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Review article

Gender, agriculture and climate change impact and vulnerability of resource poor farmers in Africa

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ABSTRACT

Gender is a socio-economic variable which can be used to analyze vulnerability and adaptive capacity of people against climate change and variability in local communities in Africa. Due to climatic change and variability, achieving sustainability inagriculture with emphasis on satisfying basic human needs and improving people's standard of living through enhancing food security and reducing poverty has been a challenge in Africa. This has been exacerbated by the fact that rapid increase in human population has outpaced the ability to produce sufficient food for the growing population. This discussion attempt to link gender vulnerability to climate change impact on resource poor peasant farmers in Africa. Climate change and variability is now widely regarded as the most serious challenge facing Africa, with consequences that go far beyond the effects on the environment, hence affecting both men and women indiscriminately. Despite the negative impact of climate change on crop, livestock production and biodiversity conservation, poor resources peasant famers are incentivized to engage in these activities because of the wide spectrum of benefits accrued, such as cash income, food, manure, draft power and hauling services, savings and insurance, and social status and social capital. It is against this background that crops and livestock species that remarkably possess distinctive qualities enabling them to excel efficiently in the context

of the uncertainties of climatic variability need to be promoted to reduce vulnerability at household level. The use of adaptive genotypes such as the local animal and crop genetic resources may sustain household production in the context of climate change. Small grain crops (sorghum, millet, cow peas. pigeon peas etc) and small stock (goats, sheep, poultry, etc) which are associated with women are less likely to succumb to climate change than the large ruminants which are owned by men. It is reasonably to suggest that the exclusion – or lack of participation – of women in decision making over biodiversity conservation and natural resource management can have implications for conservation outcomes because of gender role differences in natural resources utilization and conservation based on indigenous knowledge. The review concludes that the impact of climate change will have a graver effect on womenthan men, due to their different specific socio economic roles and their participation in different agricultural activities and biodiversity conservation effort. The range of adaptive measures that might be taken for local communities to ameliorate climate change effects should take into account gender differentials, if they are to succeed.

1. Introduction

Climate change researchers and policy makers are increasingly aware of the need to incorporate gender issues into climate change analysis and programs. Gender refers to the socially given attributes, roles, activities, responsibilities and needs connected to being men (masculine) and women (feminine) in a given society at a given time, and as a member of a specific community within that society (Christodoulou, 2005).Climate change refers to the variation in the global or regional climates over time. It describes changes in the variability or average state of the atmosphere over time scales ranging from a decade to millions of years (Ayoade, 2003). The extent of gender empowerment as stewards of their environments resulting in communities that are better able to adapt to climatic changes differ significantly, as influenced by cultural, socio economic and environmental factors.Agriculture remains the single largest source of income and livelihoods for rural households in the developing world, normally providing more than 50 percent of household income (Jayne et al., 2003; Otte and Chilonda, 2002), however climate change has had a graver effect on agricultural productivity. On the other hand, agriculture through livestock and crop production has remained the primary determinant of Africa's economic development as it generates primary food and raw materials to support the general populace who are poor. With regards to poverty status, the majority of the poor are women, who depend upon agriculture and natural resources utilization for their household livelihoods. Women comprise 70% of those living below the poverty line and so are most likely to bear the heaviest burdens of climate change, and more often than not women are overlooked as potential contributors to climate change solutions (UN. 2009). Therefore, it is reasonable to suggest that climate change will have a different impact upon men and women, depending on their capacity to adapt to climatic changes and variability.This discussion attempt to link gender vulnerability to climate change impact on agriculture and natural resource utilization by poor peasant farmers in Africa.

2. Gender, livestock production and climate change

Livestock production has been given an overriding emphasis as one of the core sectors to solve the current challenges in food insecurity, and to bring future agricultural sustainability to Africa.However, the negative impact of climate change on livestock production has been considerable, which has resulted in livestock capacity decline on the continent.For the millions of landless poor and small rural farmers whose population is rapidly increasing

due to rapid population growth on the continent, livestock production often offer the only way out of poverty and ensuring viability of household and economic survival. Against this background, livestock production researchers and policy makers are increasingly aware of the need to incorporate gender issues into livestock research analysis and programs. Focus on gender issues in livestock production hastaken a center stage within livestock development programs either through distinction of male and female headed households or through distinction between men's and women's roles in livestock production activities. Men are often viewed as the custodian of the large ruminants while women are responsible for the small stock and poultry. A general pattern is for men to own large livestock and particularly, work animals, while women own smaller livestock and yard animals. Small ruminants, micro livestock and poultry provide gainful work to women and children.Generally, the face of livestock production on the continent is female, which means women play a major role in household animal-production enterprises although their role has been undervalued. They tend to have the primary responsibility for the husbandry of small animals and ruminants, and also take care of large animal systems - herding, providing water and feed, cleaning stalls and milking. In all types of animal production systems, women have a predominant role in processing, particularly of milk products, and are commonly responsible for marketing(SD & FAO, 2014). However, limited data makes it difficult toreport on the incidence of livestock ownership by sex for most countries(Doss et al., 2008). Climate is a particularly important driver of livestock production systems performance at the agriculture end of the food chain. A changing climate and increasing climate variability are clearly going to have considerable impacts through a wide range of mechanisms on people whose livelihoods depend at least in part on livestock. The potential impact of climate change and variability on livestock systems and the resource-poor people who depend on them is expected to be considerable. This will determine the quantities and types of livestock and livestock products produced, as well as production-related income and food security at household level.Climate change is likely to have major impacts on poor livestock keepers and on the ecosystems goods and services on which they depend which include changes in the productivity of rain-fed crops and forage, reduced water availability and more widespread water shortages, and changing severity and distribution of important human, livestock and crop diseases. This will result in increase in livestock capacity decline in Africa.Also due to climatic variability the overall objective of achieving sustainable livestock production with emphasis on satisfying basic human needs, improving people's standard of living, enhancing food security and reducing poverty will be a surmountable task. The ownership of livestock within the household will influence greatly on the extent of vulnerability of household members to climate change. Traditional control over livestock by women and men within the household from cattle, milk, sheep, goats and poultry and micro livestock has climate change mitigation implication in livestock production. Generally, men and women tend to own different animal species, where in many African societies, cattle and larger animals are usually owned by men, while smaller animals, such as goats and backyard poultry which are kept near the house, are more women's domain. However, ownership patterns of livestock are more complex and are strongly related to the livestock production system and to social and cultural factors. Keeping small livestock allows women to realize some income, form part of their savings and is a source of prestige (SDC, 1999). The challenges of climate change will call for a balanced type of livestock species which can produce in stressful environment. The use of adaptive genotypes such as the local animal genetic resources may sustain household production in this regard. It may be reasonable to suggest in contrary with most common notion that women are more vulnerable to climate change than men, small stock would be less likely to succumb to the impact of climate change. This is partly true in most circumstances, however for livestock species kept by women as a result of social and cultural factors, women are less vulnerable to climate change by engaging in small stock.. There is no doubt that the increasingly warming climate will have tremendous impacts on large livestock than small stock or micro livestock.Considerable water stress and dwindling feed resources, as a result of insufficient and unreliable rainfall is expected to increase the likelihood of livestock capacity decline (Ngigi, 2009) and this will mainly affect the large ruminants which are owned by men.. Houghton et al. (2001) concluded that direct effects from air temperature, humidity, wind speed and other climate factors will influence animal performance: growth, milk production, wool production and reproduction. Despite this unfavorable phenomenon, goats which have been associated with women in most household in the semi arid tropics, have shown themselves to be an extremely adaptable livestock species, by being found at any altitude and different agro-ecological regions of Africa. The propensity towards multi-coat colors appears to be an adaptive traits in goats to withstand pronounced seasonal fluctuation in the intensity and duration of light, heat and cold in the semi arid tropics (Katongole et al., 1996). Goats coat color had a significant influence on heat tolerance traits (Adedeji, 2012) which include rectal temperature, pulse rate, respiratory rate and heat stress index, which make them a favorable species in the

context of climate change and variability. Their anatomically ideal for grazing and browsing, and many other behavioral characteristics can be logically assumed to provide the basis for much of what makes goats different from other herbivores and survive in unfavorable conditions. Goats thriving in harsh tropical environments represent a climax in the capacity of domestic ruminants to adjust to such areas where water sources are widely distributed and feed sources are limited by their quantity and quality. The ecological, physiological and feeding behavior adaptive features of goats in unfavorable tropics make them an appropriate candidate in the context of climate change. Therefore, we may assume that women's ownership of goats may be an advantage in the context of climate change.Women may take advantage of goats efficient reproductive system and their small body which allow an easy adjustment of flock size to match the available resources, facilitates the integration of goats into small scale production systems and enable flexible production in line with available resources.It is suggested women vulnerability to climate change can be ameliorated by promoting adapted small stock such as goat and sheep. Women are also known to be the custodians of poultry household activities. Exotic poultry breeds flocks are particularly vulnerable to climate change because can only tolerate narrow temperature ranges. In this regard women engaged in exotic poultry farming need to consider making adaptations to help reduce cost and risk as a result of the effects of climate change. The influence of climate change in indigenous poultry has not been studied. Thus makes us assume that the effects of climate change on exotic poultry breeds may be different from indigenous poultry. It is therefore reasonable to suggest that promotion of indigenous poultry species production may address the extent of vulnerability of women to climate change. In order to be able to address the negative influence of climate change on livestock production and reduce women's vulnerability to climate change, choice of animal species to rear will become crucial. In the event that consumer preference on free range and organic eggs grows more than the rate of conventional egg sales, women may improve their disposal income in households. However, such trends favoring alternative egg production where consumers are looking for a healthy diet are highly unlikely in developing countries.

In gender issues and climate change impact and vulnerability of resource poor farmers in Africa, there is need to consider mini livestock as a potential avenue for poverty alleviation and enhancing food security. Mini livestock species are a feasible option to meet the animal product demand in the context of human population increase, and where conventional livestock production productivity has been impacted negatively by climate change resulting in capacity decline. Owing to the pace at which the population is growing on the continent, livestock products will be beyond the reach of ordinary poor persons, especially women, unless alternative sources of animal protein are sort. The biodiversity of Africa's mini livestock provides a valuable asset and sustainable resource for improvement of resource poor household food security. Mini livestock have a host of benefits and opportunities that conventional livestock do not present for women. They can be differentiated from conventional livestock in the sense that they are inherently small by nature and may be a small species of a traditionally favored type of livestock (Ogunjimi et al., 2012) which women and children can mange. Mini livestock species refers to poultry, rabbits, bush rodents, bees, snails, guinea pigs, etc., reptiles, while snakes and birds have more recently been considered as eligible for mini livestock (Hardouin et al., 2003).Mini livestock production, if properly promoted has considerable economic potential and benefits, especially targeting the vulnerable groups of women and children, through acting as a vehicle to improved food security. Such programs should be directed on resource poor farmers to promote food security through provision of comprehensive mini livestock support services and incentives.Strategies and program of action that will enable mini livestock farming to contribute to optimization of food production and enhance food security in Africa on equitable, sustainable and environmentally sound basis is another way of empowering women in the context of climate change and variability.As a result agricultural development programmes must take into account gender roles that shape the smallholder livestock production systems in Africa.

3. Gender, crop production and climate change

An attempt has been made and literature for different communities exist dealing with gender issues in general, gender and agriculture and some specific publications related to gender and crop farming (FAO, 1990). As of late crop production specialists and policy makers are increasingly aware of the need to incorporate gender issues into crop production programs. Gender often enters discussions within crop production development programs,when men are often viewed as being responsible for cash crops while women are responsible for

producing subsistence crops for household consumption. Men are believed to be the custodian of the commercial oriented crops while women are responsible for the small grains such as sorghum, millet and cow peas. This is on the background that climate change and variability will be the major factor that will define crop production systems and their productivity in Africa and will have even greater influence on selection of crop varieties. Due to the changing climatic conditions which the continent has already witnessed many severe climatic induced vulnerability such as decline in rainfall amounts and intensity, reduced length of rain season and increasing warm and occasionally very hot conditions has affected crop production and food security at both household and national levels. Increase in heat, wide spread of different insect pests, and weather extremes will pose as major challenges for crop productivity resulting in food production capacity decline.However, the involvement of women in small grains (sorghum and millet) is a long standing tradition in most African communities. The poorest and most marginalized and vulnerable members of the communities, mostly women and children, manage not only to achieve household food security, but also to assert food sovereignty, with sorghum and millet as the cornerstones of their strategy.Unreliable rainfall, changing weather patterns and crop diseases have greatly affected the production of conventional crops such as maize in many parts of the continents. This has resulted in low yields and income for farmers, however to beat this, farmers are now trying to adapt to these changes and are shifting from maize to planting drought-resistant crops such as sorghum, finger millet, cow peas and cassava (Ngotho, 2014). It is reasonable to suggest that any programs which target the production of small grain in most African communities will definitely empower women economically and their capacity to look after their families. Simulation studies showed that the photoperiod-sensitive traditional cultivars of millet and sorghum used by local farmers for centuries seem more resilient to future climate conditions than modern cultivars bred for their high yield potential. However, given the large difference in mean yields of the modern versus traditional varieties, the modern varieties would still yield more under optimal fertility conditions in a warmer world, even if they are more affected by climate change (Sultan et al., 2013).The commercialization of the seed industry has partly affected crop productivity. Household food security and independence can be achieved by applying one basic principle of local control over seeds and recovery of traditional seeds. This has been shifted by commercialization of the seed industry. Commercialization of seed industry has pushed communities into growing new crop varieties, however this approach devalued traditional crops varieties which have shown resilient to climate change, by promoting so-called high-yielding crop varieties and in this way also devalued the traditional food culture and women participation. Due to improved crop varieties most women have been denied the chance to disseminated local seed varieties, able to exchange seeds, sell excess seeds, and use the money for household needs. Traditional cultivars of millet and sorghum used by local farmers for centuries were considered to be as valuable as relatives, and provide equally strong social ties in communities, especially among women. Traditional seed exchange had many functions, and performed a very important social function, because it affirms interdependency among neighbors and the value of social relationships. Commercialization of seed industry has resulted in communities losing this tradition, because the seed markets are influencing farming practices, breaking cultural and ethnic barriers and eroding culture and indigenous knowledge, which is mostly among the women. It means the ability to identify the most suitable small grain varieties, with the most robust characteristics for withstanding climate change, is crucial for formulating adaptation strategies for women in Africa. In addition, identifying of specific local crop characteristics is a key to developing a breeding strategy that addresses the trade-off between intensification and resilience to climate change (Dingkuhnet al., 2006, De Rouw 2004).Efforts to satisfy basic human needs are being impacted by climate change through crop production, through natural disasters and environmental challenges which have affected has affected all ecological regions of Africa population, indiscriminately.Mixed crop and livestock farming has been associated with positive and significant adaptation to climate change(Nkeme and Ndaeyo, 2013), hence if promoted may improve food security situation in Africa. This implies that farmers who engage in mixed farming are able to cope up with changes in climate conditions through undertaking various changes in management practices which enhance crop productivity. The extent of crop failure of one enterprise may be compensated by other crops or livestock ventures. Different farming enterprises respond to change in climate differently avoiding total loss of agricultural products reducing vulnerability. Onumadu (2011) cited diversification to new crop species and varieties as a mitigation strategy to climate change, where women may take advantage of their management of the small livestock and small grain which are known to be drought resistant as a strategy to deal with climate change and variability. However, high income has been positively associated with crop diversification which means women may find it difficult to diversify into other agricultural enterprises due to adequate resources. Lack of awareness and extension contact on climate change issues has

been a major concern in dealing with climate change issues in most communities. It is suggested that if women and men have equal opportunity in accessing extension services on climate change, the outcome is the capacity to reduce the effect of climate change is increased. Climate change information can be disseminated to both men and women to better equip them to deal with climate change and variability issues and increase food production.

4. Gender, biodiversity conservation and climate change

Biodiversity, the variation of life forms within a given ecosystem, has been acknowledged for its importance for food security in African communities (FAO, 2004). Gender roles in Africa put women in direct contact with natural resources such as forests, water, land and wildlife, in an attempt to supply basic needs for their households (VFA, 2009). Therefore, the utilization and conservation of natural resources cannot be effective without the involvement of women. The exclusion – or lack of participation – of women in decision making over conservation and natural resource management can have implications for conservation outcomes because of their different roles and relationships with natural resources and their different indigenous knowledge of biodiversity. Rural women, in their role of farmers are key to maintaining and conservation of local biodiversity. In their effort to improve and adapt plant varieties, cultivate plants, store and exchange seeds (FAO, 2004), women have the greatest impact on biodiversity. Men and women haveequally relied on their environments to provide basic food, water, and energy resources, however the impacts of climate change has been devastating on local biodiversity in most communities. Changing climate conditions havethreatened many native plant and animals species which have been predominantly utilized by women. As animal and plants resources become scarce due to climate change effect, women may spend more time to resource collection, less sustainable options may be employed which will erode the existing plant and animal species biodiversity. For the communities which rely on these resources for survival, it presents a spectrum of challenges that most communities are simply not prepared to face and making them more vulnerable.The vulnerability of communities to climate change can be ameliorated if women who hold the most reliable indigenous knowledge about biodiversity conservation and utilization are involved. If women'sindigenousknowledge can be put into good use through biodiversity utilization and conservation, most communities are less likely to become vulnerable in the context of climate change.

5. Implications

Sustainable crop and livestock production systems supporting rural development should be compatible with the goals of curbing the effects of climate change and variability in Africa.Understanding gender differentials in livestock and crop production through their categorization of livestock and crops as men's and women's,can simplify policy intervention on agricultural developmental programs. This give space for targeting specific gender, for example small stock programs may empower more women than men. This also apply to crop production intervention programs, promotion of cash crops will sideline women participation and empower more men.It is reasonable to suggest that the choice of specific crop and livestock intervention programmes will definitely influence which gender to target and empower. Major shift to what species to keep or promote is needed to cope with the worst effects of global warming and avoid widespread loss of our native species. On sustainable utilization of natural resources the involvement of women, as the primary users of their communities' natural resources, can enhance bolstering their communities resiliency to climate change while also reducing future climate impacts. Climate change interventions should be gender sensitive, advancing measures that could help vulnerable women mitigate its impact on both crop and livestock production. Programs that target of small stock(goats, sheep, poultry) and small grains(sorghum, millet, pigeon peas, cow peas) that adapt easily to climate regimes will deliberately promote the welfare of women and improve household food security. Climatic adaptation programs can be made in the context of policy sphere which take into account the needs and priorities of both men and women in Africa. The climate is changing and reacting to these changes is crucial for the future of both crop and livestock production. Gender sensitive policies on climate change can take advantage of the opportunities offered by climate change by being ahead of the adaptation mechanisms and taking early action to adapt livestock production, crop production and biodiversity conservation to the foreseeable climatic variability uncertainties. African populace will not be able to buffer themselves from the disastrous effects of climate change and variability due to their close economic ties to natural resources, and climate sensitive sectors such as agriculture, water and

forestry, are perceived to face a major threat and when this happens the outcome is disastrous. Due to their adaptive capacity to harsh environmental conditions goats are likely to make a very valuable contribution to reduce vulnerability of women in the context of all challenges associated with climate change. Goats should be an integral part of the livestock production strategies to counteract the effects of climate change and empower women in the marginal semi arid areas of Africa.Due to goats' adaptive features they offer a compelling solution to women in livestock production systems, as a mitigation strategy to climate change. On natural resource utilization and conservation policies should be put in place which take into account the role of women in natural resource conservation, in the event that women are ignored, they become the greatest victims of such a policy. Useful synergies exist which can be used by both men and women for adaptation and mitigation in crop and livestock production and biodiversity conservation. These include conservation agriculture, avoiding deforestation, forest conservation and management, agro-forestry for food and energy, land restoration, recovery of biogas and waste and in general, a wide set of strategies that promote the conservation of soil and water resources by improving their quality, availability and use efficiency. Due to their specific roles in food production, many women are the repositories of indigenous knowledge about biodiversity utilization and conservation. Given the right platform women can effectively use this knowledge to advance sustainable use of biodiversity in most communities as a result lessening the impact of climate change. Improving the participation of women in biodiversity issues would deliver significant progress in biodiversity utilization and conservation moderating the consequences of climate change in Africa.

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