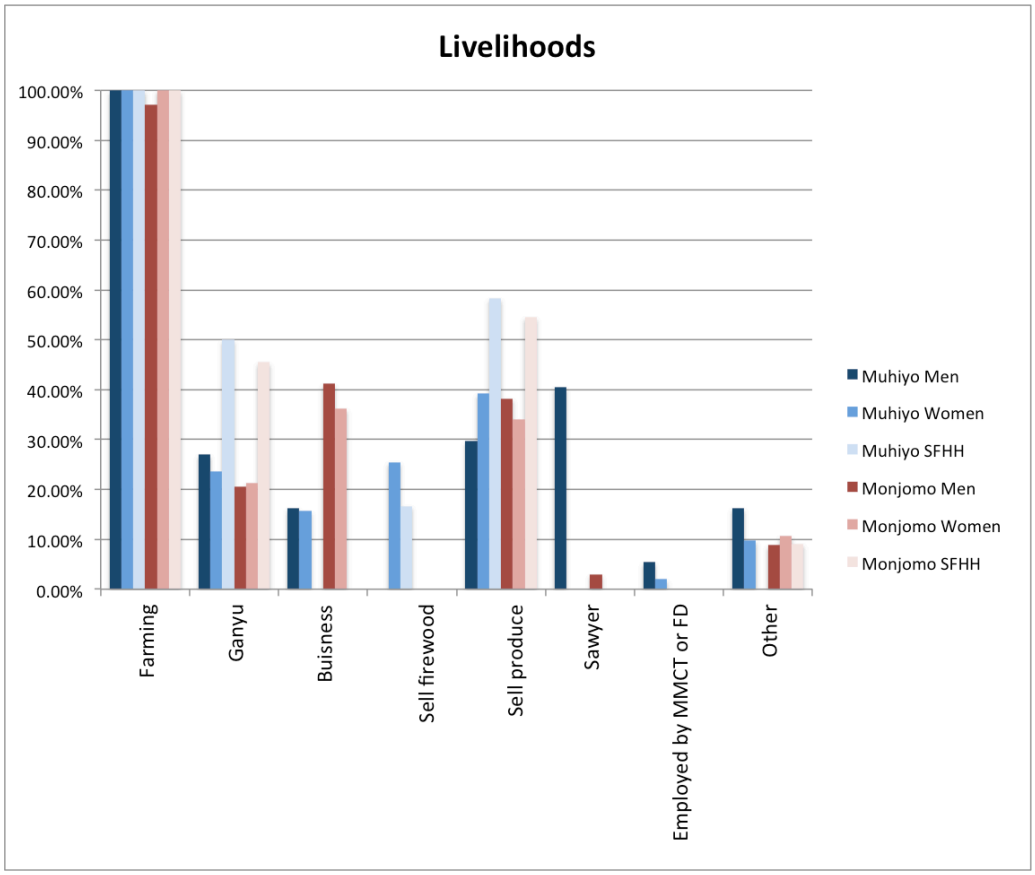


Figure 21: Livelihoods by social grouping and village

In summary, in Muhiyo and Monjomo we see a clear demonstration of Arora-Jonsson's (2011) argument that there is little evidence to suggest that women are, *a priori*, the most vulnerable part of a given population (see also Carr, 2008; Warner & Kydd, 1997). Here, women's *activities* are impacted differently than men's, but the *outcomes* of these activities are pooled at the household level such that these vulnerabilities come to be distributed and managed across the entire household, regardless of gender. Grounding an analysis of this population's vulnerability to climate variability and change in a binary gender analysis would be misleading, as it is the spatial differentiation of livelihoods across villages around the MMFR, and the presence/absence of a male head of household, that produces meaningful differences in livelihoods activities. These differences are most visible *within* the genders, between villages. These differences are so polarized between households in the two villages that, despite their proximity, they would likely experience distinct outcomes from the same economic issues at the national and district levels.

This is not to say that identifying gendered differences in livelihoods activities in these villages is without merit. By understanding who conducts what activity, we can better understand who will be most impacted by a given adaptation intervention. This, in turn, speaks to the potential for social disruption if particular groups are targeted in a manner insensitive to local context. For example, agricultural interventions will clearly have a greater impact on women's day-to-day lives than men's. Such interventions could add to women's workloads, or in changing the labor regime on farms open women up to new household or other duties that add to their daily burdens. This concern, however, should emerge after the identification of particular vulnerabilities, and these vulnerabilities are difficult to discern if predicated on binary gender analysis.

Critical Summary Points: Malawi

- A binary gender analysis of livelihoods in two villages at the base of the Mt. Mulanje Forest Reserve does not reveal any major differences in activities or vulnerabilities across men and women.

- The presence of a male head of household does impact the livelihoods activities of households, such that women heading households do engage in different livelihoods activities, though crop selection and agricultural strategy is not shaped by household situation.

- There are, however, distinct and differentiated vulnerabilities to climate variability, climate change, and economic change in these villages. These vulnerabilities emerge around the village of residence for men and women, as residence shapes proximity to the MMFR and the unique livelihoods opportunities it presents. It is also shaped by the household the woman lives in, for women heading households have unique vulnerabilities in the sample communities

- In these villages, gender is not the primary determinant of vulnerability. Gender does matter, but as a secondary issue after the village of residence. Thus, this case reinforces arguments in the contemporary literature against assuming that women are always the most vulnerable to climate variability and change, and that gender is always the most salient social cleavage around which distinct and differentiated vulnerabilities emerge.

SUMMARY

The literature on gender and development is in the process of moving beyond binary gender analysis. While such analyses are still conducted, there is widespread understanding in the literature that using this simplistic lens to explore gender differences and their impacts on development outcomes is inadequate if we wish to build explanations of what works and what does not (see Appendix I). The gender and adaptation literature has been somewhat slower in making this transition, though it is clear that these gender and development lessons are making their way into this literature as well. Earlier binary approaches to gender in development served to highlight the ways in which women were overlooked or ignored in development thought and implementation. Further, they demonstrated how the roles and responsibilities associated with different genders shaped different development outcomes within a target population or community. However, the lessons of this work cannot and should not stop with gender. The larger lessons of this literature are about the importance of social difference, *whatever form it takes*, and how those differences are translated into different development outcomes. Gender is an identity that takes shape through reference to other identities, ranging from caste to ethnicity to age. Thus, we cannot really understand gendered vulnerabilities, and gendered impacts of development and adaptation interventions, unless we understand gender itself in terms of other salient identities that are also associated with the roles and responsibilities that contribute to the particular livelihoods strategies and social positions of those whose needs we seek to address in our programming.

The case studies in this report serve to reinforce this message through empirical demonstration of the value of taking up this more complex contemporary lens on gender in the context of development and adaptation. While each case offers its own lessons about gender and adaptation in agrarian settings, taken together these cases demonstrate two key points.

First, the identity categories most relevant to understanding vulnerability in a particular place are contextually specific. In the Ghana case, it was the intersection of gender with livelihoods strategies and household situation that brought out the identities most responsible for the production of different livelihoods vulnerabilities to climate change impacts. In the Mali case, the salient intersection was gender and seniority. In Malawi, distinct and differentiated vulnerabilities within gender groups only become visible when gender is understood in the context of the village of residence, and its proximity to the unique livelihoods opportunities and resources in the MMFR.

Second, the use of binary gender analysis to explore vulnerability to climate change impacts risks glossing over important intra-community and intra-household vulnerabilities, including those of the most marginal and vulnerable. For example, in the Ghana case, it is very difficult to identify and address the specific livelihoods vulnerabilities of women in female-headed households, and women in diversified households, via a binary gender analysis, as such analysis aggregates the situations of all women into something that most resembles the situations of women in market households, the most secure members of the community. In the Mali case, binary gender analysis suggest gendered patterns of livelihoods activities that, in fact, are produced through specific intersections of seniority and gender. For example, a vulnerability analysis built on this generalized pattern would overlook the specific vulnerabilities and capacities of senior men in this cluster by ignoring their gardening activities. In Malawi, a binary analysis of gender suggests that vulnerability is evenly distributed across the married study population (though women heading households have some distinct vulnerabilities, due to their different livelihoods activities). Yet there are distinct and differentiated vulnerabilities within married households that are tied first to location, and then to gendered emphases with regard to crop selection and livelihoods activities.

The legacy of gender and development research and implementation is an enhanced sensitivity to the role of social difference in the production of vulnerability and adaptive capacity. By moving beyond a narrow focus on gender to a treatment of gender as a key part of the many different, contextually-specific identities that inform the decisions and outcomes that shape the world of the global poor each day, we can better identify and address the challenges that climate change and poverty present, now and in the future.

APPENDIX I: GENDER AND CLIMATE CHANGE ADAPTATION IN AGRARIAN SETTINGS

Literature Review

Introduction

The impacts of a changing climate on the livelihoods of the global poor become more clear with each passing year. Among agrarian populations these impacts are particularly pronounced, as they contend with ever-more uncertain conditions in which to raise their food and earn their livelihoods.

While the impacts of climate change have effects, large and small, on all who rely on agriculture for their livelihoods, these effects are not uniformly felt. The contemporary literature on adaptation widely acknowledges that the patterns of vulnerability to climate change impacts we see today are largely, if not principally shaped by social factors such as gender roles, class and caste biases, and other markers of social status and expectation that shape access to livelihoods and other resources (for example, Pelling & High 2005; Reid & Vogel 2006; Paavola & Adger 2006; Adger 2006). This broad understanding informs that portion of the literature focused on agricultural development and adaptation. Drawing on decades of feminist scholarship on agriculture and agricultural development in the Global South (a very partial list includes Barrientos et al. 2005; Barry and Yoder 2002; Bassett 2002; Bhuyan and Tripathy 1988; Boserup 1970; Bryceson 1995; Carney 1996; Carr 2005; Chikwendu and Arokoyo 1997; Creevey 1986; Dixon 1982; Egharevba and Iweze 2004; Feldman and Welsh 1995; Ferguson 1994; Gairola and Todaria 1997; Goebel 2002; Goheen 1988; Grier 1992; Harrison 2001; Harriss-White 1998; Jackson 1993, 1998a; Jha 2004; Leach and Fairhead 1995; Mama 2005; Mbata and Amadi 1993; Moser 1993; Peters 1995; Riley and Krogman 1993; Rocheleau, Thomas-Slayter, and Wangari 1996; Radel 2011; Angeles and Hill 2009; Shahra Razavi 2009; Koopman 2009; Oakley and Momsen 2007), this literature focuses heavily on gender as a critical social cleavage around which agricultural livelihoods are shaped. More recently, emerging work on the gendered implications of climate change in agrarian settings has highlighted how these gendered patterns of labor and responsibility produce different vulnerabilities, different impacts, and different livelihoods outcomes for men and women living in the same regions, countries, agroecologies, and indeed within the same households (Carr, 2008a; Swai, Mbwambo, & Magayane, 2012). These findings make a compelling case for the incorporation of gender analysis in the design of any program or project that aims to address the vulnerability to climate change experienced by those living in agrarian settings.

While it serves to highlight one set of important social differences that shape livelihoods and adaptation outcomes in agrarian settings, the bulk of the contemporary gender and adaptation literature makes its case on a very narrow gender analysis, where "man" and "woman" are treated as unitary categories with contrasting needs. This binary framing of gender does not reflect current understandings in the wider social science literature. Contemporary feminist research has moved beyond the duality of man vs. woman to demonstrate the ways in which gender categories gain meaning not just through opposition to one another, but also with reference to a host of other social markers like age, income, and ethnicity. Thus, contemporary feminist research demonstrates that a wide range of social differences play important roles in the constraints

and opportunities people face in a variety of settings. In the context of climate change adaptation in agrarian settings, this approach suggests that within a given community, the vulnerabilities of, for example, a wealthy woman may have more in common with those of a wealthy man than they do with the vulnerabilities of a poor woman. As the second part of this review will show, a small but growing body of work in development studies and the literature on adaptation to climate change has taken up this approach to understanding gender in the context of climate change adaptation. A portion of this literature makes a conceptual argument for this approach, while the rest is driven to consider gender as itself differentiated by empirical case study evidence whose interpretation demands the disaggregation of gender categories. These case studies suggest that aggregating information on vulnerability on the basis of gender creates a situation in which we are likely to miss the needs of significant portions of the population that we mean to target with climate-sensitive development interventions. Such situations can result in maladaptive interventions that enhance, instead of ameliorate, the vulnerability of the most marginal and vulnerable in a given population. Thus, while this contemporary approach to gender analysis reveals a more complex landscape of vulnerability otherwise invisible under previous forms of gender analysis, it also points us toward more sources of vulnerability that might be addressed in our programming, and therefore improves the chances that a given intervention will be effective for the entire target population.

Gender, Adaptation, and Agrarian Development

Since at least the 1970s, the field of development studies has recognized the importance of gender as a means of explaining development outcomes, and therefore the importance of gender analysis in designing programs and projects that are targeted to the often-variable needs of men and women in the same country, community, and even household. The bulk of this work starts from the assumption that men and women are social categories with distinct vulnerabilities, and that both men's and women's vulnerabilities present challenges to economic growth and other means to improved well-being in the Global South (for discussion, see Lawson 1995; Jackson 1998b; Moser 1993).

While a full review of this extensive literature is beyond the scope of this literature review, it has produced several findings critical to programming at the nexus of climate change adaptation and agricultural development. First, this literature demonstrates the existence of a broad, pervasive (if not universal), and enduring lack of women's inclusion in agricultural decision-making in households at scales and settings from the household to agricultural development programs and projects, to climate negotiations (Alston & Wilkinson, 1998; Damisa & Yohanna, 2007; Dankelman, 2010; Naila Kabeer, 2005; Nalia Kabeer, 2001; Lambrou & Paina, 2006; Merha & Rojas, 2008; Skinner, 2011; Skutsch, 2002). This inequality in decision-making goes beyond selection of what crops will be planted and when, to socially constructed rules of who is allowed to sell in markets, rules on traveling to markets, and similar mobility restrictions (Chaudhury, Kristianson, Kyagazze, Naab, & Neelormi, 2012; Djoudi & Brockhaus, 2011). On a broader scale, sparse women's input on national, regional, and global climate decisions and agreements is viewed as a visible reminder of antiquated male-dominated power structures that remain pervasive today (Boyd, 2002; Skinner, 2011).

Second, in agrarian communities in the Global South access to land is often marked by significant gendered inequalities. These inequalities include disparities between men's and women's abilities to purchase and hold land, as well as inequalities in access to communally-held or managed land (especially the most desirable farm plots) (Agrawal, 2003; Brody, Demetriades, & Esplen, 2008; Djoudi & Brockhaus, 2011; FAO, 2011; Karanja, 1991; Nelson, Meadows, & Cannon, 2002a; Quisumbing & Pandolfelli, 2008; Tripp, 2004; Udry & Goldstein, 2008; Whitehead & Tsikata, 2003). Such inequalities have wide-reaching gendered impacts on agricultural productivity. Not only does unequal entitlement to land affect women's agricultural options by limiting the size and quality of their farms, but it also affects their ability to access credit (FAO, 2011; Fletschner & Kenney, 2011). This credit is a necessity for many small farmers in order to purchase more climate change-resistant seeds and livestock varieties, farm technologies, and fertilizer inputs (Ahmed & Fajber, 2009a; Demetriades & Esplen, 2008).

A third theme focuses on the existence of gendered agricultural practices and crops, demonstrating how the different crops grown by men and women present different challenges and opportunities in the context of particular environments and economies (Arndt & Tarp, 2000; Carr, 2008b; Cloud, 1986; C. R. Doss, 2002; Ezumah & Di Domenico, 1995; Gladwin, 1992; Kevane, 2011; Lope-Alzina, 2007; Padmanabhan, 2007; Sachs, 1996; Shiva, 1988). These studies find that women often raise crops that are more sensitive to climate variability than do men. As many such women are not the principal agricultural decision-makers in their households or communities, the vulnerabilities that result from this differential climate impact are often not addressed by indigenous strategies, and can be exacerbated by development interventions that work within existing divisions of labor. These authors argue that by understanding the different vulnerabilities associated with particular crops grown by men and women, we can better understand the challenges that development programming is meant to address, and therefore improve development outcomes for women (and ideally men, though men's needs and benefits are not always explicitly mentioned in the literature on gendered crops).

A fourth theme in this literature is the failure to identify women's activities as appropriate targets for development or extension programs. As Demetriades and Esplen (2008: 3) explain: "These obstacles are further exacerbated by gender biases in institutions which often reproduce assumptions that men are the farmers… The result is that agricultural extension services and technologies are rarely available to women farmers" (see also Ahmed & Fajber, 2009a; Boserup, 1970; Buvenic, 1986; Saito & Weidemann, 1990).

A final, newer theme emerging at the nexus of gender and climate change adaptation in agrarian settings is that of promising adaptation strategies that are unique to women. This theme deals with new and innovative ways women are addressing existing and increasing impacts of climate change within their daily lives today, and is founded on the assumption that women can and do utilize their unique roles in their households and communities in order to come up with new strategies for dealing with situations of drought, flooding, uncertainty, and other climate change-related stressors (Babugura, Mtshali, & Mtshali, 2010; Demetriades & Esplen, 2008; Djoudi & Brockhaus, 2011; Mitchell, Tanner, & Lussier, 2007; Swai et al., 2012). While this literature does not discount the fact that men also are actively developing new coping strategies and adaptation activities to address the impacts of climate change, coverage of these men's activities are more cursory in this theme (Lane and McNaught 2009, however, discuss men's and women's activities more thoroughly). Although this focus at times risks replicating potentially problematic generalizations about the connection between women and land or women and the environment (see Chant, 2010; Jackson, 1998a for a discussion of the problematic feminization of poverty in the development literature), there is great potential in this line of thought for developing more critical gender analyses that go beyond persistent problematic categorizations of women as always comprising a majority of the poor and most vulnerable in society.

The themes in the mainstream literature examining gender and climate change adaptation in agrarian settings demonstrate a clear need for gender analysis as a part of both program/project design and monitoring and evaluation. Without some form of gender analysis, it is unlikely that any project design process would adequately capture the range of vulnerabilities and challenges at play within a target population, resulting in an intervention that produces less-than-optimal outcomes, or even intensifies the challenges of some of the poorest and weakest in society. However, the framing of gender analysis promoted (perhaps inadvertently) by this work rests on a very simplistic comparison of men's and women's situations, built on homogenous categories of "men" and "women" that many now argue are no longer the most effective tool for addressing challenges associated with gendered aspects of adaptation to climate change (Carr, 2008a; Dankelman, 2002; Demetriades & Esplen, 2008; Djoudi & Brockhaus, 2011; McGregor, 2009; Skinner, 2011). For example, Demetriades and Esplen (2008, p.24) explain that

> The tendency has been to conceptualise women everywhere as a homogenous, subjugated group… such representations are problematic on multiple accounts, particularly in their failure to account for the complex interactions between gender and other forms of disadvantage based on class, age, 'race'/ethnicity and sexuality.

Bringing Gender Analysis Up To Date

Dividing communities and even households into gendered categories reveals differential vulnerabilities and opportunities within these social groupings. However, relying on the categories "man" and "woman" as the principal means of capturing the varieties of experience at play in any context risks overlooking significant differences with regard to knowledge, resources, and power *within* gender roles that shape development and adaptation outcomes. In the broader gender and development literature, a body of work that employs feminist post-structural approaches to gender calls into question the validity of crudely dividing any social unit by such broad categories as "man" and "woman" (for example, Goheen 1991; Grigsby 2004; Jackson 1998b; Pankhurst 1991; Pearson and Jackson 1998; Wangari, Thomas-Slayter, and Rocheleau 1996; Bigombe Logo and Bikie 2003; Carr 2008a; Kandioti 1998; Lawson 1995; S. Razavi and Miller 1995; Secretariat 2001; C. Doss 2001). This literature argues for a framing of gender not as a stand-alone marker of social difference, but as a social category that gains meaning through its time- and place-specific interplay with other social markers of difference.

A relatively small body of work applies this framing of gender to the study of adaptation in agrarian settings. Moving beyond the majority of the mainstream adaptation literature, which like much of the mainstream gender and development literature acknowledges the complex interplay of social factors affecting development and adaption outcomes without actually addressing that complexity in its research or programming, these studies apply this more complex frame to both conceptual and empirical studies of emerging agrarian vulnerability in the context of climate change.

In various conceptual pieces, this work challenges a fundamental premise of mainstream work on adaptation in agrarian settings in the Global South – that binary gender analysis captures the most relevant and important social factors shaping agricultural decisions and vulnerability to climate change. At the very least, as Warner and Kydd (1997, p.144) argue, "the identification of gender roles does not usually do justice to the actual complexity which characterizes the social and economic lives of rural people in Africa" (see also Demetriades & Esplen, 2009). Others (Arora-Jonsson, 2011; Carr, 2008b; Harris, 2006) argue more explicitly that gender should not be seen as an isolated, or even primary, cause of vulnerability, and therefore a narrowly-framed gender analysis of vulnerability to climate change impacts in agrarian settings might not be as productive as a wider effort to understand the locally-specific identities and activities that intersect to produce varying vulnerabilities within agrarian communities and even households. For example, Arora-Johnsson (2011, p.746) notes that while most general claims about women's vulnerabilities to climate change impacts are poorly supported by empirical evidence, there is good evidence to suggest that disasters produce gendered outcomes that discriminate against women *when such events exacerbate existing patterns of discrimination* (see also Nelson, Meadows, & Cannon, 2002). Such discrimination, she argues, is not merely about gender, but an intersection of different identity categories ranging from socio-economic status to ethnicity. Because "vulnerability is generated by multiple processes and different situations," to effectively address the range of impacts that a community or household might experience from climate change, "we need to examine the specific form of vulnerability and discrimination that people face in order to respond to it effectively," (Arora-Jonsson, 2011, p.746) whether or not gender is the definitive social cause of vulnerability (see also Brouwer, Akter, Brander, & Haque, 2007; Carr, 2008a, 2008b).

When this conceptual lens is applied to the examination of adaptation in agrarian settings, a new set of lessons emerges. First, a growing literature grounded in empirical, case-study evidence bears out the conceptual arguments above, providing several examples of gender intersecting with another significant social category to produce complex, variable vulnerabilities within and between the genders in particular places. Warner and Kydd (1997), Bassett (2002), and Nelson and Stathers (2009) have demonstrated that *age can be a significant social modifier of gender* that produces very different challenges and opportunities to agricultural adaptation under climate change. Warner and Kydd (1997), looking at the differences *among* Dagomba women, note myriad changes in social status throughout the life course, such as those associated with marriage (junior wife) and childbearing (cooking wife). These changes in status are accompanied by different expectations with regard to labor and expenditures, such that cooking wives have more days off from household labor but also greater expectations to find income to meet the needs of their compound. These

differences produce different types of agricultural practice as "apart from having the time and incentive to engage in individual production activities, separate from the compound [family], cooking wives are also much more likely than other married and unmarried, junior women to be able to mobilize cash and other resources with which to purchase inputs and, if necessary, pay for hired labor" (Warner & Kydd, 1997, p.148).

Onta and Resurreccion's (2011) consideration of agricultural adaptation strategies in Nepal explicitly considers the *intersection of gender and caste as producing the social categories that most shape vulnerability to climate change*. Interestingly, they note that while this particular intersection enables particular cross-caste relationships that might foster adaptation to climate change, these relationships are not reshaping gender boundaries within castes and may well reinforce possibly problematic gender roles (see also Ahmed & Fajber, 2009; Jones, 2010).

In their work in rural Burkina Faso, Nielsen and Reenberg (2010) demonstrate that *variable gender expectations associated with particular ethnicities produce different adaptive capacities in similar agrarian settings*. They note that Fulbe members of their study communities have not adopted the same range of livelihoods activities to manage the challenges brought on by economic and environmental change as their Rimaiibe counterparts because, even though Rimaiibe household have demonstrably more resources with which to buy food due to the diversification of their livelihoods and the incomes of women in Rimaiibe households, "Fulbe men see the growing power of the Rimaiibe women as a confirmation of the moral and personal weakness of Rimaiibe men as people 'easily manipulated and pushed around,' " (Nielsen & Reenberg, 2010, p.149)

A second broad theme in this literature notes that *gender often intersects with livelihoods* in important ways to produce variable vulnerabilities and adaptation decisions/outcomes within the categories "men" and "women" (Carr, 2008b, 2011; Codjoe, Atidoh, & Burkett, 2011; Molua, 2010; Nielsen & Reenberg, 2010). Codjoe, Atidoh, and Burkett (2011), demonstrate that preferences for adaptation projects in an ethnically and ecologically different part of Ghana emerge at the intersection of gender and livelihoods. For example, when looking at preferences for adaptation to drought, they demonstrate that women fishers preferred options addressing post-harvest technology and seasonal forecasts, while men preferred constructing fish ponds, crop insurance, and fish culture technologies. However, to suggest that gender is an adequate lens through which to capture adaptation preferences in their study area would be incorrect, as they also show that women producing charcoal also wanted seasonal forecasts, but wanted new/more wells and boreholes, and technologies that would facilitate sedentary pasture management. This makes sense, as under particular climate stresses fisheries will respond differently than the forests from which charcoal's raw material comes, and therefore those engaged in these different occupations will have different vulnerabilities, even when they are of the same gender.

A third theme focuses on *recognizing the ways in which gender roles are created and maintained with reference to other social categories, forms of labor, and social expectations that transcend the household or community*. This research helps to explain the persistence of gender roles that place unjust burdens on particular members of society. In his discussion of adaptation and livelihoods decision-making in Ghana's Central Region, Carr (2008b, 2013) lays out the ways in which particular livelihoods mobilize and reinforce existing social categories and expectations in a manner that legitimizes both these categories and the different expectations attached to them. Carr argues that this creates the potential for unacceptable tradeoffs in adaptation programming and projects, for example between interventions aimed at producing socially just outcomes that address gender inequalities in terms of adaptation outcomes, but which result in locally unacceptable challenges to men's authority in target households that would make the intervention inherently unsustainable in the absence of sustained external engagement.

A fourth theme relates to the implications of this reframed approach to gender for gender analysis in agrarian settings. It remains clear that gender is very often an important social category central to the production of problematic livelihoods and adaptation outcomes in agrarian communities and even households. However, both the conceptual arguments and empirical evidence generated by this literature suggest that starting with gender as the most important social characteristic shaping adaptation and livelihoods outcomes risks overlooking other social differences that might be equally or even more important. Warner and Kydd (1997,

p.144) argue that their research suggests the need to start any vulnerability, livelihoods, or participatory planning exercise by identifying "important categories of individuals (whose social and economic roles are defined by gender, age, marital status, parental status and other social and biological factors)" (Warner & Kydd, 1997, p.160), as opposed to starting from *a priori* presumptions about the importance of particular social categories such as gender.

Similarly, in his discussion of the development implications of gendered patterns of cropping in Ghana's Central Region, Carr (2008a) argues that the different experiences of women earning livings under different livelihoods strategies, even in the same village, suggest

> that the key questions for any development program [concerned with addressing vulnerabilities in the context of livelihoods] should not begin with gender at all. Instead, it may be more productive to start with an understanding of the different modes of livelihood within the community in question and the identification of the social groups associated with these various modes (Carr, 2008a, p.911)

This approach, while perhaps sounding at odds with gender analysis, is actually gender analysis taken to its logical conclusion as a search for the social differences that produce particular vulnerabilities. As Carr argues, this approach

> will allow us to better understand the challenges facing the community in question, and the likely impacts of any intervention package on these various vulnerabilities. Such information allows for the assessment of winners and losers under a particular package of interventions before implementation, thus minimizing the "surprise" outcomes that so often plague development projects. Further, the nuanced, complex picture of vulnerability enabled by this approach allows for the identification and targeting of the needs of minority or underrepresented populations that might not be heard in even the most sensitive participatory development consultations (Carr, 2008a, p.912).

Pushing Gender Analysis Forward: Lessons and Opportunities

As in the broad literature on gender and development, the literature that addresses the intersection of climate change adaptation and gender in agrarian settings demonstrates the importance of gender to the outcomes of climate-smart development efforts. There is ample evidence to suggest that in agrarian settings women are often constrained in their decision-making and access to key livelihoods resources such as land and inputs. The failure to identify and address such constraints in project and program design will limit the effectiveness of any development intervention aimed at reducing the vulnerability of agrarian populations to climate change. Further, women are generating their own adaptations, building locally-appropriate techniques and strategies to address the impacts of climate change in their lives. Without first identifying such strategies, we risk duplicating or even compromising existing viable adaptations without putting a comparable package of interventions in their place. Such outcomes would, without question, cause more harm than good for women and other vulnerable populations in agrarian settings.

At the same time, development and adaptation programs in agrarian settings remain plagued by surprise outcomes and failures, even projects and programs whose design was informed by well-executed mainstream gender analyses. An emerging body of literature on gender and identity in development helps explain such surprises by demonstrating that any assessment of social vulnerability that starts from the assumption that gender is the most important and salient social difference shaping livelihoods and adaptation outcomes, and presumes gender to be meaningfully understood as a binary category, risks missing other critical differences that shape actions and outcomes in agrarian settings as much as, if not more than, gender. This new literature calls for a different kind of gender analysis, which focuses on social difference more broadly and allows gender to emerge as important where it is appropriate.

While the conceptual arguments at the heart of this new literature are generally accepted by those working on issues of both gender in development and gender and climate change, calls for a more nuanced, complex gender analysis have yet to gain wide acceptance in development implementation and policy. This stems, at

least in part, from the fact that, with exception of Carr (2008b), none of these studies concretely demonstrates what gets lost by homogenization of women and men in gender analysis. Even the case-study driven portions of this literature tend to focus on empirical data to demonstrate that within the categories of "men" and "women" there is great diversity. The reader is left to sort out the implications of this demonstration with regard to project efficacy and impact, as such issues are largely implicit in this literature. There is a tremendous opportunity to demonstrate the value of such an approach, and generate wider acceptance of this approach to gender, by taking it and applying it to several disparate cases to demonstrate the different ways in which social difference shapes development and adaptation outcomes in agrarian settings.

REFERENCES

Adger, W. N. (2006). Vulnerability. *Global Environmental Change*, *16*(3), 268–281.

Agrawal, B. (2003). Gender and Land Rights Revisited: Exploring New Prospects via the State, Family and Market. *The Journal of Agrarian Change*, *3*(1-2), 184–224.

Ahmed, S., & Fajber, E. (2009a). Engendering adaptation to climate variability in Gujarat, India. *Gender & Development*, *17*(1), 33–50.

Ahmed, S., & Fajber, E. (2009b). Engendering adaptation to climate variability in Gujarat, India. *Gender & Development*, *17*(1), 33–50.

Akeredolu, M., Asinobi, C. O., & Ilesanmi, I. (2007). Gender and Trends in Production Constraints among the Bambara People of Mali. *Proceedings of the 23rd Annual Meeting of the Association for International Agricultural and Extension Education* (pp. 1–13). Polson, Montana.

Alston, M., & Wilkinson, J. (1998). Australian Farm Women-Shut out or Fenced in? The Lack of Women in Agricultural Leadership. *Sociologia Ruralis*, *38*(3), 391–408.

Angeles, L., & Hill, K. (2009). The gender dimension of the agrarian transition: women, men and livelihood diversification in two peri-urban farming communities in the Philippines. *Gender, Place & Culture*, *16*(5), 609–629.

Arndt, C., & Tarp, F. (2000). Agricultural Technology, Risk and Gender: A CGE Analysis of Mozambique. *World Development*, *28*(7), 1307–1326.

Arora-Jonsson, S. (2011). Virtue and vulnerability: Discourses on women, gender and climate change. *Global Environmental Change*, *21*(2), 744–751.

Babugura, A., Mtshali, N., & Mtshali, M. (2010). Gender and Climate Change : South Africa Case Study. Cape Town. Retrieved from https://www.donorplatform.org/resources/63/file/2010_Heinrich-Boll-Stiftung_Gender-and-Climate-Change_South-Africa.pdf

Barrientos, S., Kritzinger, A., Opondo, M., & Smith, S. (2005). Gender, Work and Vulnerability in African Horticulture. *IDS Bulletin*, *36*(2), 74–79.

Barry, H., & Yoder, B. L. (2002). Multiple predictors of contribution by women to agriculture. *Cross-Cultural Research*, *36*(3), 286–297.

Bassett, T. (2002). Women's Cotton and the Spaces of Gender Politics in Northern Cote d'Ivoire. *Gender, Place and Culture*, *9*(4), 351–370.

Becker, L. C. (1990). Evidence The collapse of the family farm in West Africa? Evidence from Mali. *The Geographical Journal*, *156*(3), 313–322.

Benjaminsen, T. A. (2010). Enclosing the land: Cotton, population growth and tenure in Mali. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography*, *56*(1), 1–9.

Bhuyan, B., & Tripathy, S. K. (1988). Role of Women in Agriculture - a Study in Ganjam-District of Orissa. *Journal of Rural Development*, *7*(4), 445–452.

Biasutti, M., & Sobel, A. H. (2009). Delayed Sahel rainfall and global seasonal cycle in a warmer climate. *Geophysical Research Letters*, *36* (December), 1–5.

Bigombe Logo, P., & Bikie, E.-H. (2003). Women and Land in Cameroon: Questioning Women's Land Status and Claims for Change. In L. M. Wanyeki (Ed.), *Women and Land in Africa: Culture, Religion and Realizing Women's Rights* (pp. 31–66). London: Zed Books.

Boserup, E. (1970). *Women's Role in Economic Development*. London: George Allen and Unwin.

Boyd, E. (2002). The Noel Kempff project in Bolivia: Gender, power, and decision-making in climate mitigation. *Gender and Development*, *10*(2), 70–77.

Brody, A., Demetriades, J., & Esplen, E. (2008). *Gender and Climate Change: Mapping the Linkages* (pp. 1–25). Brighton, UK.

Brouwer, R., Akter, S., Brander, L., & Haque, E. (2007). Socioeconomic vulnerability and adaptation to environmental risk: a case study of climate change and flooding in Bangladesh. *Risk analysis : an official publication of the Society for Risk Analysis*, *27*(2), 313–26.

Bryceson, D. F. (1995). Women Wielding the Hoe. Oxford: Berg Publishers.

Buvenic, M. (1986). Projects for Women in the Third World: Explaining their misbehavior. *World Development*, *14*(5), 653–664.

Carney, J. A. (1996). Converting the Wetlands, Engendering the Environment: the Intersection of Gender with Agrarian Change in The Gambia. In R. Peet & M. Watts (Eds.), *Liberation Ecologies: Environment, Development, Social Movements*. London: Routledge.

Carr, E. R. (2005). Development and the Household: Missing the point? *GeoJournal*, *62*(1-2), 71–83.

Carr, E. R. (2008a). Between structure and agency: Livelihoods and adaptation in Ghana's Central Region. *Global Environmental Change*, *18*(4), 689–699.

Carr, E. R. (2008b). Men's Crops and Women's Crops: The Importance of Gender to the Understanding of Agricultural and Development Outcomes in Ghana's Central Region. *World Development*, *36*(5), 900–915.

Carr, E. R. (2011). *Delivering Development: Globalization's Shoreline and the Road to a Sustainable Future*. New York: Palgrave Macmillan.

Carr, E. R. (2013). Livelihoods as Intimate Government : Reframing the logic of livelihoods for development. *Third World Quarterly*, *34*(1), 77–108.

Chant, S. (2010). Gendered poverty across space and time: introduction and overview. In S. Chant (Ed.), *The International Handbook of Gender and Poverty: Concepts, Research, Policy*. Cheltenham, UK: Edward Elgar.

Chaudhury, M., Kristianson, P., Kyagazze, F., Naab, J. B., & Neelormi, S. (2012). Participatory gender-sensitive approaches for addressing key climate change-related research issues: evidence from Bangladesh, Ghana, and Uganda. Copenhagen.

Chikwendu, D. O., & Arokoyo, J. O. (1997). Women and sustainable agricultural development in Nigeria. *Journal of Sustainable Agriculture*, *11*(1), 53–69.

Cloud, K. (1986). Sex Roles in Food Production and Distribution Systems in the Sahel. In L. E. Creevey (Ed.), *Women Farmers in Africa: Rural Development in Mali and the Sahel* (pp. 19–50). Syracuse, NY: Syracuse University Press.

Codjoe, S. N. A., Atidoh, L. K., & Burkett, V. (2011). Gender and occupational perspectives on adaptation to climate extremes in the Afram Plains of Ghana. *Climatic Change*, *110*(1-2), 431–454.

Creevey, L. E. (1986). Introduction. In L. E. Creevey (Ed.), *Women Farmers in Africa: Rural Development in Mali and the Sahel* (pp. 1–14). Syracuse, NY: Syracuse University Press.

Damisa, M. A., & Yohanna, M. (2007). Role of Rural Women in Farm Management Decision Making Process: Ordered Probit Analysis. *World Journal of Agricultural Sciences*, *3*(4), 543–546.

Dankelman, I. (2002). Climate change : *Gender and Development*, *10*(2), 21–30.

Dankelman, I. (2010). Climate change: Learning from gender analysis and women's experiences of organising for sustainable development. *Gender and Development*, *10*(2), 21–29.

Demetriades, J., & Esplen, E. (2008). The Gender Dimensions of Poverty and Climate Change Adaptation. *IDS Bulletin*, *39*(4), 24–31.

Diarra, D., & Kangah, P. D. (2007). Agriculture in Mali. *Climate and Society: Climate risk management in Africa: Learning from practice*, *1*, 57–74.

Dixon, R. B. (1982). Women in Agriculture - Counting the Labor-Force in Developing-Countries. *Population and Development Review*, *8*(3), 539–566.

Dixon, S., & Holt, J. (2010a). *Livelihood Zoning and Profiling Report: Mali*. Washington, DC.

Dixon, S., & Holt, J. (2010b). *Livelihood Zoning and Profiling Report: Mali*. Washington, DC.

Djoudi, H., & Brockhaus, M. (2011). Is adaptation to climate change gender neutral? Lessons from communities dependent on livestock and forests in northern Mali. *International Forestry Review*, *13*(2), 123–135.

Doss, C. (2001). Is Risk Fully Pooled Within the Household? Evidence from Ghana. *Economic Development and Cultural Change*, *50*(1), 101–130.

Doss, C. R. (2002). Men's Crops? Women's Crops? The Gender Patterns of Cropping in Ghana. *World Development*, *30*(11), 1987–2000.

Egharevba, R. K., & Iweze, F. A. (2004). Sustainable agriculture and rural women: Crop production and accompanied health hazards on women farmers in six rural communities in Edo State Nigeria. *Journal of Sustainable Agriculture*, *24*(1), 39–51.

Ellis, F., Kutengule, M., & Nyasulu, A. (2003). Livelihoods and Rural Poverty Reduction in Malawi. *World Development*, *31*(9), 1495–1510.

Ezumah, N. N., & Di Domenico, C. M. (1995). Enhancing the Role of Women in Crop Production - a Case-Study of Igbo Women in Nigeria. *World Development*, *23*(10), 1731–1744.

FAO. (2011). *The State of Food and Agriculture 2010-2011: Women in Agriculture Closing the gender gap for development*. Rome. Retrieved from http://www.fao.org/docrep/013/i2050e/i2050e00.htm

Feldman, S., & Welsh, R. (1995). Feminist Knowledge Claims, Local Knowledge, and Gender Divisions of Agricultural Labor - Constructing a Successor Science. *Rural Sociology*, *60*(1), 23–43.

Ferguson, A. E. (1994). Gendered Science - a Critique of Agricultural-Development. *American Anthropologist*, *96*(3), 540–552.

Fletschner, D., & Kenney, L. (2011). Rural women's access to financial services- Credit, savings and insurance. Rome.

Gairola, J., & Todaria, N. P. (1997). The status of women in subsistence agriculture in the Garhwal Himalaya, India. *Mountain Research and Development*, *17*(2), 169–170.

Giannini, A., Salack, S., Lodoun, T., Ali, A., Gaye, A. T., & Ndiaye, O. (2013). A unifying view of climate change in the Sahel linking intra-seasonal, interannual and longer time scales. *Environmental Research Letters*, *8*(2), 1–8.

Gladwin, C. H. (1992). Gendered Impacts of Fertilizer Subsidy Removal Programs in Malawi and Cameroon. *Agricultural Economics*, *7*(2), 141–153.

Goebel, A. (2002). Gender, environment and development in Southern Africa. *Canadian Journal of Development Studies-Revue Canadienne D Etudes Du Developpement*, *23*(2), 293–316.

Goheen, M. (1988). Land and the Household Economy: Woman Farmers of the Grassfields Today. In J. Davison (Ed.), *Agriculture, Women and Land: The African Experience*. Boulder, CO: Westview Press.

Goheen, M. (1991). The Ideology and Political Economy of Gender: Women and Land in Nso, Cameroon. In C. H. Gladwin (Ed.), *Structural Adjustment and African Women Farmers* (pp. 239–256). Gainesville: University of Florida Press.

Grier, B. (1992). Pawns, Porters, and Petty Traders: Women in the Transition to Cash Crop Agriculture in Colonial Ghana. *Signs*, *17*(2), 304–328.

Grigsby, W J. (1996). Women, descent, and tenure succession among the Bambara of West Africa: A changing landscape. *Human Organization*, *55*(1), 93–98.

Grigsby, William J. (2004). The Gendered Nature of Subsistence and Its Effecton Customary Land Tenure. *Society & Natural Resources*, *17*(3), 207–222.

Harrigan, J. (2003). U-Turns and Full Circles: Two Decades of Agricultural Reform in Malawi 1981-2000. *World Development*, *31*(5), 847–863.

Harrigan, J. (2008). Food insecurity, poverty and the Malawian Starter Pack: Fresh start or false start? *Food Policy*, *33*(3), 237–249.

Harris, L. M. (2006). Irrigation, gender, and social geographies of the changing waterscapes of southeastern Anatolia. *Environment and Planning D-Society & Space*, *24*(2), 187–213.

Harrison, M. (2001). Women, land and agriculture. *Geography*, *86*, 267–268.

Harriss-White, B. (1998). Female and male grain marketing systems: Analytical and policy issues for West Africa and India. In C. Jackson & R. Pearson (Eds.), *Feminist Visions of Development: Gender analysis and policy* (pp. 189–213). London: Routledge.

Hellmuth, M., Diarra, D., Vaughan, C., & Cousin, R. (2011). *World Resources Report Case Study. Increasing Food Security with Agrometeorological Information: Mali's National Meteorological Service Helps Farmers Manage Climate Risk* (pp. 1–11). Washington, D.C.

Jackson, C. (1993). Doing what comes naturally? Women and environment in development. *World Development*, *21*(12), 1947–1963.

Jackson, C. (1998a). Gender, irrigation, and environment: Arguing for agency. *Agriculture and Human Values*, *15*, 313–324.

Jackson, C. (1998b). Rescuing Gender from the Poverty Trap. In C. Jackson & R. Pearson (Eds.), *Feminist Visions of Development: Gender analysis and policy* (pp. 39–64). London: Routledge.

Jayne, T. S., Govereh, J., Mwanaumo, A., Nyoro, J. K., & Chapoto, A. (2002). False Promise or False Premise? The Experience of Food and Input Market Reform in Eastern and Southern Africa. *World Development*, *30*(11), 1967–1985.

Jha, N. (2004). Gender and Decision Making in Balinese Agriculture. *American Ethnologist*, *31*(4), 552–572.

Jones, L. (2010). Overcoming social barriers to climate change adaptation. London.

Kabeer, Naila. (2005). Gender Equality and Women's Empowerment: A Critical Analysis of the Third Millennium Development Goal. *Gender & Development*, *13*(1), 13–24.

Kabeer, Nalia. (2001). Conflicts over credit: re-evaluating the empowerment potential of loans to women in rural Bangladesh. *World Development*, *29*(1), 63–84.

Kandioti, D. (1998). Gender, power and contestation: "Rethinking bargaining with patriarchy". In C. Jackson & R. Pearson (Eds.), *Feminist Visions of Development: Gender analysis and policy* (pp. 135–151). London: Routledge.

Karanja, P. (1991). Women's Land Ownership Rights in Kenya. *Third World Legal Studies*, *10*, Article 6.

Kevane, M. (2011). Gendered production and consumption in rural Africa. *Proceedings of the National Academy of Sciences*, *109*(31), 12350–12355.

Koopman, J. E. (2009). Globalization, Gender, and Poverty in the Senegal River Valley. *Feminist Economics*, *15*(3), 253–285.

Lamb, P. J., & Peppler, R. A. (1992). Further case studies of tropical Atlantic surface atmospheric and oceanic patterns associated with sub-Saharan drought. *Journal of Climate*, *5*, 476–488.

Lambrou, Y., & Paina, G. (2006). *Gender: The Missing Component of the Response to Climate Change*. Rome: Food and Agriculture ORganization of the United Nations, Gender and Population Division.

Lane, R., & McNaught, R. (2009). Building Gendered Approaches to Adaptation in the Pacific. *Gender and Development*, *17*(1), 67–80.

Lawson, V. (1995). The Politics of Difference: Examining the Quantitative/Qualitative Dualism in Post-Structuralist Feminist Research. *Professional Geographer*, *47* (November 1994), 449–457.

Leach, M., & Fairhead, J. (1995). Ruined Settlements and New Gardens: Gender and Soil-Ripening Among Kuranko Farmers in the Forest-Savannah Transition Zone. *IDS Bulletin*, *26*(1), 24–32.

Lodoun, T., Giannini, A., Traoré, P. S., Somé, L., Sanon, M., Vaksmann, M., & Rasolodimby, J. M. (2013). Changes in seasonal descriptors of precipitation in Burkina Faso associated with late 20th century drought and recovery in West Africa. *Environmental Development*, *5*, 96–108.

Lope-Alzina, D. G. (2007). Gendered production spaces and crop varietal selection: Case study in Yucatán, Mexico. *Singapore Journal of Tropical Geography*, *28*(1), 21–38.

Mama, A. (2005). Demythologising Gender in Development: Feminist Studies in African Contexts. *IDS Bulletin*, *35*(4), 121–124.

Mbata, J. N., & Amadi, C. J. (1993). The Role of Women in Traditional Agriculture - a Case-Study of Women in Food Crops Production in Rivers State, Nigeria. *Discovery and Innovation*, *5*(1), 81–87.

McCusker, B., & Conley, J. (n.d.). Spatializing the study of livelihoods: natural resource dependence, marginality and vulnerability in southern Malawi. *Annals of the Association of American Geographers*.

McGregor, A. (2009). New Possibilities? Shifts in Post-Development Theory and Practice. *Geography Compass*, *3*(5), 1688–1702.

Merha, R., & Rojas, M. H. (2008). *Women, Food Security and Agriculture in Global Marketplace. A Significant Shift*. Washington, D.C.

Mitchell, T., Tanner, T., & Lussier, K. (2007). *"We know what we need!" South Asian Women Speak Out on Climate Change Adaptation* (pp. 1–22). London.

Molua, E. L. (2010). Farm income, gender differentials and climate risk in Cameroon: typology of male and female adaptation options across agroecologies. *Sustainability Science*, *6*(1), 21–35.

Moser, C. O. N. (1993). *Gender Planning and Development: Theory, Practice and Training*. London: Routledge.

Nelson, V., Meadows, K., & Cannon, T. (2002a). Uncertain predictions, invisible impacts, and the need to mainstream gender in climate change adaptation. *Gender & Development*, *10*(2), 51–59.

Nelson, V., Meadows, K., & Cannon, T. (2002b). Uncertain predictions, invisible impacts, and the need to mainstream gender in climate change adaptations. *Gender and Development*, *10*(2), 51–59.

Nelson, V., & Stathers, T. (2009). Resilience, power, culture, and climate: a case study from semi-arid Tanzania, and new research directions. *Gender & Development*, *17*(1), 81–94.

Nicholson, S. E., Some, B., & Kone, B. (2000). An analysis of recent rainfall conditions in West Africa, including the rainy seasons of the 1997 El Niño and the 1998 La Niña years. *Journal of Climate*, *13*, 2628–2640.

Nielsen, J. Ø., & Reenberg, A. (2010). Cultural barriers to climate change adaptation: A case study from Northern Burkina Faso. *Global Environmental Change*, *20*(1), 142–152.

Oakley, E., & Momsen, J. H. (2007). Women and seed management: A study of two villages in Bangladesh. *Singapore Journal of Tropical Geography*, *28*(1), 90–106.

Onta, N., & Resurreccion, B. P. (2011). The Role of Gender and Caste in Climate Adaptation Strategies in Nepal. *Mountain Research and Development*, *31*(4), 351–356.

Orr, A., & Mwale, B. (2001). Adapting to Adjustment: Smallholder Livelihood Strategies in Southern Malawi. *World Development*, *29*(8), 1325–1343.

Owusu, K., & Waylen, P. (2009). Trends in spatio-temporal variability in annual rainfall in Ghana (1951-2000). *Weather*, *64*(5), 115–120.

Paavola, J., & Adger, W. N. (2006). Fair adaptation to climate change. *Ecological Economics*, *56*(4), 594–609.

Padmanabhan, M. A. (2007). The making and unmaking of gendered crops in northern Ghana. *Singapore Journal of Tropical Geography*, *28*(1), 57–70.

Pankhurst, D. (1991). Constraints and Incentives in "Successful" Zimbabwean Peasant Agriculture: The Interaction between Gender and Class. *Journal of Southern African Studies*, *17*(4), 611–632.

Pearson, R., & Jackson, C. (1998). Introduction: Interrogating Development: feminism, gender and policy. In C. Jackson & R. Pearson (Eds.), *Feminist Visions of Development: Gender analysis and policy* (pp. 1–16). London: Routledge.

Pelling, M., & High, C. (2005). Understanding adaptation: What can social capital offer assessments of adaptive capacity? *Global Environmental Change*, *15*, 308–319.

Peters, P. E. (1995). Uses and Abuses of the Concept of "Female-headed Households" in Research on Agrarian Transformation and Policy. In D. F. Bryceson (Ed.), *Women Wielding the Hoe: Lessons from Rural Africa for Feminist Theory and Development Practice* (pp. 93–108). Oxford: Berg Publishers.

Quisumbing, A., & Pandolfelli, L. (2008). Promising Approach to Address the Needs of Poor Female Farmers. Washington, D.C.

Radel, C. (2011). Becoming Farmers: Opening Spaces for Women's Resource Control in Calakmul, Mexico. *Latin American Research Review*, *46*(2), 29–54.

Razavi, S., & Miller, C. (1995). *From WID to GAD: Conceptual Shifts in the Women and Development Discourse.* New York.

Razavi, Shahra. (2009). Engendering the political economy of agrarian change. *Journal of Peasant Studies*, *36*(1), 197–226.

Reid, P., & Vogel, C. (2006). Living and responding to multiple stressors in South Africa—Glimpses from KwaZulu-Natal. *Global Environmental Change*, *16*(2), 195–206.

Riley, P. J., & Krogman, N. T. (1993). Gender-Related Factors Influencing the Viability of Irrigation Projects in Lesotho. *Journal of Asian and African Studies*, *28*(3-4), 162–179.

Rocheleau, D., Thomas-Slayter, B., & Wangari, E. (1996). Gender and Environment: A feminist political ecology perspective. In D. Rocheleau, B. Thomas-Slayter, & E. Wangari (Eds.), *Feminist Political Ecology: Global issues and local experiences* (pp. 3–23). New York: Routledge.

Sachs, C. E. (1996). *Gendered Fields: Rural Women, Agriculture and Environment. Rural Studies Series.* Boulder: Westview Press.

Saito, K. A., & Weidemann, C. J. (1990). *Agricultural extension for women farmers in Africa*. Washington, D.C.

Secretariat, C. (2001). Gender Mainstreaming in Agriculture and Rural Development: A Reference Manual for Governments and Other Stakeholders.

Shiva, V. (1988). *Staying Alive: Women, Ecology and Survival in India*. New Delhi: Kali for Women.

Skinner, E. (2011). *Gender and Climate Change Overview Report* (pp. 1–85). Brighton, UK.

Skutsch, M. (2002). Protocols, Treaties, and Action: The 'Climate Change Process" Viewed Through Gender Spectacles. *Gender and Development*, *10*(2), 30–39.

Swai, O., Mbwambo, J., & Magayane, F. (2012). Gender and perception on climate change in Bahi and Kondoa Districts, Dodoma Region, Tanzania. *Journal of African Studies and Development*, *4*(9), 218–231.

Tripp, A. (2004). Women's Movements, Customary Law, and Land Rights in Africa: The Case of Uganda. *African Studies Quarterly*, *7*(4), 1–19.

Udry, C., & Goldstein, M. (2008). The Profits of Power: Land Rights and Agricultural Investment in Ghana. *Journal of Political Economy*, *116*, 981–1022.

Wagner, R., & DaSilva, A. (1994). Surface conditions associated with anomalous rainfall in the Guinea coastal region. *International Journal of Climatology*, *14*, 179–199.

Wangari, E., Thomas-Slayter, B., & Rocheleau, D. (1996). Gendered Visions for Survival: Semi-arid regions in Kenya. In D. Rocheleau, B. Thomas-Slayter, & E. Wangari (Eds.), *Feminist Political Ecology: Global issues and local experiences* (pp. 127–154). New York: Routledge.

Warner, M. W., & Kydd, J. G. (1997). Beyond Gender Roles? Conceptualizing the Social and Economic Lives of Rural Peoples in Sub-Saharan Africa. *Development and Change*, *28*(1993), 143–168.

Waylen, P., & Owusu, K. (2007). Going, Going . . . Gone? West Africa's Disappearing Short Dry Spell. *Annual Meeting of the Southeastern Division of the Association of American Geographers*. Charleston, SC.

Whitehead, A., & Tsikata, D. (2003). Policy Discourses on Women's Land Rights in Sub-Saharan Africa: The Implications of the Return to the Customary. *Journal of Agrarian Change*, *3*(1-2), 67–112.

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712 0000
Fax: (202) 216 3524
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