RESEARCH ARTICLE

Gendered differentials in climate change adaptation amongst the Shona ethnic group in Marondera Rural District, Zimbabwe: A social inclusions lens. [version 1; referees: 2 approved with reservations]

Tendayi C. Garutsa 1, Chipo P. Mubaya2, Leocadia Zhou1

1University of Fort Hare, Alice, 5700, South Africa
2Chinhoyi University of Technology, Chinhoyi, Zimbabwe

Abstract

Background: Various studies on climate change treat men and women as unitary categories with contrasting needs. There is a dearth of studies which use a social inclusions lens to understand the impacts of climate change on gender. Other social markers that give an in-depth insight of the social differences within and between genders to the impacts of climate change are consequently ignored.

Methods: Utilizing a mixed methods approach, this study aimed to explore and investigate the gendered crops grown as a climate adaptation strategy to respond to perennial droughts, increased temperatures and unreliable rainfall patterns amongst the Shona in Marondera rural district.

Results: The findings indicated that social differences between gender lines like age, household types, income, education and employment status amongst other social variables produce differentiated vulnerabilities and potential opportunities towards climate adaptation.

Conclusions: The main position advanced in this article is that treating gender as the primary cause of vulnerability produces a narrow analysis making other social markers (age, types of households, income and ethnicity) analytically invisible. This paper recommends a holistic and comprehensive analysis to inform climate change programming and policy frameworks. This would in turn address and improve climate adaptation strategies within and between genders which are often obscured to address the needs of all vulnerable members of a given economy.

Keywords
Agriculture, Climate Change Adaptation, Gender, Social Inclusion
Corresponding author: Tendayi C. Garutsa (mgarutsa@gmail.com)

Author roles: Garutsa TC: Conceptualization, Formal Analysis, Investigation, Methodology, Project Administration, Resources, Validation, Writing – Original Draft Preparation, Writing – Review & Editing; Mubaya CP: Conceptualization, Formal Analysis, Supervision, Validation, Visualization, Writing – Review & Editing; Zhou L: Conceptualization, Formal Analysis, Supervision, Validation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: This work was supported by the African Academy of Sciences through the Climate Impacts Research Capacity and Leadership Enhancement in Sub-Saharan Africa (CIRCLE) program under the grant number 77. This is an initiative of the UK’s Department for International Development (DFID) our sponsors who provided financial support for the researchers.

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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How to cite this article: Garutsa TC, Mubaya CP and Zhou L. Gendered differentials in climate change adaptation amongst the Shona ethnic group in Marondera Rural District, Zimbabwe: A social inclusions lens. [version 1; referees: 2 approved with reservations] AAS Open Research 2018, 1:14 (https://doi.org/10.12688/aasopenres.12826.1)

First published: 26 Apr 2018, 1:14 (https://doi.org/10.12688/aasopenres.12826.1)
**Introduction**

Climate change adaptation produce different and distinct gendered vulnerabilities meaning the effects of climate change are not uniformly felt (Carr, 2008; Swai et al., 2012). Most contemporary analysis explore vulnerabilities in rural populations to the impacts of climate change through binary gender lenses thereby overlooking other social inequalities in determining the coping capacity of women and men to the impacts of climate change (Dankelman, 2010). Using a binary approach runs the risk of overlooking the needs and the potential agency of the most marginal sections of rural populations in responding to climate change (Carr & Thompson, 2014). Instead of using a binary lens i.e. men and women, this study will give an analysis of an intersectoral gender dynamics in crop choice as an adaptation strategy for climate change adaptations. There is a huge gap of research on gendered vulnerability and climate variability. Vulnerability and climate change opportunities in responding to climate change vary from one context to another, with women, orphans, the elderly being particularly vulnerable to climate change effects. Though there is an increasing recognition of using a gender lens, gender concerns added into climate change adaptation policy or policy (if any) are added as an afterthought, and they only focus on issues concerned with women relegating human dimensions or the multidimensional vulnerability which encompasses other social indicators faced by ordinary people as participants and contributors to climate change adaptation (Dankelman, 2010; Skinner 2011: 15). Against this background this study aims to analyse and understand the social differences between gender, age, income, types of crops in their experiences in climate change adaptation and their potential to build resilient communities. This paper will also propose gender sensitive recommendations using a social inclusions lens to ascertain climate resilient communities especially for Africa.

**Research questions**

Based on the research problem and purpose of the study, the research questions of the study are:

a) What types of crops are grown across gender lines as an adaption strategy to climate change in Marondera rural district?

b) What are the factors within gender lines using a social inclusions lens inhibit or promote to crop production?

**Research objectives**

This study aimed to

a) To determine the types of crops are grown across gender lines as an adaption strategy to climate change in Marondera rural district?

b) To ascertain the factors within gender lines using a social inclusions lens inhibit or promote to crop production as an adaptation strategy in Marondera rural district.

**Methods**

**The Zimbabwean context and background**

With a total population of 11.63 million Zimbabwe has suffered economic and political upheavals since the 2000 with increasing temperatures, recurrent droughts and unpredictable rainfall patterns worsening the situation of the rural poor (Chagutah, 2010). Over the last three decades there has been reduced rainfall or heavy rainfall with droughts occurring back to back in the same season. The frequency and length of dry spells have increased with the frequency of rain days declining (Zimbabwe’s National Climate Change Response Strategy, 2016). On average 1 to 3 droughts occur every ten years due to changes in the phases of the El Niño Southern Oscillation phenomenon. Zimbabwe’s climate is mostly semi-arid with limited and unreliable rainfall patterns ranging from 300mm to 3000mm per annum, and temperatures ranging from 23 to 40 degrees Celsius in summer (IPCC, 2014). Climate change has an effect on agricultural production. Rural communities largely depend on rainfed agriculture, but weather related hazards like strong winds, hailstorm floods and thunderstorms have a negative impact on both crop and animal husbandry (Manyanhaire & Chitura, 2015). Zimbabwe has experienced it’s worst drought in 1992–1993 which caused loss of 60% of the national herd in Zimbabwe (Ngara & Rukobo, 1994). In 2000 the country experienced cyclone Eline which was characterised by excess rainfall leading to loss of life and damage to property and infrastructure. This led most rural areas to utilize their Indigenous Knowledge Systems to detect and respond to changes in atmospheric conditions.

Land holdings have increased despite the Zimbabwean controversial land reform (Manyanhaire & Chitura, 2015) the relationship between land holding and climate change adaptation has proved to be weak. The rural poor lack resources which could potentially assist communities to buffer against the effects of climate change. Furthermore, the racial colonial agrarian structure (Land Appropriation Act of 1930, the Native Husbandry Act Number 52 of 1951, Land Tenure Act Number 55 of 1969) forced most black people to marginal areas and the best land was reserved for the white colonial farmers (de Villiers, 2003). Prior to the Fast Track Land Reform Program in Zimbabwe, the Black owned small holding and small grazing areas. An accelerated resettlement program in 2000 was introduced by the government of Zimbabwe with 80% of the former large-scale commercial farms redistributed (de Villiers, 2003). Although the government maintains that the land reform process was successful, the land use performance has been largely associated with the 3 droughts Zimbabwe has experienced within the 2001–2003 period coupled with the external sanctions imposed on the country since 2000. The wider economic challenges (devaluation of the Zimbabwean Dollar, rising inflation) had negative implications on the beneficiaries of the Fast Track Land Reform Program (Chagutah, 2010).

The study was undertaken in Marondera rural district which covers Mahusekwa, Chihota, Chiwanzamarara and Chionanana communal areas with a general poor rural population majority being peasant farmers. Perennials droughts have affected water supply impacting negatively the food supply in Marondera rural households. The area receives scanty rainfall leading to an increase of vulnerability because of non-availability of water for agriculture and livestock husbandry which have serious implications for small scale farming. Weather extremes have negatively affected agricultural outputs. Heat waves, high temperatures and
droughts led to a drop in agricultural crop output. A European Environment Agency (EEA) report from 2004 mentions that in some areas people have resorted to earlier sowing dates for certain crops due to an earlier start of raining seasons (EEA, 2004). Higher temperatures have now shortened the growing season by 2 to 35 days reducing crop yields (Kane & Shogren, 2000). The district is mainly rural with people who derive their livelihoods from agriculture. Because of changing climatic conditions people have resorted to planting drought resistant crops. In some areas they practice market gardening, and produce is sold to nearby markets in towns. Food crops (maize, wheat, sorghum, millet and vegetables) are the major crops grown in this district. The resettled farmers in Marondera rural district remain constrained by resources to ensure the full utilisation of acquired land. Since women form a disproportionate share of the poor in the rural areas, women are likely to be disproportionately vulnerable to the effects of climate change. Land allocation was done under A1 and A2 models. A1 farms are on average 37 hectares including crop and grazing land for small scale farms whilst the average A2 is 318 hectares which are medium to large scale commercial farms. There has been a low delivery of tillage due to lack of agricultural input (seed and fertiliser). Government support to agricultural services in terms of research extension, pest and disease control has remained at low levels. The contribution of non-farm income sources is also apparent. Most households secured their living through mixed activities from crop and livestock production, casual labour, non-farm income generating activities and remittances from relatives working from home (Manyanhaire & Chitura, 2015).

70% of the people in rural areas depend on agriculture as their main source of livelihood (Scoones & John, 1994) Food security is therefore adversely affected by extreme climatic events (floods and drought) (Scoones, 1998). The 1991–1992 drought in Zimbabwe led to a 9% decrease of the Gross Domestic Product because of the reduction of maize production, the main source of the country’s economy. The large scale commercial sector now produces one tenth of the maize it produced in the 1990s. Its share of export had fallen to 29% by 2008, and production declined by 79% between 2002 and 2008 (Food Agricultural Organisation, 2008). In addition, climate change had a negative impact on livestock husbandry because of the diseases which affect livestock like tsetse fly. Drought years are depicted by negative deviation corresponding with a low growth rate in Gross Domestic Product contribution. There is a need for major changes in the farming systems which can be attained through irrigation, seed supply and additional fertiliser. Furthermore, climatic change interventions should be gender sensitive and pro-poor utilising a social inclusions lens to create climate resilient programs.

Research design and procedures
A mixed method research design was used to generate data relating to the objectives of the study. Methods to collect qualitative data involved in-depth interviews. The interviews took place in the Marondera rural district covering Mahusekwa, Chihota, Chiwanzamarara and Chionana communal areas in the Mashonaland East Province. For interviews, the researcher through purposive sampling, chose women and men who provided information-rich data on crop types, decision making power dynamics, division of labor and the implication these have on climate change adaptation strategies until the research process reached a point of data saturation. Purposive non-probability sampling was utilized and the researcher used their judgment in determining who the participants would be. To identify the respondents the researcher and research assistants were assisted by the village heads of each particular village in Marondera rural district. 20 women and 15 men were purposefully selected for the in-depth interviews for information rich cases. A structured questionnaire was used to collect quantitative data (Supplementary File 1). Using a mixed method approach ensured that the research approach captured the different crops grown in Marondera rural district as a climate change adaptation strategy using a social inclusions lens to understand the complexities in gender and climate change adaptation. Data which the structured questionnaire elicited were other social categories which include age, gender, employment status and types of households to fully comprehend other social factors which can promote or inhibit climate change adaptation in rural settings. This gave a comprehensive analysis on gender and intra-household dynamics that shape vulnerability to climate change adaptation. The empirical data provided information on gender roles which include decision making powers within different households, comparison of crops across Marondera rural district using a gender social inclusion lens. A multistage sampling strategy was used to select 147 respondents. Furthermore, data was collected on the female participants (n=97) who took part in the study to elicit important insights in the complex intersection of other variables nuanced with gender in climate change.

Individual respondents for key informant interviews were selected through purposive sampling and to trace additional respondents’ snow balling technique was used. The sample frame included representatives of households in the Marondera rural district covering Mahusekwa, Chihota, Chiwanzamarara and Chionana communal areas in the Mashonaland East Province. Justification of Marondera rural district was the harsh climatic conditions the area has experienced over the past 20 years which has significantly affected the agricultural sector and food production. Identification of community members was based on discussions with the village heads. In addition, participants were also selected on the following criteria: willingness to participate, informed consent and seniority in household structures. Data was analysed through content analysis and documentary analysis for qualitative data and Statistical analysis for quantitative data. Content analysis allowed the researcher to discuss the common themes from the thick descriptions of the gender dynamics in adapting to climate change. Statistical Package of Social Sciences (SPSS) version 24 was employed to supply frequency distribution of data from the questionnaire for the household survey. Data was presented in interview excerpts, pie charts, frequency tables and graphs.

Ethics and consent
This study addressed some ethical issues that included sensitive information, the right to privacy and the right to answer
questions. Towards this end, the researcher made sure all the University of Fort Hare protocols with regards to administering an ethical consent form were adhered to. The University of Fort hare board approved the study before the research was undertaken. The village heads were consulted between the 29th and 31st of May to gain entry and seeking permission to undertake the research in Marondera district. This was done by seeking the permission of the respondents, individually or through village heads to conduct the research. Sensitive issues revealed by community members during data collection were kept confidential and were used only for purposes related to the study. The researcher did not reveal the identities of the respondents and thereby ensuring the anonymity of the participants in addition to making the personal particulars of the respondents confidential.

Results and discussion

Households dynamics in the Marondera rural district

Although the linkages between climate change and household dynamics are complex and indirect, the effects of climate change and variability have differential impacts on vulnerability and adaption strategies along gender lines. Changing social and economic structures emerge with new gender roles were most women are still subjugated. Women are marginalized due to cultural factors which relegate them as the “other” sex despite their immense contribution to agriculture. Blanket interventions obscure the diversity of experiences experienced in differing households (McDowell & Hess, 2012). Hence treating gender as the primary cause of vulnerability produces a narrow analysis making other social markers (age, types of households, income and ethnicity) analytically invisible (Carr & Thompson, 2014).

The gender binary categories negate the differences which are household and context specific. De-jure female headed households with an unmarried head (who are less likely to receive income support from a migrant partner) are more vulnerable to de-facto female headed households where the head is married although their husbands do not reside with them. Dejure female headed households are usually headed by widows or unmarried divorced/separated women.

Results in Figure 1 indicated that 66% of the respondents mentioned they lived in female headed households compared to 34%. This might be ascribed to the fact that women and children constitute larger populations of rural areas. The nexus between gender dynamics and food production is associated with women and their roles which are historically and culturally constructed (Beneria, 2003; Gaidzanwa, 1992; Krishnaraj & Desmurch, 1993). This reveals the direct correlation between the climate adaptation strategies utilised and gender role allocations where most women are considered as active agents of climate change adaptation. Approximately 80% of women in Nigerian rural areas engage in food crop production despite the challenges anchored in the subjugatory patriarchal practices which under-line access to and ownership of land, coupled with statutory laws which are discriminatory. The capacity of women and men to cope with weather extremes varies widely between settings depending on a number of factors. Climate-related shocks and stresses add pressure to the already precarious livelihoods of the marginalised sections of the rural livelihoods. A point to note is that despite the fact that women and female headed households have fewer resources and limited decision making powers,

![Figure 1. Household profile for respondents in Marondera rural households.](image-url)
because of their role as users, conservation knowledge holders and managers of agro-biodiversity, they have demonstrated the ability to undertake adaptive measures.

Therefore gender should not be regarded as a stand-alone category, but should interplay with other markers difference (Carr & Thompson, 2014). It is worth mentioning that there are varying responses to the impacts of climate change, and different members of the populations are exposed to different climatic events and trends. One participant mentioned that,

“I totally agree that female headed households are more disadvantaged compared to male headed households, but it is also important to take note that households with older women as family members can equally or potentially respond to climate change through the vast amount of indigenous knowledge they possess compared to households without the elderly. In my family my grandmother advises us on how to plant these indigenous vegetables like pig weed and spider flower (mowa and nyevhe) which helps the family in having a more diverse diet which is also nutritional…..” (Interviewee No 1, June 2017).

The above participant mentions two important factors which climate change policies and programs need to take cognisant of. Gerontology and indigenous knowledge within gender lines have the potential of contributing to sustainable rural livelihoods among environmental crises rural communities experience. Therefore generalising that all women are marginalised can potentially deter us from understanding the social dimensions which can affect women differently. It must be noted that this paper acknowledges the role of women in the climate change discourses and agriculture but also takes cognisance of the varying factors that produce differentiated outcomes.

Socio-Economic Demographics
The following table presents findings on age, education and employment status of female respondents from Marondera rural district and its indirect and complex relationship with the choice of crops female headed households utilise. These results give a comprehensive analysis on gender and intra-household dynamics that shape vulnerability to climate change adaptation. The findings illustrate that the majority of the females in Marondera rural district (37%), who participated in this study were in the “above 45” age group whilst the lowest (9%) were in the “26–35” age group. This might be attributable to the rural-urban migration were most of the younger people migrate for better socio-economic opportunities. The highest proportion of the “above 45” age group might be ascribed to the fact that most people who are well versed with the necessary local knowledge on food processing, production and storage are older women (although both older women and men are the primary bearers of IKS).

The table indicated that gerontology is highly important in climate change adaptation along gender lines therefore directly influencing how households utilise local knowledge systems as a buffer for climatic hazards. The unequal impact of climate change impinges directly on women’s livelihoods. Women are primarily responsible for food production through subsistence forms of production that are highly exposed to drought and uncertain rainfall patterns. Nevertheless, elderly women play a vital role as powerful agents of change as they possess unique indigenous knowledge and expertise in natural disaster management to combat the effects of climate change. Therefore a feminist approach which explores how multiple and fragmented dimensions intersect in the context of climate change in undertaking comprehensive adaptive measures is of paramount importance in this case how gender and gerontology can positively impact on adaptation programs.

Table 1 shows that most of the women in Marondera rural district were unemployed (54%). This might be emanating from the high illiteracy rates accounting for 17% of females with no formal education and 41% who went through primary education translating into increased number of women who are not formally employed. Kingdon & Knight (2000: 3) mentioned that the incidence of unemployment varies by region, gender and education. Although there might be an indirect relationship between unemployment rates and climate change adaptation amongst women, the deep entrenched complexities of climate change in Marondera rural district are revealed by the crops

| Table 1. Social demographic characteristics of women in Marondera rural district (n=97). |
|---------------------------------|--------|-----|
| Variable                        | Category | %  |
| Age Distribution                | Below 15 | 21  |
|                                | 16–25    | 19  |
|                                | 26–35    | 9   |
|                                | 36–45    | 14  |
|                                | Above 45 | 37  |
| Employment Status               | Unemployed | 54  |
|                                | Self employed | 21  |
|                                | Employed  | 25  |
| Age distribution                | Below 15 | 21  |
|                                | 16–25    | 19  |
|                                | 26–35    | 9   |
|                                | 36–45    | 14  |
|                                | Above 45 | 37  |
| Education Status                | No formal education | 17  |
|                                | Primary education | 41  |
|                                | Secondary education | 28  |
|                                | Post-secondary education | 14  |

Source: Computer printout of a table derived from the data and findings of the study.
which are more common to women than men. Most female headed households were commonly involved in the agricultural production of traditional crops like pumpkins, finger millet, wild okra, pear millets amongst a number of traditional crops. This might also be attributable to the fact that women are unemployed or do not have access to credit to purchase seed, fertiliser or inputs for market crops that men in this study commonly produce as a safety net for climate change adaptation. Simplistic dichotomies of men versus women and considering women as uniform, centred and fixed fails to explore other social factors which challenges the notion of generalising the impacts of climate change to acknowledge the differences of adaptation strategies along gender lines (Resurreccion, 2011).

Comparison of crops between female headed and households and Marondera rural district

Patterns of agricultural and crops grown for climate change adaptation mirror the differentiated gendered impacts and response to climate change. Results revealed gendered crops for women and men in Marondera rural district. Literature does not necessarily discount that gender dynamics in agriculture vary across societies although women generally have less personal autonomy, limited decision making power and fewer resources compared to men. With less autonomy, gender differentiated roles are furthered in the types of crops both men and women grow to respond to weather related droughts. Literature has shown that women raise crops that are sensitive to climate variability. These roles are underlined in cultural meanings assigned to being male or female (Tschakert, 2013). The term “women’s crops” is a familiar feature in small holder agriculture and climate change adaptation in Africa. There has been varying meanings to the gendered crops with Njuki et al., 2011 referring to the amount of labour contributed by a particular gender, whilst Doss (2011) mentions the concepts of decision making and control over crops by gender.

The communities’ adaptive capacity in this study was their ability to tolerate and deal with changes to meet their food needs and mobilise their knowledge of indigenous crops. Many households mentioned the traditional crops they planted helped to buffer against uncertain weather conditions. Most of these traditional crops were grown by women because they had traditional knowledge they used in their agricultural practices to respond to climatic conditions. Orr et al. (2016) similarly mentioned the fact that traditional norms attached to these crops determine which types of crops a particular gender commonly produces. Crops grown for home consumption are commonly grown by women whilst crops grown for sale are grown by men. This is attributed to women’s responsibility of feeding the family and men’s responsibility of producing cash income (Orr et al., 2016)

Table 1 represents the percentage of crops grown by men and women in Marondera rural district, Mashonaland East Province. No crops are grown exclusively by either women or men. This reflects that lumping women as a homogenous group might deter policy makers to reflect on differences within gender lines, as some households were also involved in the production of market crops although the statistical representation of men was lower compared to women. A limited number of crops may be considered as men’s crops, not because they are exclusively grown by men, but are proportionally common to men than women. Many of the “market crops” are commonly grown in male headed households compared to female headed but this does not mean that market crops were exclusive to male headed households. Some participants mentioned that,

“Crops like maize, tomatoes and vegetables are mainly decided by men or male heads of households. This is due to the fact that they also bring revenue to the family and provide income when the maize output have not provided enough income for those households like the paying of school fees or preparing for the next farming season…….” (Interviewee No 6, June 2017).

“Our gardens are all year round despite the fact that it’s a rainy season or not. That is the reason why we have boreholes or water sources near our gardens. The male household members decides what type of crops we plant in these gardens depending on the demand of certain crops and seasons like tomatoes, onions vegetables that we grow for market purposes for revenue…….” (Interviewee No 1, June 2017).

Market crops are disproportionately grown by male-headed households. “Subsistence crops” are disproportionately grown by female headed households. Table 2 shows that out of the 16 crops which were grown in Marondera rural districts only 6 crops were more common to men than women (maize, sweet potato, sorghum, tomatoes, spinach and finger millet). Farmers preferred to grow cash crops as an adaptation strategy to generate cash for the family’s needs. An observation that came out of the study was for market crops men increased their control through decision making power, dividing tasks within the family and male control over women’s labour power. 10 of the 16 crops were more common to women because they guard against environmental shocks and fill in food gaps to ensure substantial food supplies. Some of these crops include wild vegetables like pumpkin leaves and groundnuts because of their immense importance as a valuable food source. Groundnuts and roundnuts are regarded as women’s crops in Southern Africa primarily because of the labour provided by women towards these crops (Tsusaka et al., 2016).

In addition, most women are more knowledgeable about the traditional crops compared to men. These crops were more common in female headed households because of their role to cushion households in times of drought through increasing food choices and providing balanced nutrition. After growing and harvesting these traditional crops most of the female headed households mentioned that they sundried these crops to increase shelf life therefore ascertaining food security for households in food gaps.

A new wave of criticism from feminist political ecology perspective questions how women are treated as a homogenous group which falls short in terms of the complex views of identity within these gender categories (Tschakert, 2013). Feminists have portrayed intersectionality as an important aspect
of adaptation to climate change in agrarian settings (Carr & Thompson, 2014; Tschakert, 2013). There are multiple factors (social, cultural, economic) which interact with gender which lead to differences in vulnerability and adaptation in climate change. Presenting women as victims of change in determining their vulnerability and adaptive responses within gender may misrepresent the causes of vulnerability and obscure the role of women as proactive agents of climate change adaptation.

**Decision-making Power and Gender differentials in crop production**

Most rural populations who rely on ecosystem based livelihoods have the least capacity to the afore-mentioned climate risks. Lack of access to resources may restrict people to participate in decision making towards crop production. The United Nations Development Programme UNDP (2010) is of the viewpoint that women commonly lack access to resources and are more likely to face higher risks and greater burdens in responding to climate variability when endeavouring to build resilient communities. Nevertheless it must be challenged that despite their unequal participation in decision making processes and labour markets, compound inequalities deter women’s meaningful participation and decrease effectiveness in climate change programming and policy. Extreme weather patterns are felt along gender lines. The most vulnerable and minority groups are vulnerable to environmental shocks and mobilise different capacities to inform their resilience. Vulnerabilities are differentiated across households and to some extend go beyond the gender binaries of masculinity and femininity.

Results in Figure 2 show that decision making regarding the variety of seed (63%), sowing time (54%), determination of cash crops (63%), marketing of crops (80%), and area to be cultivated (74%) is mainly common to men than women. Results on decision regarding traditional crops indicated women had more capacity than men with regards to post harvesting decisions on traditional crops (77%), and crop choice (58%) as a response strategy to the increasing temperatures, droughts and unpredictable rainfall patterns. This might be attributable to the commercialisation of cash crops interrelated with masculinity roles. However, it can also be noted that even in the commercialisation of these market crops some female headed households used market crops as a strategy to access revenue.

The differences within female-headed households could be attributable to households that had access to a variety of financial assets with an ability to raise and spend a higher household income per capita compared to households which did not have financial assets to secure income. This paper concludes that there is need to take a social inclusions lens approach to have a comprehensive view of the gender differences of climate change adaptation. The social and cultural norms and beliefs ascertain

### Table 2. Comparison of Crops (cereals, tubers, legumes and oil seeds) between households to respond to climate change in Marondera rural district.

<table>
<thead>
<tr>
<th>Shona Name</th>
<th>English Name</th>
<th>Common to Female Headed Households (%)</th>
<th>Common to Male Headed households (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zviyo</td>
<td>Finger Millet</td>
<td>38</td>
<td>62</td>
</tr>
<tr>
<td>Nyevhe</td>
<td>Spider Flower</td>
<td>58</td>
<td>42</td>
</tr>
<tr>
<td>Chibage</td>
<td>Maize</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Derere</td>
<td>Wild Okra</td>
<td>78</td>
<td>22</td>
</tr>
<tr>
<td>Mubowora</td>
<td>Pumpkin Leaves</td>
<td>75</td>
<td>24</td>
</tr>
<tr>
<td>Mhunga</td>
<td>Pearl Millet</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Mowa</td>
<td>Pig weed</td>
<td>74</td>
<td>36</td>
</tr>
<tr>
<td>Mbambaira</td>
<td>Sweet potato</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Mapudzi</td>
<td>Bottle-guard</td>
<td>67</td>
<td>33</td>
</tr>
<tr>
<td>Nyimo</td>
<td>Bambara groundnuts</td>
<td>67</td>
<td>32</td>
</tr>
<tr>
<td>Mapfunde</td>
<td>Sorghum</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Ipwa</td>
<td>Sweet Cane</td>
<td>65</td>
<td>35</td>
</tr>
<tr>
<td>Nzungu</td>
<td>Groundnuts</td>
<td>69</td>
<td>31</td>
</tr>
<tr>
<td>Manhanga</td>
<td>Pumpkin</td>
<td>71</td>
<td>20</td>
</tr>
<tr>
<td>Madomasi</td>
<td>Tomatoes</td>
<td>52</td>
<td>58</td>
</tr>
<tr>
<td>Mavheji</td>
<td>(rape and spinach)</td>
<td>46</td>
<td>64</td>
</tr>
</tbody>
</table>

Source: Computer printout of a table derived from the data and findings of the study.
that the husband’s role is to provide, whilst women’s roles are relegated in the domestic spheres and caregivers of both the family and the biodiversity. Another point reflected in the Figure 2 is that due to Shona traditional cultural norms women had limited capacity to make decisions on market crops compared to traditional crops. Women are unable to participate in external social roles, therefore their inputs and ideas are deemed unimportant. This is the reason why women have limited power to make decisions towards market or cash crops that most households used to secure income for their households. They had limited power to make decisions in the choice of crop varieties and when the seed varieties could be sown. There are various factors that cause limited capacity in making decision making. These might be attributable to lack of information, lack of knowledge, support and cultural norms and values.

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 and restrictions on mobility (Chaudhary et al., 2012). Skinner (2011) further concurs with the above when he mentioned the limited input of women’s view on climate change on national, regional and global climate concerns (Skinner, 2011). Although women are understood to be managers’ of the biodiversity amid climate change, their decision making roles are undermined through social and cultural norms and beliefs. Findings demonstrated that gender inequality negatively affects their role to fully adopt strategies which respond to climate change.

Most of these households practice intercropping. The staple crops of this agro-ecological region which are intercropped include maize, vegetables, tomatoes, pumpkins, millet, wild vegetables, pumpkin leaves, spider flower, wild okra, sweet potato and bottle guard. Maize has been often viewed as a man’s crop although ownership and control over crop choice may be very complex and vary from one household to another.

One participant said, “My husband stays in town and I am responsible for ascertaining that the family if food secure. I plant when it deemed appropriate especially with the changing weather conditions. When it comes to maize my husband decides and buys the type of maize variety we should plant. This also goes for the fertiliser and he makes decisions even when he is absent about when to plant. This is mainly because in the previous years we have been experiencing uncertain weather conditions. But for other crops like spider flower, millet, sweet potato, bottle guard, groundnuts, pumpkins I sow and plant it at my own discretion depending on the weather conditions……..”(Interviewee No 4, June 2017).

The fact that maize is a staple and market crop which has been experiencing low crop yields over the years, means men tend to orient all other household members to ensure they secure higher yields for both household use and market purposes. Therefore the husband makes primary decisions on what type of maize variety is to be sown, what type of fertiliser is to be applied and when. Most of the “men’s crops” take their value

![Figure 2. Comparison of decision making power between female headed and male headed households in Marondera rural households.](image-url)
from the market value. The differences show patterns of cropping in climate change and variability by gender. Environmental shocks produce both distinct and differentiated vulnerabilities which can also be revealed through varying capacities and power in decision making pertaining to crop choice.

**Land holdings and types of crops grown by gender in responding to climate change**

Although the linkages between climate change and land tenure are complex and indirect, the effects of climate change and variability are felt through land use system. There is a need for gender sensitive land tenure systems which would enhance women’s capacity through growing cash crops, which would assist households in terms of securing credit to adapt to environmental problems societies face. Men still head households, have authority, and the ultimate decision power in the Shona culture. Male authority legitimizes female oppression. Even in their absence, the women are still underneath the husband's authority and have to consult them before making decisions. A peculiar feature in gender and land literature is that 90% of men own land in Zimbabwe. In Nigeria 50% of the women own only 5% of the land and in Botswana women own a third of the land (Weidman, 2004: 363). Even in De jure female headed households representatives from the husbands make decisions on behalf of the family reinforcing existing discriminatory practices which have a harmful impact on the Shona women. This has been extended to many traditional Shona courts (Kwamambo) where women have to represented by their husbands or male figureheads in the absence of the male partners.

In practice many rural women already struggle with traditional authorities that regularly attempt to prevent them from accessing land, and inheritance rights favour male family members compared to women (Wilson, 2013). The results of the study illustrated in the Figure 3 show that more women (26%) lacked access to land compared to men in Marondera rural district. This may be ascribed to the discriminatory customary practices. The social system in the Shona society is a patriarchal society is characterized by gender inequities in land ownership and access embodied in the traditional tenure systems. Despite women’s significant share in agricultural labour, they face a number of constraints which limit their access to productive assets and inputs important for climate change adaptation. Their lack of access to land deters them from concentrating on cash or market crops which are commonly grown by males to secure credit which helps with access purchased inputs leaving them to concentrate on traditional crops which require less inputs like fertilisers and pesticides.

This leads to more male headed households compared to female headed households generating income in cash or kind. Tomatoes, green maize, grain maize and leaf vegetables are among the market crops that most Male headed families grow because of their high returns. Most farmers hold 1.5 hectares. Tomatoes require are most demanding in terms of labour and inputs. Although women contribute more labour they have less decision making power. Most families mentioned they grow them between September and November since during this period the crop matures and demand is also high. Grain maize is grown for home consumption and for income generation. Surplus grain is sold to

![Figure 3. Comparison of decision making power between female headed and male headed households in Marondera rural households.](image-url)
the Grain Marketing Board and the outside markets. Vegetables include rape, cabbage and onions to maintain a continuous inflow of cash throughout the year. Green maize is grown in winter for income generation.

**Conclusion and recommendations**

Men and women face distinct and differential vulnerabilities in climate change. Empirical findings in this paper offered important insights on the complex intersection of other variables nuanced with gender in climate change. Results show how multiple and fragmented dimensions within gender lines like age, gerontology, crop choice, decision making power, household dynamics and employment status intersect in the context of climate change in undertaking adaptive measures. Conventional contextualisation of gender as a binary social construction obscure potential gender roles that can be harnessed in creating climate resilient communities gender sensitive. Interventions should acknowledging the gender distinct differentials to produce recommendations for climate change. Other social categories beyond gender should also be taken into consideration to ascertain effective climate change interventions. That negates primarily looking at gender as the most important social characteristic in shaping livelihoods outcomes but considering other social differences that might be equally or even more important. Another important point raised in the empirical findings is that despite the fact that most women have no or less access to resources like land, credit, markets and lesser decision making power, generalisations which label them as “victims of climate shocks” should be challenged as these blanket connotations mask their pro-active role and ability to contribute to sustainable resource management enhancing their roles in reducing vulnerability. Further research is needed on adaptive development to respond to poverty and inequality within and between genders. This paper recommends a holistic and comprehensive gender analysis to inform climate change programming and policy frameworks. This would in turn address and improve climate adaptation strategies within and between genders which are often obscured to address the needs of all vulnerable members of a given economy.

**Data availability**

Raw data for this study is available from Open Science Framework. Dataset 1: Gendered differentials in climate change adaptation amongst the Shona ethnic group in Marondera Rural District, Zimbabwe: A social inclusions lens http://doi.org/10.17605/OSF.IO/ZV9Q8. (Garutsa, 2018)

Data is available under a CC0 1.0 Universal licence.

**Competing interests**

No competing interests were disclosed.

**Grant information**

This work was supported by the African Academy of Sciences through the Climate Impacts Research Capacity and Leadership Enhancement in Sub-Saharan Africa (CIRCLE) program under the grant number 77. This is an initiative of the UK’s Department for International Development (DFID) our sponsors who provided financial support for the researchers.

*The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.*

**Acknowledgements**

Acknowledgement goes to University of Fort Hare the Home institution and Chinhoyi University of Technology. We also extend our acknowledgement to the participants of Marondera rural district, Zimbabwe.

**Supplementary material**

Supplementary File 1 – Questionnaire used to conduct this study.

[Click here to access the data.](#)

**References**


Carr ER: Men’s crops and women’s crops: The importance of gender to the understanding of agriculture and development outcome in Ghana’s central region. World Development. 2008; 36(5): 900–915. [Publisher Full Text](#)


Dankelman I: Gender and Climate Change: An Introduction. Earthscan. 2010. [Reference Source](#)


Doss C: Intrahousehold Bargaining and Resource allocation in developing countries.
Deepa Joshi
Centre for Agroecology, Water and Resilience (CAWR), Coventry University, Coventry, UK

The article comes across as a genuine effort to unpack complex inequalities by gender. However, unfortunately the paper fails to present an intersectional overview of gender, and also fails to demonstrate any theoretical insight of the Feminist Political Ecology Framework. I list a couple of key gaps in the paper below:

Firstly, although, the authors claim that a simplisitic binary view of differences or divide by gender is inappropriate and flawed, this is precisely what they themselves present and several times in the paper. See below a couple of examples of such statements made in the text:

"Women are marginalized due to cultural factors which relegate them as the "other" sex despite their immense contribution to agriculture."

"…women and female headed households have fewer resources and limited decision-making powers."

"Another point reflected in the Figure 2 is that due to Shona traditional cultural norms women had limited capacity to make decisions on market crops compared to traditional crops. Women are unable to participate in external social roles, therefore their inputs and ideas are deemed unimportant. This is the reason why women have limited power to make decisions towards market or cash crops that most households used to secure income for their households. They had limited power to make decisions in the choice of crop varieties and when the seed varieties could be sown. There are various factors that cause limited capacity in making decision making. These might be attributable to lack of information, lack of knowledge, support and cultural norms and values."

"Results in Figure 2 show that decision making regarding the variety of seed (63%), sowing time (54%), determination of cash crops (63%), marketing of crops (80%), and area to be cultivated (74%) is mainly common to men than women. Results on decision regarding traditional crops indicated women had more capacity than men with regards to post harvesting decisions on traditional crops (77%), and crop choice (58%) as a response strategy to the increasing temperatures, droughts and unpredictable rainfall patterns."

"In practice many rural women already struggle with traditional authorities that regularly attempt to prevent them from accessing land, and inheritance rights favour male family members compared to women (Wilson, 2013)."
While the authors emphasize an intersectional focus – even concluding this well before the findings have been presented and/or analysed, see page 8 (of 15): “This paper concludes that there is need to take a social inclusions lens approach to have a comprehensive view of the gender differences of climate change adaptation”; they seem to present exactly such a limited view in stating how women should be seen in relation to climate change:

“Presenting women as victims of change in determining their vulnerability and adaptive responses within gender may misrepresent the causes of vulnerability and obscure the role of women as proactive agents of climate change adaptation”.

So essentially, what the authors are saying is - do not present women as vulnerable victims, rather present them (because they are) as proactive agents of climate change. I would recommend the authors read the article: Cornwall, A., Harrison, E. and Whitehead, A. 2007: Gender myths and feminist fables: The struggle for interpretive power in gender and development1.

The most serious drawback of this paper is the rather weak interpretation of intersectionality as well as Feminist Political Ecology. Essentially what the paper demonstrates is a two fold framework for understanding gender:
First adopt a simple binary lens and segregate women and men - by crops, activities etc. Then, within this simplistic binary - look for what further divides women (age, marital status etc.). I am afraid, feminist scholars would disagree with such a distorted vision of Feminist Political Ecology. The authors talk a bit about masculinities but do not really take these discussions anywhere in the analysis or review of data.

A few other minor points:
Why use data from the 1990s for an overview of livelihoods and climate impacts? Is there no recent data? Why the reference to Nigeria: "Approximately 80% of women in Nigerian rural areas engage in food crop production despite the challenges anchored in the subjugatory patriarchal practices which underline access to and ownership of land, coupled with statutory laws which are discriminatory."

Check the double referencing as in: “Skinner (2011) further concurs with the above when he mentioned the limited input of women’s view on climate change on national, regional and global climate concerns (Skinner, 2011)”.

So while, I commend the attempt made by the authors to understand the complexity of inequality by gender, I am afraid - the analysis is far too simplistic and technocratic.

References

Is the work clearly and accurately presented and does it cite the current literature? Partly

Is the study design appropriate and is the work technically sound? Partly
Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
No

**Competing Interests:** No competing interests were disclosed.

**Referee Expertise:** Gender, Feminist Political Ecology, Water, Environment

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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**General comment**

Overall, the article have great potentiality and I really enjoyed of the reading. The topic is highly relevant and the research sounds very rich. The use of mixed methods is really innovative and necessary in this kind of research. The research questions/objectives are well formulated. It fits well in the scope of the journal,

Despite the positive evaluation, some changes are needed before indexing. I have suggestions for improving the analysis of the huge amount of data collected. My final decision is: major changes required.

Looking at the methods and the results, I think the huge amount of data are not completely exploited by the authors. I think they have potentially a great work, but sometimes the have to review the structure and the way the results are presented is sometimes confused (first sections of results and methods). In general, I would suggest the authors better use their data and connect their arguments with the figures and results. I suggest below how to do it.

I would also suggest to the authors a further analysis. A good representation of the “intersectionality” concept could be realized using a multivariate analysis and intersecting variables (age, gender, etc.) (see Ravera et al. 2016 in AMBIO) - to demonstrate that different choices for adaptation (examples types of practices or types of crops) can depend on multiple variables at the same time. It may be possible to use the quantitative data you collected to do this?

I also suggest a new structure
1. I also suggest a new structure

Introduction
Background: the case study
Material and methods
Results and discussion

- Comparison of crops from female headed and male headed HH
- Land holdings and types of crops grown by gender in responding to climate change
- Decision-making Power and Gender differentials in crop production
- Socio-demographic information (if necessary to be used in further analysis, otherwise delete or merge in the final section of intersectional analysis)
- A new section with intersectional analysis of data

An English editing is needed.

Specific comments section by section

Introduction
Well written. I think the authors should expand more on new literature on “gender and Global environmental change”. See for instance the special issue in AMBIO December 2016. Specifically different articles may help the authors to connect agrobiodiversity management & adaptation & gender.

I would suggest presenting a general goal and then the research questions. How research questions and objectives are now formulated it seems quite repetitive.

Material and methods
I would suggest moving out of this section the section of background of the studied area. The area should be cited in the introduction.

The authors should specify what they asked in the quantitative survey.

I think other analyses are needed for supporting the rigor of the results.
   1. As mentioned before, a good representation of the “intersectionality” could be to use intersecting variables (age, gender, etc.) in a multivariate analysis (see Ravera et al. 2016 in AMBIO). Do we have from the data statistically significant differences, corroborated by the interviews, between female/male headed families? Do we have different variables (sex, if you are female-head, age, education state, unemployment etc.) that influence at the same time the number of varieties, the types of crops, climate-sensitive crops etc. (all the variable that we can connect to vulnerability/adaptation to CC)?

   2. I would also suggest to substitute figure 1 with a graphical representation on differences between female & male headed households and number & types of crops, quantity of crops per type produced and goal of production (sale, self-consumption etc.). Could you also calculate from your data?

Results
As mentioned before, more results and data analysis are needed in supporting the arguments discussed of intersectionality. I would suggest reviewing completely the structure of results and deleting section 1, moving the content in a new section, after new analysis (see above).

Results and discussion
- Comparison of crops from female headed and male headed HH
- Land holdings and types of crops grown by gender in responding to climate change
- Decision-making Power and Gender differentials in crop production
- Socio-demographics (if necessary to be used in further analysis, otherwise delete or merge in the final section of intersectional analysis)
- **A new section with intersectional analysis of data (optional but very powerful if the authors can do it)**

Socio-economic demographics should be presented as part of the final section or before this final section. I don’t understand very well the arguments of the authors. They are showing data on socio-demography in this section. I would suggest to have a simply descriptive section. In these data there are not information about dichotomic approach to adaptation. Or they are not showing with these data. They should statistically demonstrate that women, with old age or unemployed or female-headed have different adaptive strategies. As I mentioned before, they should better analyse their data.

I would invite the authors to substitute “gerontology” with “age”. The gerontology is the study of elderly people. The variable is the old age.

I liked the last section “Comparison of crops …..”. Here the results well support the arguments discussed. The title has an error because they are comparing men/women headed HH, don’t they?

Some of the arguments of this section should be moved to a possible section 3 of results with intersectionality analysis.

**Figures and tables**

Figure 1 is not necessary, because the authors can simply introduce the percentage in the text. Figure 3 is also useless. I would eliminate them and introduce the data in the text. Figure 3 has the same caption figure than figure 2.

I hope my review can help improving this very good article and I'm available for helping the authors, if necessary.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Partly

**Are the conclusions drawn adequately supported by the results?**

Yes
**Competing Interests:** No competing interests were disclosed.

**Referee Expertise:** Vulnerability and adaptation to climate change; gender

I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.