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Adapting Gambian women livestock farmers' roles in food production to climate change

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Abstract

Women livestock farmers are very productive and contribute greatly towards ensuring food security of their nations. However, their efforts are sometimes limited by climate-related hazards. This case study of The Gambia used content analysis, interviews, consultative seminars, policy mapping and dialogues to examine climate change adaptation issues confronting women livestock farmers in particular. Consequences of climate hazards, such as drought, flood, and temperature variability, have been experienced in The Gambia. Domestication of fast-growing small animals, use of resilient livestock breeds, stock size management, feed gardening and conservation, bushfire control, and regular supply of water to animals can reduce farmers' exposure to climatic variations. There were varied opinions among male and female stakeholder groups concerning adaptation options, such as rangeland management and bush fire control. Enhancing the adaptive capacities of women livestock farmers will involve many stakeholders: the government, research institutions, extension service agencies, non-governmental organizations, and the private sector have varying but complementary roles to play.

Introduction

The quantity of food produced and how impacts of climate change are felt by male and female farmers may not be the same, even when they are located in the same environment. Some studies have focused on the effects of gender in determining adaptation strategies utilized by farmers (Arora-Jonsson, 2011; Below et al., 2012; Deressa et al., 2009; Djoudi & Brockhaus, 2011). Most of the existing literature regarding this aspect deals with crop farming, while there are just a few studies concerning how women livestock farmers, especially in the developing countries of Africa, are adapting to climate change. Focusing on The Gambia and with emphasis on the feed and livestock resources, the present research hypothesizes that remarkable disparities exist between men and women livestock farmers in terms of their climate change adaptation strategies for food production and management.

The Gambian agricultural sector is predominantly traditional and largely depends on rainfall, which lasts for four to five months of the year. In addition to tourism, this sector is a main pillar of the country's economy. Given a projected population of 4,466,000 by 2040 under a constant fertility scenario (UN, 2012), the number of Gambian livestock, as well as their productivity needs to increase substantially in order to meet the expected food demand. However, there is a challenging relationship between livestock production and variations in climatic elements (Challinor et al., 2014; Nardone et al., 2010; Thornton et al., 2009; Thornton & Herrero, 2010; Weindl et al., 2015). Depending on their magnitude, climate hazards have negative effects on livestock species and farmers whose livelihoods are sensitive to climate change (Olaniyan & Orunmuyi, 2017). A typical incident was the climate-induced flooding of some farming communities in North Bank of The Gambia in 2010, which led

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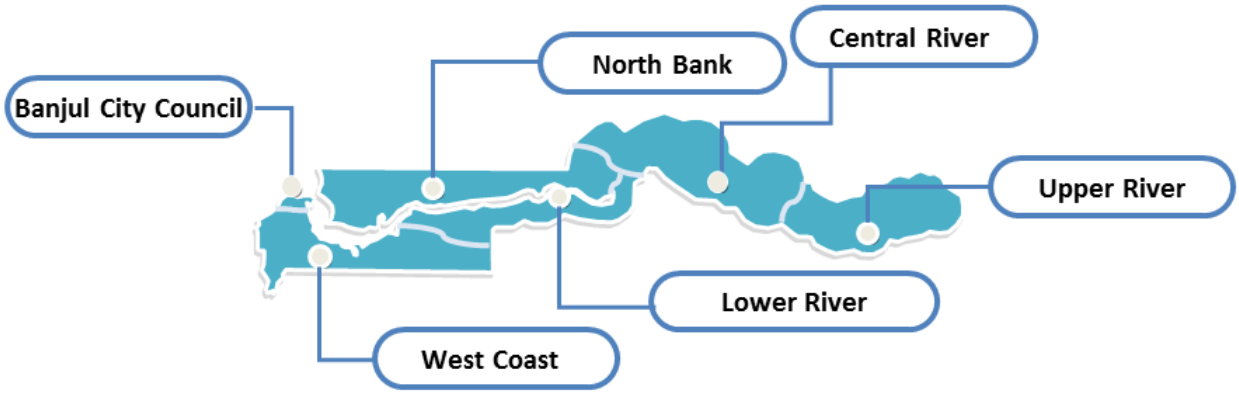

Figure 1: Map of The Gambia showing the study areas
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to economic loss of livestock and other important farm assets. In addition, the Gambian agricultural sector's performance with regard to livestock production has been fluctuating in relation to climate change hazards, with effects such as seasonal feed shortage (Olaniyan, 2016). The Gambian women farmers, who are particularly known for cultivating horticultural and food crops (Sanyang et al., 2009), as well as keeping poultry and small ruminants, are affected by variations in climatic elements (Olaniyan, 2016). According to the country's National Gender Policy (2010), the Gambian women smallholder farmers contribute up to 70% of the total food and agricultural labour force, but their productivity is less than that of male farmers. FAO (2011) has also reported a lower quantity of food production, leading to meagre income for some women farmers as compared to their male counterparts. Despite their ability to enhance climate change adaptation, food production, livestock and environmental management, Olaniyan (2016) documented that Gambian women livestock farmers still have limited access to resources and are less involved in decision and policy making.

Concerning the challenges of adapting The Gambia's livestock subsector to climate change, inadequate data for resource planning and poor exchange of data among stakeholders has been reported (ANR, 2009). There is little research concerning the potential of adaptive breeds and feed resources in the Gambian context. Considering their key roles in food production, food waste management and climate change adaptation, this study focuses on key climate change adaptation issues confronting women livestock farmers. The general objective is to suggest livestock feeding and production strategies that can be used by livestock farmers in their efforts to produce food and adapt to undesirable impacts of climate change, especially in the smallholder farming systems. Evidence-based information generated in this study can inform future policy making and livestock development activities.

Methodology

Study area

The Gambia is located in the Sudano-Sahelian zone of West Africa, with a climate typically characterized by a short rainy season from June to October and a dry season from November to May. The country (**Figure 1**) is bounded on the western side by the Atlantic Ocean, while its length along the north-south horizon is almost entirely divided into two by the River Gambia. Average daily temperature in the country varies, but it increases with distance from the ocean. Agriculture is one of the country's main productive activities. According to UN (2012), more than 50% of the total Gambian land mass is used for agriculture and food production purposes. The Gambia is one of the smallest and most densely populated countries in mainland Africa.

Data collection methods

Government, policy and institutional documents on women, agricultural development and climate change in The Gambia were reviewed using content analysis. This step was used to gain insights into the past, present and intended efforts of various stakeholders. The documents included Gambia Environmental Action Plan (GEAP, 1992), Poverty Reduction Strategy Paper (PRSP, 2006), National Adaptation Programme of Action (NAPA, 2007), Nationally Appropriate Mitigation Actions (NAMA, 2007), Agriculture and Natural Resources (ANR, 2009), The Gambia National Gender Policy (GNGP, 2010), Gender and Women Empowerment Policy (GWEP, 2010), Gambia National Agricultural Investment Programme (GNAIP, 2011), and Intended Nationally Determined Contribution of The Gambia (INDC, 2015). The keywords included livestock, resilience, feed, strategy, farmer, climate, women, adaptation, and agriculture. Policy and stakeholder mapping was used to emphasize certain

Table 1: Climate change-related risks for livestock production in The Gambia

Risks	Consequences
Drought	• Inadequate pasture for livestock feeding • Shortage of water due to drying up of watering points • Land degradation and desertification due to overgrazing • Death of animals due to starvation
Climate-induced flooding	• Death of animals • Reduced adaptive capacity of livestock farmers due to loss of natural resources
High Temperature	• Death of animals from heat wave • Drying up of watering points, such as rivers
Climate-induced pest infestation	• Reduced productivity of animals and their owners • Emaciation and death of animals

information, indicate the trends in important events and categorize the group of actors identified during the study. Relevant information was summarized as text, figures, and tables.

The content analysis was complemented by a consultative seminar. This step was used to gather additional information from stakeholders in research institutions, community-based organizations, farmers' associations, government agencies, non-governmental organizations, women's groups, and the private sector. The participants were divided into separate male and female groups, while the same task, namely, to mark various adaptation options arranged in a tabulated format, was given to both groups. These tasks, based on predefined criteria of whether each adaptation option could reduce farmers' exposure and sensitivity to climatic elements or enhance their adaptive capacities were accomplished through group discussions. A maximum of three '+' marks for each option was possible. Thereafter, there was a plenary session wherein the findings of each group were presented, compared and further discussed. Interviews, secondary data obtained from UN (2012), policy mapping and dialogue involving the previously mentioned stakeholder groups were also utilized.

Findings

Livestock and climate-related challenges in The Gambia

According to The Gambia's Agricultural and Natural Resources Policy (ANR, 2009), livestock species in the country include cattle, sheep, goats, horses, donkeys, pigs and poultry. Based on data from UN (2012), cattle and chicken are the most commonly reared species in the country, although their populations varies across the monitored years. Meanwhile, the livestock subsector of this country is mainly traditional and relatively under-exploited. Climate-related hazards, such as drought, flood, and temperature variability, as well as some of their consequences as previously observed in The Gambia are explained in **Table 1**. Livestock and crop sensitivity to the impacts of climate change partly accounted for lower productivity per animal and total food production in terms of milk, meat and eggs. Factors such as the presence of disease vectors and inadequate access to inputs, such as feed, veterinary and extension services, also influenced the type of livestock species and production systems that farmers adopted in meeting their food requirements.

Food production and management-related adaptation options for livestock farmers

Some feasible adaptation options identified from NAPA (2007) and found applicable to both men and women livestock farmers are presented in Table 2. There were some similarities in those options marked as '+' by both male and female groups. However, there was not a consensus between male and female stakeholders for certain adaptation strategies, such as controlled use of bush fire and rangeland regeneration and management.

Feed production strategies

Concerning the issue of feed shortage, which can be an effect of variations in climatic elements, such as rainfall, the following strategies can enhance women livestock farmers' resilience:

- Establishment of a fodder tree plantation including intensive feed gardens

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Table 2: Ranking of adaptation options by separate male and female groups

Adaptation options and their relationship to vulnerability in the livestock subsector	Adaptation potential					
	Women group			Men group		
	1	2	3	1	2	3
Genetic improvement of animals	+		+		+	+
Provision of adequate water for animals	+					+
Domestic farming of fast-breeding small animals		+	+			+
Controlled use of fire	+			+	+	+
Establishment of intensive feed gardens		+		+		+
Demarcation of rangelands	+			+	+	+
Stock size management	+	+			+	+
Restricted grazing	+		+	+		
Rangeland regeneration and management	+			+	+	+
Animal vaccination		+	+	+	+	+

Legend:
1 = option can reduce frequency, duration or severity of a farmer's exposure to climatic elements.
2 = option can reduce degree to which a farmer is sensitive to variations in climatic elements.
3 = option can increase ability of a farmer to withstand or recover from climate-related shocks.

- Fallowing of farmland
- Building capacities of farmers regarding feed formulation, processing and storage
- Utilization of compost to improve soil fertility
- Bushfire control
- Feed resources conservation
- Increased dry season feed production
- Demarcation/regeneration of rangelands

Animal production and breeding strategies

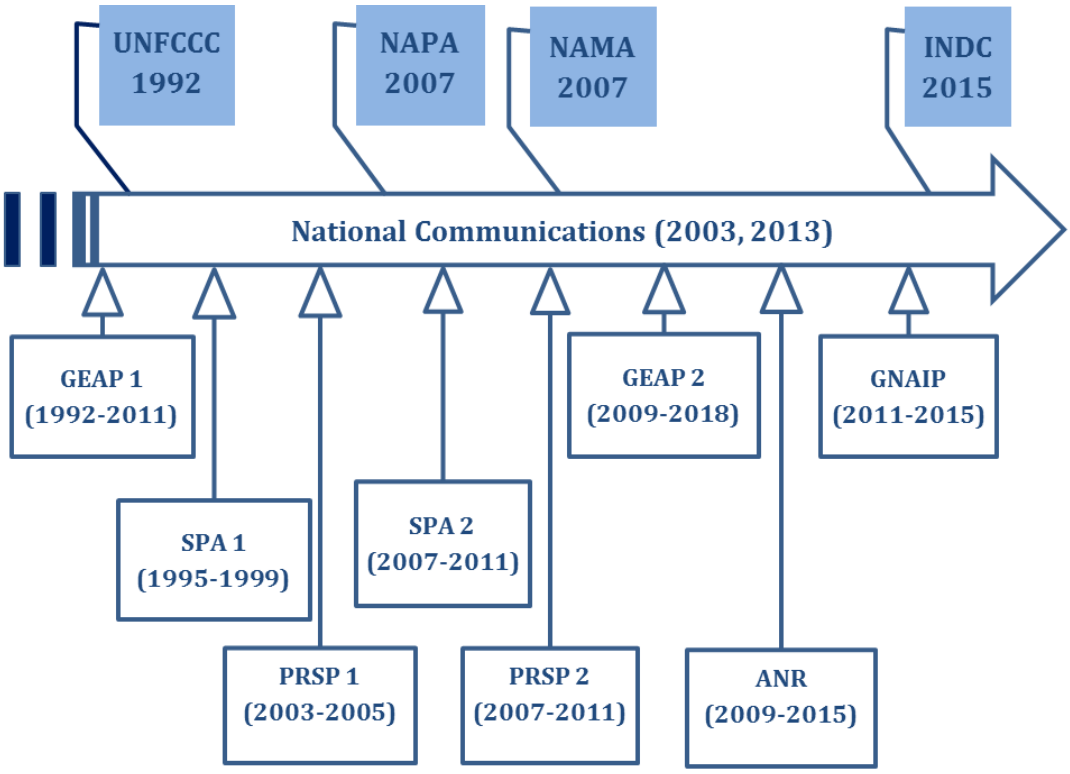
The following animal husbandry strategies can improve Gambian women livestock farmers' adaptation to climate change:

- Use of resilient livestock breeds, e.g., N'Dama cattle, Djallonke sheep, local poultry and their adaptive crossbreeds
- Keeping short-cycle animal species, e.g., quails, grass-cutters, rabbits
- Use of improved but locally-adapted forage varieties, e.g., Panicum maximum and Andropogon gayanus
- Control of vector breeding sites and habitats
- Breeding, genetic improvement, and utilization of appropriate breeds
- Improved management of agro–pastoral infrastructure
- Semi-intensive livestock production systems
- Research and extension on animal genetic resources

Strategies involving policy and stakeholders

The challenge of food shortage linked to climate change was recognized by the Gambian government and some other stakeholders. In terms of managing causes and effects of climate change, Figure 2 illustrates some of the Gambian government policies and strategies at the international (upper boxes) and national levels (lower boxes). The central arrow in the middle indicates that the country's two national communications on climate change, which were released in 2003 and 2013.

In addition to the various policy and institutional documents depicted in **Figure 2**, indications of how women livestock farmers' adaptation strategies and sustainable food production can be collectively achieved are illustrated with **Table 3**. The roles described here are not independent of each other, but are rather complementary.



Keys: NAPA= National Adaptation Programme of Action; NAMA= Nationally Appropriate Mitigation Actions; INDC= Intended Nationally Determined Contribution of Gambia; SPA= Strategy for Poverty Alleviation; ANR= Agriculture and Natural Resources; GNAIP= Gambia National Agricultural Investment Programme; GEAP= Gambia Environment Action Plan; PRSP= Poverty Reduction Strategy Paper; UNFCCC= United Nations Framework Convention on Climate Change.

Figure 2: Relevant policy and institutional landscape on climate change adaptation and livestock in The Gambia

Table 3: Relevant stakeholders and their expected roles

Stakeholder groups	Expected roles
Livestock producers	• Create awareness concerning use of climate-smart production strategies
Government	• Provide legislation, regulations, policies, development and funding for adaptation projects
Research institutions	• Identify best practices through climate-oriented research • Provide evidenced-based facts for policy advocacy, design and implementation
Extension service agencies	• Provide communication, education and information services to farmers by complementing government and other stakeholders' efforts.
NGOs/CSOs/CBOs	• Support policy implementation, funding, and training on climate-smart methods of livestock farming and food waste management
Regional & international development partners	• Provide funding and technical support to government and other stakeholders on climate change issues
Private sector	• Invest in technologies, trainings and solutions that can enhance farmers' resilience

* NGOs = non-governmental organizations; CSOs = civil society organizations; CBOs = community-based organizations

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Discussion

Vulnerability of The Gambia's livestock sector to climate change

The use of content analysis for qualitative assessment of policy and institutional documents in this study were discussed by Bowen (2009), Cho and Lee (2014), Elo and Kyngäs (2008), as well as Vaismoradi et al. (2013). To address some limitations associated with this method, content analysis was combined with interviews, policy dialogues, and policy mapping in this study. Separating respondents into male and female groups during a consultative meeting provided a basis to understand gender differences among male and female livestock farmers in terms of adapting their food production and management to climate change impacts. Further study is required to understand the rationale behind individual farmer's choices in comparison to their collective decisions or activities.

The Gambian livestock subsector is exposed to climate-related hazards because of the country's geographical location in the Sahelian zone of sub-Saharan Africa. Low productivity of this agricultural subsector has been linked to its dependence on natural resources, such as water, pasture and rangelands (ANR, 2009). Weindl et al. (2015) indicated that natural resources on which livestock production systems in developing countries depend are particularly vulnerable to the impacts of climate change. The challenges of climate change are not unique to this country, but are also noticeable in some other developing countries of Africa (Challinor et al., 2007; Jones & Thornton, 2009; Kima, et al., 2015). However, Gregory et al. (2005) pointed out that there are differences among countries with regard to the impact of climate change on food security. Concerning the vulnerable countries, a decrease in land suitable for crop production may necessitate a change from crop to livestock production (Jones & Thornton, 2009). This is because adapted livestock species in the dry areas can survive well on degraded lands when compared to some crop varieties.

For The Gambia, availability of feed resources correlates with season of the year, with more forage for animals in the wet season compared to the dry season. This makes farm animals and the livestock subsector vulnerable to variations in climatic elements, such as rainfall and its unpredictable patterns. It also causes seasonal migration of animals and herdsmen in search of both water and grasses during the dry season. However, The Gambia's NAPA (2007) indicated that many rangelands which are owned by communities are not properly managed or are occasionally destroyed by bush fire. Recurrent, indiscriminate burning of rangelands can result in destruction of natural resources which could have otherwise enhanced the adaptive capacities of farmers during critical periods of the year (Olaniyan, 2016). Relationships between rangeland management and the nutritive value of livestock feed (Abusuwar & Ahmed, 2010), biogeochemical cycles (Rumpel et al., 2015), rural livelihoods (Eriksen, 2007) and food production (Alkemade et al., 2013) exist in the literature. In this regard, the 240,000 ha (UN, 2012) which are available for pasture production and transhumance in The Gambia need to be sustainably utilized in order to safeguard against undesirable outcomes. A cost-effective tidal and pump irrigation for continuous crop and livestock production which was suggested in the Gambia National Agricultural Investment Programme (2011-2012) could be considered as one of the options that could reduce pressure on the existing rangeland used for pastoral farming

There are some indirect effects of climate change on livestock species and their owners, such as food waste and economic costs incurred in treating sick animals and controlling the spread of climate change-borne disease pathogens or vectors. There is also a challenge of food waste resulting from underutilization of animals and poor storage of perishable products, such as milk, eggs and meat. In the Gambia's NAPA (2007), high mortality rates and significant reduction in milk yield, growth rates and reproductive rates of animals were documented. However, smallholder food production and management systems can also be affected by the quality of inputs and methods used by farmers. The effects of climate change could hamper the policy goal to "meet at least 75% of national food demands in terms of meat and meat products" (ANR, 2009), as expressed in the country's Agricultural and Natural Resources Policy document.

Addressing women livestock farmers' vulnerability

The Gambian women livestock farmers are vulnerable to the impacts of climate change because of their unavoidable reliance on agricultural produce as both sources of food and livelihood. However, their abilities to diversify into non-agricultural sources of livelihood, use of indigenous knowledge, and access to family labour, can increase their resilience (Morton, 2007). A change of farming systems was suggested by Thornton & Gerber (2010). In this regard, Havlík et al. (2014) indicated that a change from grazing to combined crop-livestock production systems would both reduce both deforestation and greenhouse gas emissions. Meanwhile, a mixed farming strategy can reduce food waste because animals can thrive on the residues left after harvesting crops, while animal faeces in turn are potential sources of fertilizer for

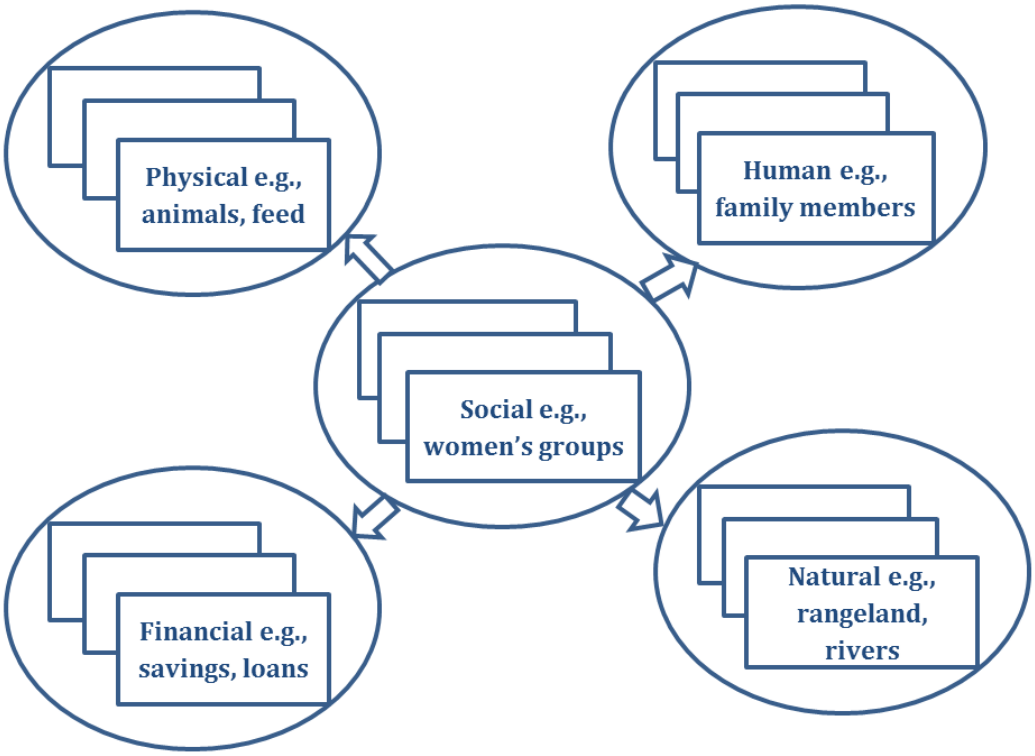

Figure 3: Typical assets that can improve women livestock farmers' adaptation to climate change

crop production. Vulnerability analysis was suggested by Godber & Wall (2014) concerning prediction of climate change impacts on food security. Selling of animals by both male and female livestock owners just before harvest of new crops has been documented in The Gambia (Yaffa, 2013). A consequence of this strategy for vulnerable women livestock farmers is gradual reduction in their livestock-based assets, especially if the animals sold are not frequently replaced. This practise can decrease farmers' subsequent ability to cope with climate change and food management-related challenges.

In The Gambia, Olaniyan (2015) indicated that women are mostly engaged in poultry and small ruminant production. Based on this, five forms of assets (i.e. physical, human, natural, capital, and social) potentially owned by vulnerable women livestock farmers were identified, as illustrated with Figure 3. The physical assets include locally-adapted animal breeds, such as West African Dwarf goat, Djallonke sheep, and N'Dama cattle. There are also locally available feed resources. The use of crop residues preserved on the roofs of houses as feed for cattle, goat and sheep during the dry season is a common practise. Meanwhile, this is still insufficient in terms of the quantity and quality needed to meet the nutritional requirements of those animals. To date, there is little research concerning the overall effectiveness of this practise and how it enhances farmers' adaptation to climate change or food production.

As also depicted in **Figure 3**, women livestock farmer groups or networks are important social assets. Women farmers can leverage this asset in order to access other forms of assets. The same claim is true for their human assets, which include family members. The relevance of microfinance institutions as a financial asset in supporting climate change adaptation in Indonesia's agricultural sector was discussed by Budiman et al. (2016). However, inappropriate use of available assets by farmers can cause food waste and distortion of the sharing process, especially at the retail levels of buying and selling. Whenever this happens, women livestock farmers, because of their dual productive and reproductive activities, can be more affected than their male counterparts in terms of meeting their food requirements. Olaniyan et al. (2015), who assessed institutional aspects of some Gambian livestock farmers', recommended a need for their capacity development. Figure 4 depicts how farmers, because of poor coping strategies, can be exposed to a deeper level of poverty and other unintended social consequences, which include an enlarged gender gap. The parts of **Figure 4** marked with red borders indicate the areas where women livestock farmers are very vulnerable.

The role of stakeholders in this perspective

Many stakeholders with various responsibilities were identified in this study. This indicates that the tasks of enhancing adaptive capacities of women livestock farmers and reducing food waste due to climate change requires active involvement and good coordination of many stakeholders. In addition to policy design and

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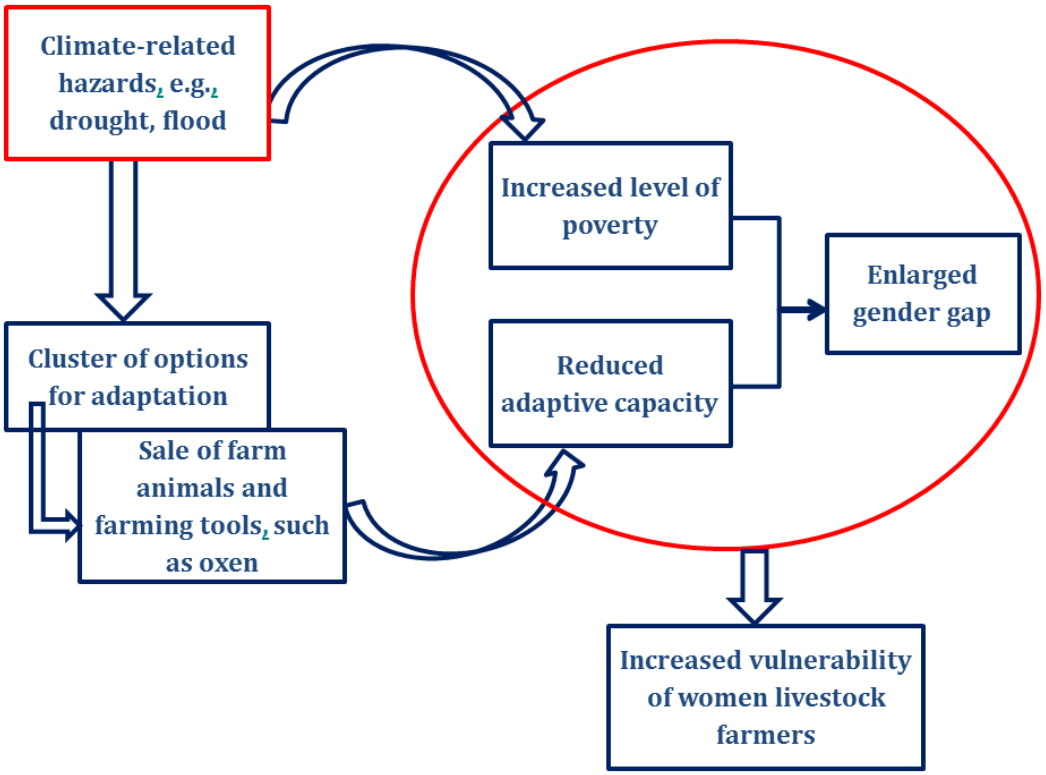

Figure 4: Women livestock farmers' vulnerability as a result of poor coping strategies

implementation, as mentioned by Olaniyan (2015), the government needs to work in partnership with other stakeholders to ensure a climate-resilient economy and livestock development. A multilevel governance approach was suggested by Amundsen et al. (2010), while Mees et al. (2012) emphasized collaboration between the private and public sector. Since gender is an important crosscutting issue in climate change adaptation, every stakeholder should ensure that this subject is well incorporated into initiatives, projects and programmes. Meanwhile, efforts to enhance climate change adaptation strategies of women livestock farmers should not be dissociated from economic development because both are mutually and closely interdependent. The stakeholders' roles in climate change adaptation, as illustrated in this study, are also relevant for food waste management.

Conclusion

Women livestock farmers, because of their dual reproductive and productive responsibilities, are particularly more vulnerable than their male counterparts. Their poor adaptation strategies often predispose them to fall into deeper levels of poverty, thereby enlarging the gender gap. Among many possible adaptation strategies for the livestock sector is the utilization of resilient livestock breeds, such as N'Dama cattle, Djallonke sheep, and the West African Dwarf goat, which can adapt to the prevailing environmental conditions of the country. Feeding strategies, such as restricted grazing, bush fire control, intensive feed gardening, and good management of rangelands were also identified as viable options. While each adaptation option can help address the challenges of climate change and food waste in The Gambia, no single option is sufficient by itself. Furthermore, effective implementation of adaptation strategies needs to be enhanced through favourable policies and cooperation of relevant stakeholders at all scales. This study generated additional evidence to prove that gender differences sometimes exist between male and female livestock farmers in terms of the climate change adaptation strategies used in food production and management. It is recommended that this gender difference should be thoroughly considered in developing climate change adaptation strategies, interventions and policies.

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Conflict of Interests

The author hereby declares that there is no conflict of interests.

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