



**SUSTAINABLE LAND USE PRACTICES AND FOOD SECURITY AMONG WOMEN SMALL HOLDER FARMERS IN SHINYALU SUB COUNTY, KENYA**

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**ABSTRACT**

*Over the last few decades, climate change and food security aspects have become increasingly important in all societies globally. However, research on climate change, its impact on agricultural production and adaptation strategies is largely focused on large scale farming systems. Furthermore, gaps exist in knowledge of climate change effects and adaptation approaches on smallholder farming systems in Kenya. The purpose of this study was to analyze the effect of Sustainable Land Use Practices on Food Security among small-holder women farmers in Shinyalu Sub-County, Kakamega County, Kenya. The study adopted a descriptive survey research design. The study targeted small-holder women farmers in Shinyalu Sub-County. The sample was determined by use of Krejcie and Morgan formula. Pilot study was carried out in the same Shinyalu sub-county; Kenya but on respondents who were not included in main study. The Questionnaire was used as an instrument for primary data collection. The study descriptive and inferential statistics was analyzed by use of SPSS software version 24, further; a regression equation model was developed to test the relationships between the variables. Results of the findings indicated Sustainable Land use Practices had an effect on Food Security among women holder farmers in Shinyalu Sub-County; Kenya. The study recommended for the policy influencers to integrate gender perspectives into mitigation and adaptation actions. Sustainable Land use actions need to be based on consultation with women, in order to build and incorporate their skills and knowledge, and to provide opportunities for improving livelihoods. Comparative studies to be conducted in other Sub-Counties and Counties on the impact of climate change mitigation and adaptation strategies on food security of women smallholder farmers.*

**Key words:** Sustainable Land Use Practices, Climate Change Mitigation, Food Security

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## INTRODUCTION

Globally, farmers possess knowledge and experience that need to be taken into account in the design of adaptation strategies in smallholder agriculture. However, women bear the greatest burden, and are most vulnerable to environmental degradation, and are disproportionately affected by climate change compared to men for a variety of reasons (Wong, 2016). Disparities in economic opportunities and access to productive resources render women more vulnerable to negative impacts of climate change because they are often poorer and are not involved in political, community and household decision-making processes that affect their lives. Women tend to possess fewer assets and depend more on natural resources for their livelihoods (Mearns & Norton, 2014). India is estimated to have 14,224 million to 24,602 million trees outside the forest, spread over an area of 17 million ha, supplying 49 per cent of the fuel wood and 48 per cent of timber consumed annually by country (Pandey, 2017). It serves as very good source for the food production along with fuel wood and production of other products. Agro forestry contributes in fuel wood, timber, fodder, food, fruits, livestock and bio energy (Dhyani, 2017).

In the global south (South America), women are responsible for 60 to 80% of food production and thus are more impacted by any strains on agricultural production. During periods of drought and erratic rainfall, women must work harder to secure food and water for their families. This puts added pressure on the girls within households, who may be forced to drop out of school to help their mothers manage the heavier burden (UN Women Watch, 2018). This undermines productivity and fuels a cycle of poverty that limits the economic and social capital that could be generated to combat climate change (Lake, Osprey & Orielle, 2015). This diminished adaptive capacity makes them even more vulnerable, forcing them to engage in unsustainable environmental practices such as deforestation in order to sustain their well-being. Smallholder and subsistence farmers in developing

countries therefore, are among those who suffer the most from climate change impacts. Reduction of crop yields due to crop damage and crop failure, water logging of soils due to increased rainfall and flooding, increased livestock disease and mortality and salinization of irrigation water can all be expected to affect the activities and productivity of smallholder farms (International Food Policy Research Institute, 2014).

Sustainable Development Goal (SDG) one; (no poverty), two; (zero hunger) and thirteen' (climate action) have put a much-needed spotlight to this study. The Sendai Framework for Disaster Risk Reduction 2015–2030, a successor instrument to the Hyogo Framework for Action 2005–2015, incorporated key recommendations on gender-sensitive Disaster Risk Reduction (DRR) and promoted a stronger role for women in building resilience (UN Women Watch, 2018). The 2015 Paris Agreement calls for women empowerment, and its provisions on adaptation and capacity-building efforts towards climate change; urging member states to adopt gender-responsive approaches. Further, many Intended Nationally Determined Contributions (INDCs) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) as part of the implementation regime of the Paris Agreement to reflect gender priorities in their pledges for climate action (United States Agency for International Development, 2016).

In Sub-Sahara Africa (SSA), women play a pivotal role in natural resources management as well as in other productive and reproductive activities at the household and community levels. This puts them in a position to contribute to livelihood strategies adapted to changing environmental conditions. Such knowledge and capabilities can and should be deployed for/in climate change mitigation, disaster reduction and adaptation strategies (UNDP, 2015). A study conducted in Swaziland demonstrated that women empowerment is central to economic development as well as environmental sustainability (Shongwe & Manyatsi, 2014).

Increased participation of women is crucial to the climate effort – for example, there is evidence that women play a vital role in dealing with disasters by effectively mobilizing communities in the different phases of the risk-management cycle; thus their greater involvement would contribute substantively to disaster risk management and reduction (World Bank, 2010).

In Kenya, climate change has had far reaching effects since majority of the country's population depend on rain-fed agriculture. More so, 75% of Kenya's population depends on agriculture for food and income. The agricultural sector contributes 26% to the national Gross Domestic Product and 60% to foreign exchange earnings (Perret, 2016). Over the past decade, the incidence and intensity of hunger and malnutrition has increased significantly and food availability has not kept pace with the rapidly growing population in Kenya (Shori, 2010). Decreased food production and famine have become common in most parts of Kenya despite the involvement of the largest proportion of population in agriculture (Ogalleh *et al.*, 2019). Increasing temperatures and frequent droughts have worsened the already fragile situation of the small-scale farmers who rely on rain-fed agriculture for survival (Kabubo-Mariara, 2018). Roughly one-third of the food produced by farmers is lost between the field and the market in low- and middle-income countries (Deressa, 2016). In high-income countries, a similar amount is wasted between the market and the table (Karuki, 2019). Currently, the food system contributes 21–37% of greenhouse gases, meaning that these food losses add to the climate crisis but do nothing for food security or malnutrition levels (FAO, 2011). With climate change, severe droughts are likely to occur more often and to affect larger areas (IPCC, 2007).

Across all countries, people living in rural areas are the most exposed to food insecurity, owing to limited access to food and financial resources. Among them, 50% are smallholder farmers, producing on marginal lands that are particularly sensitive to the adverse effects of weather

extremes, such as droughts or floods. An additional 20% are landless farmers, and 10% are pastoralists, fishers and gatherers. The remaining 20% live in the periphery of urban centers in developing countries (FAO, 2011). A study by Mburu (2018) on climate change adaptation strategies in Kakamega County, Kenya; asserts that weather patterns are not predictable anymore as they used to be a decade ago. Seasonal rainfall is uneven and dry conditions have become more frequent and severe. These changes in weather patterns have led to increased presence of pests and diseases, which affect agricultural production of small-holder farmers (IFRI, 2014).

A baseline survey conducted on status of water catchments in Kakamega County indicated that the rivers Isiukhu, Lusumu and Yala had reduced in their water capacity. This was due to increased human activities up-stream such as deforestation and encroachment of river banks (GiZ/GOPA, 2018). Reduction in water capacity implies that more pressure is exerted upon remaining meager water resource leading to resource conflicts as well as the extinction of the resource. On the other side, human activities along Kakamega forest in Shinyalu Sub-County have reduced the forest cover (Kenya Forest Service, 2019). Reduction in water capacity and forest cover acting as carbon sinks therefore, has exposed small-holder women farmer in Shinyalu Sub-County to adverse impacts on climate change. Thus, this study examined the impact of climate change mitigation and adaptation strategies on food security of women small- holder farmers in Shinyalu Sub-County, Kenya. Agriculture remains a mainstay to Kenya's economy with 85% of rural population deriving livelihoods from agricultural related practices (Government of Kenya, 2016). Due to these reasons, the Government of Kenya (GoK) has put in effort in prioritizing agriculture as a tool for promoting nation development, adapt to and mitigate negative effects of climate change (Kenya Climate Smart Agriculture Programme) as well advancing food security under the Big Four Agenda. However, despite the efforts, increasing persistence

of extreme weather events coupled up with poverty, insecure land rights, market access and postharvest losses; have small-holder women farmers in the county food insecure.

### **Statement of the Problem**

Climate change and variability is already causing negative impacts in many parts of the world (Jat *et al.*, 2019) particularly in Sub-Sahara Africa that is most vulnerable owing to the fact that over 70% of the population deriving their livelihoods from agriculture and natural based resource activities (Antwi, 2020). This climate change will reduce crop yields and in turn will increase the price of food that force people to change production and consumption patterns and directly will reduce calorie intake. So climate change is one of the world's most serious but least addressed socioeconomic and health problem (United Nations System Standing Committee on Nutrition, 2020). Developing nations, especially those in Sub-Saharan Africa are more vulnerable to the effects of climate change; this is because of their geographical location and climatic conditions, high dependence on agriculture, natural resources-driven activities and weak adaptive capacity to the change in climate (Eriksen *et al.*, 2018). However, despite different attempts geared towards stabilizing food security in the East African Community region, the link between climate change and food security has received limited attention.

Despite having various studies in existence on the impact of climate change, most of them focus on the relationship between climate change and the environment (IPCC, 2007; FAO, 2011; Lake, Osprey & Orielle, 2015; Mburu, 2018; Ogaleh *et al.*, 2019; Kariuki, 2019). Gray areas still exist on the impact of climate change to food security and especially among small-holder farmers (women included). Kabubo-Mariara and Kabara (2015) further affirms that the poor and other marginalized segments of society are especially vulnerable to climate change since their livelihoods are often highly dependent on natural resources that are sensitive to climate variability. Research on climate change, its impact

on agricultural production and adaptation strategies is largely focused on large scale farming systems in Kenya. The effect of sustainable land use practices on food security being a function of Climate Change Mitigation and Adaptation Strategy gave rise to a research gap to necessitate this study to be undertaken since few scholars had zeroed on the relevance of sustainable land use practices on food security while there is a lot to be captured.

### **Objective of the Study**

The study analyzed the influence sustainable land use practices adoption on food security among women small- holder farmers in Shinyalu Sub-County, Kakamega; Kenya. The study was guided by the following research hypothesis;

- **H<sub>01</sub>:** Sustainable land use practices do not influence food security among women small-holder farmers in Shinyalu Sub-County, Kakamega County; Kenya

## **LITERATURE REVIEW**

### **Theoretical Review**

#### **Sustainable Livelihood Theory**

The existing analytical frameworks struggle to deal with the complex interactions between climate change and other existing or future stresses, or to explain how vulnerability may be mediated by new adaptations to climate change (Small, 2017). The sustainable livelihoods framework (Scoones, 2014) offers many useful insights and has rarely been used to assess the vulnerability of rural livelihoods to climate change.

There are many different interpretations of the concept of vulnerability in relation to climate and other environmental changes (Smit and Wandel, 2016). Whilst there is little consensus about its precise meaning (Gallopín, 2016) the concept usually relates to the degree to which a human social and/or ecological system will be affected by some form of hazard (Turner *et al.*, 2013). Hazards can take the form of perturbations, which are major spikes in some kind of pressure, which are continuous slowly increasing pressures (such as soil



degradation). In addition, some spikes may have a cumulative effect, especially when added to underlying pressures (Turner *et al.*, 2013). Vulnerability also does not always have negative connotations, and can be expressed as a positive, such as the degree to which a social group can emerge from poverty (Gallopín, 2016).

Despite numerous interpretations, the literature consistently considers vulnerability of any system to be a function of three elements: exposure to a hazard; sensitivity to that hazard, and the capacity of the system to cope, adapt or recover from the effects of those conditions (Smit and Wandel, 2016). The combination of the three elements therefore determine the degree to which a household, community, or system is vulnerable to changing climatic conditions. These elements are usually incorporated into vulnerability assessments in one way or another (IPCC, 2007).

Vulnerability assessments do often take into account livelihoods and/or the factors that are likely to constrain or influence the way in which adaptation may occur. The sustainable livelihoods framework is particularly relevant to understand vulnerability to climate change because it provides a framework for analyzing both the key components that make up livelihoods and the contextual factors that influence them (Scoones, 2014). Both of these relate closely to the elements that make a household or community more sensitive or exposed to the effects of a changing climate and affect their ability to cope with environmental change (Eakin and Luers, 2016).

There are a number of ways in which the sustainable livelihoods approach may be used in climate change vulnerability analyses. First, the framework provides the basis for understanding how livelihood strategies can build adaptive capacity to enable people to better cope with change, and diversify their activities to increase resilience to unforeseen future change (Adger, 2013). The framework, for example, helps explain how livelihoods adapt to shocks, seasonality and economic or resource trends, and how their

vulnerability may be reduced, for example through building social capital, increasing the flow of information about new technologies or by improving access rights to alternative crop varieties during drought (Ziervogel *et al.*, 2016).

Second, the framework recognizes that different stakeholders are affected by climate change in different ways and have different capacities to adapt, depending on their reliance on and access to capital assets (Ziervogel *et al.*, 2016). As a result, participatory, people-centered and action research approaches are often used in sustainable livelihoods research and practice to build adaptive capacity to different and dynamic livelihood contexts (Small, 2017).

Third, the framework emphasizes the need to address the underlying causes of weak adaptive capacity, such as the inability to access inequitably distributed resources (Kelly and Adger, 2010). This recognizes that it is often access to capital assets that is most limiting to livelihoods, rather than the total stock of an asset that is theoretically available. To alter access to these assets may require adaptation of the formal and informal institutions that constrain and shape social behavior and the institutional rules that affect negotiation and the performance of power (Pelling *et al.*, 2016).

Although the sustainable livelihoods framework has been widely adopted by donors and NGOs in relation to development (UNDP, 2015), there are a number of general criticisms. These include its inability to capture the dynamism in capital assets over time, the high levels of resourcing and skills required to implement the framework on the ground, and insufficient attention to the often complex ecological consequences of livelihood adaptations (Small, 2017).

In addition to these concerns, less debated are questions about different communities' vulnerabilities, inequitable distributional impacts, social justice issues and how vulnerability links to social exclusion (Arthurson & Baum, 2013). The

theory of social exclusion complements the sustainable livelihood approach.

**Social Exclusion Theory**

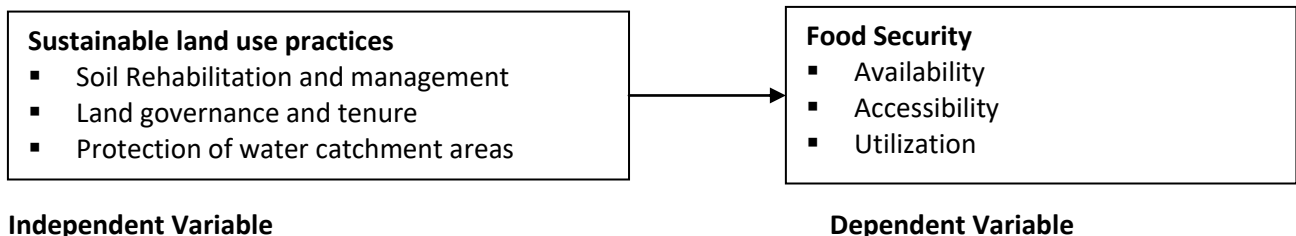
Levistas *et al.*, (2007) describes this theory as a complex and multidimensional process. It involves the lack of or denial of resources, rights, goods and services, and the inability to participate in the normal relationships and activities, available to the majority of people in the society, whether in economic, social, cultural or political arenas. It affects both the quality of life of individuals and the equity and cohesion of society as a whole. Not only is a person poor, but they may be systematically denied access to the means to overcome their poverty. Those who are excluded typically lack the capacity for collective action to overcome their exclusion (Baum, 2012).

The increasing research-base on climate change shows that the predicted variations in temperature and weather patterns will have serious social and economic consequences; ranging from flooding, long dry spells and storm erosion (Allen, 2013). Bell (2010) argues that both the research and policy agenda is mainly focused on technical, scientific and economic aspects. Important as these findings are about the economic and technical facets, in comparison little is known about the unequal impacts of climate change from a fairness, ethical and social justice perspective. There are critical questions for discussion regarding distributional and differential impacts as it is becoming increasingly evident for a variety of reasons that the

most *vulnerable* societal groups will be most affected by climate change (Lindley *et al.*, 2011).

Arthurson & Baum (2013) assert that in seeking to conceptualize and increase understanding of vulnerability some of the broader critical questions requiring further debate are: how will the impacts of climate change be experienced across socio-economically diverse groups, different households and distinct spatial areas (e.g. metropolitan versus rural areas) and countries. In turn, what are the best policies for ameliorating the worst effects of climate change and its unequal impacts for the most vulnerable groups’ health and life expectancy? What are the best ways to enable and foster the capability and choices of different communities and countries’ governments to cope with climate change? From a social justice perspective it would be grossly unfair to encumber the poor or developing countries with responsibilities that they may be unable to meet due to a lack of resources or capabilities (Adger, 2013). From this viewpoint we need to ensure that knowledge and support are available, and societal context is taken into account in devising climate change policies. This theory has demonstrated to be relevant to the study where women are socially excluded in matters of land ownership, decision making in regard to what to farm, sharing proceeds from farming among others. This is clear that women do not get a fair share from farming. This should be a growing area of research for researchers interested in understanding processes and outcomes of climate change for disadvantaged communities.

**Conceptual Framework**



**Figure 1: Conceptual framework**

### Review of study variable

Greater attention is being given to alternative models of intensification, and in particular, the potential of Sustainable Land Use practices (SLM) technologies. SLM practices include: soil rehabilitation and management, land governance and tenure, protection of water catchment areas, irrigative agriculture among others. Such practices can generate private benefits for farmers, by improving soil fertility and structure, conserving soil and water, enhancing the activity and diversity of soil fauna, and strengthening the mechanisms of elemental cycling. The literature suggests that these benefits can lead to increased productivity and stability of agricultural production systems (World Bank, 2006; Pretty, 2015). They thus offer a potentially important means of enhancing agricultural returns and food security, as well as reducing the vulnerability of farming systems to climatic risk.

Agriculture is the most important sector in Sub-Saharan Africa and is set to be hit the hardest by climate change (Deressa, 2016; Hassan, 2018). Although climate change may affect the agricultural sectors of different countries in different ways, what is clear is that these changes will bring about substantial losses, especially for smallholders whose main source of livelihood derives from agriculture. Adaptation seems to be the most efficient way for farmers to reduce these negative impacts (Fussel, 2016). This can be achieved through the smallholder farmers themselves taking adaptive actions or by governments implementing policies aimed at promoting appropriate and effective adaptation measures like adopting SLM practices.

Some studies report that SLM measures such as soil conservation, soil fertility management and irrigation are the most used adaptation strategies in African countries (Deressa, 2016; Kabubo-Mariara 2018; Mideksa 2019). Thus, there is a need for each nation to understand the scope of climate change and the drivers of adaptation, particularly amongst its smallholder farmers, in order to craft appropriate policy responses, as the vulnerability

and sensitivity of each country differs, as does the accessibility of the different adaptation methods.

In the face of the ever burgeoning population, agricultural land has continually diminished, forcing people to make maximum use of the available land, often at the expense of sound agriculture practices (IFRI, 2014). The problem of the reduced land size is aggravated by poor and unsustainable agricultural practices such as excessive use of chemicals and cutting down of trees, which ultimately lead to environmental degradation. Pretty (2015) advocates for sustainable land use models; including conservation agriculture to ensure maximum food production on a small piece of land. SLM thus is the cure to environmental degradation among African countries, leading to non-expansion of human activities into marginal areas such as forests and wetlands (National Environment Policy, 2013).

A study by the World Bank indicates that 155 of the 173 economies it covered globally have at least one law impeding women's economic opportunities (World Bank Group, 2015). For example, women do not always enjoy the same rights as men to land, a crucial resource for poverty reduction, food security and rural development. Although women make up more than 40% of the overall agricultural labour force in the developing world (ranging from 20% in Latin America to 50% or more in parts of Africa and Asia), they own between 10 and 20% of the land (Food and Agricultural Organization, 2011). Poverty, along with socio-economic and political marginalization, therefore cumulatively put women in a disadvantaged position in coping with the adverse impacts of the changing climate.

Land access and control especially among women is still a challenge in Africa and especially in Kenya (Mucheru-Muna & Muriuki, 2013). On the other hand, access to land with no resources to improve it will not be very useful in achieving food security (Ananda, 2012). These competing land uses have adverse environmental effects on long term sustainability of agricultural production. It is arguable that even though land reform has often



been advocated for (and rightly so) as a solution to food insecurity in Kenya, the problem is more deeply rooted in patterns of inequality in power and access to human and material resources, necessary for sustainable agriculture (FAO, 2011). Widespread adoption of better land tenure systems such as communal land leasing and ownership has the potential to generate significant public environmental goods in the form of climate change mitigation (UNDP, 2015). In Kenya, SLM represents the critical merger of agriculture, environment and human socioeconomic well-being. It has the dual objectives to maintain long-term productivity of ecosystem functions for land, water and biodiversity and, at the same time, to increase productivity of goods and services, and particularly safe and healthy food (FAO, 2011). Well-structured and resourced SLM programs have the potential to provide environmental benefits through their contribution to combating land degradation and to arresting and reversing decline in biodiversity and other ecosystem services (Mucheru- Muna & Muriuki, 2013).

## METHODOLOGY

Descriptive research survey design was therefore used to determine an association between the conceptualized independent and dependent variables as shown in the study's conceptual model. This study targeted 67861 women of Shinyalu Sub County, Kakamega County; Kenya. A sampling frame is a list of all the items in the population (Cooper & Schinder, (2007). That is, it is a complete list of everyone or everything you want to study or a list of things that you draw a sample from. In this study it consisted of women from Shinyalu Sub-County, Kakamega County; Kenya. The study sample size was determined using Krejcie and Morgan (1970) formula, sample size determination formula yields a sample size of 382. Primary data was collected by means of self-administered questionnaires. The questionnaires had structured questions. These questionnaires were structured and designed in multiple choice formats. Section one introduced the

researcher, topic of research and its purpose to the respondent.

Data collected from the field was coded, cleaned, tabulated and analyzed using both descriptive and inferential statistics with the aid of specialized Statistical Package for Social Sciences (SPSS).version 24 software. Descriptive statistics such as frequencies and percentages as well as measures of central tendency (means) and dispersion (standard deviation) was used. Data was also organized into graphs and tables for easy reference. Further, inferential statistics such as regression and correlation analyses was used to determine both the nature and the strength of the relationship between the dependent and independent variables. Correlation analysis is usually used together with regression analysis to measure how well the regression line explains the variation of the dependent variable. The linear and multiple regression plus correlation analyses were based on the association between two (or more) variables. SPSS version 24 is the analysis computer software that was used to compute statistical data.

Study conceptualized Regression Model;

$$y = \beta_0 + \beta_1 X_1 + \varepsilon$$

y = Food Security

$\beta_0$  = Constant

$X_1$  = Sustainable Land use Practices

$\{\beta_1\}$  = Beta coefficients

$\varepsilon$  = the error term

## FINDINGS AND DISCUSSIONS

The study involved 361 questionnaires being dispatched for data collection, 296 questionnaires were returned completely filled, representing a response rate of 82% which was good for generalizability of the research findings to a wider population.

### Descriptive Statistics: Impact of Sustainable Land Use practices on Food Security among Women Small holder farmers

The objective of the study sought to analyze the impact of sustainable land use practices adoption

on food security among women small- holder farmers in Shinyalu Sub-County, Kenya. Questionnaires and interview guides helped to gather raw data for this study objective.

Respondents were requested to rate the subsequent attributes on the impact of SLM on food security where SA represented Strongly Agree, A represented Agree, N represented Neutral, DA represented Disagree and SDA represented Strongly Disagree.

55% of the respondents strongly agreed that they plant cover crops to protect the soil from harsh climatic conditions and environmental degradation with a mean of 4.86, while 51% agreed that encroachment of river banks and forests interrupted with weather conditions affecting planting and harvesting seasons with a mean of 4.21 and 50% plant legumes that enhance nitrogen fixing in the soil and source of manure with a mean of 3.96. However, 66% of the respondents strongly disagreed that they have freedom to make decisions on crops to plant on their land with a mean of 0.97. Furthermore, 52% of the respondents affirmed that they did not have secure land tenures with a mean of 0.98.

From the findings, it was evident that women smallholder farmers practiced SLM approaches on their respective farms to increase productivity and ensure food security at the household level. However, their accessibility to land and lack secure of land tenure derailed their effectiveness in practicing the SLM approaches for improved soil fertility and productivity.

### Inferential Statistics

**Table 1: Correlation between SLM practices and food security**

Correlation between SLM practices and Food Security		SLM practices	Food security
SLM practices	Pearson Correlation	1	.987
	Sig. (2-tailed)		.76
	N	296	296
Food Security	Pearson Correlation	.987	1
	Sig. (2-tailed)	.029	
	<b>N</b>	<b>296</b>	<b>296</b>

SLM measures such as soil conservation, soil fertility management and irrigation are the most used adaptation strategies in African countries (Deressa, 2016; Kabubo-Mariara 2018; Mideksa 2019). Thus, there is a need for each nation to understand the scope of climate change and the drivers of adaptation, particularly amongst its smallholder farmers, in order to craft appropriate policy responses, as the vulnerability and sensitivity of each country differs, as does the accessibility of the different adaptation methods.

In the face of the ever burgeoning population, agricultural land has continually diminished, forcing people to make maximum use of the available land, often at the expense of sound agriculture practices (IFRI, 2014). The problem of the reduced land size is aggravated by poor and unsustainable agricultural practices such as excessive use of chemicals and cutting down of trees, which ultimately lead to environmental degradation. (Pretty, 2015) advocates for sustainable land management models including conservation agriculture to ensure maximum food production on a small piece of land. SLM thus is the cure to environmental degradation among African countries, leading to non-expansion of human activities into marginal areas such as forests and wetlands (National Environment Policy, 2013).

Land access and control especially among women and youth is still a challenge in Africa and especially in Kenya (Mucheru-Muna & Muriuki, 2013). On the other hand, access to land with no resources to improve it will not be very useful in achieving food security (Ananda, 2012).

The findings obtained from the correlation analysis in table 1 indicated that the SLM practices were strong, positive and significant ( $r=0.987^{**}$ ,  $p<0.001$ ). This implied that increase in SLM practices such as agroforestry, composting, mulching etc. will definitely have a great significant influence on food security of women smallholder farmers. These findings corroborate with those of FAO (2011). SLM represents the critical merger of agriculture, environment and human socioeconomic well-being. It has the dual objectives to maintain long-term productivity of ecosystem functions for land, water and biodiversity and, at the same time, to increase productivity of goods and services, and particularly safe and healthy food. Furthermore, well-structured and resourced SLM programs have the potential to provide environmental benefits through their contribution to combating land degradation and to arresting and reversing decline in biodiversity and other ecosystem services (Mucheru-Muna & Muriuki, 2013).

### CONCLUSIONS AND RECOMMENDATIONS

The objective of the study sought to analyze the impact of sustainable land use practices on food security among women small-holder farmers in Shinyalu Sub-County, Kenya. Correlation results showed that the Sustainable Land use practices had a mean of 0.987 with a significance level of 0.001 ( $r=0.987^{**}$ ,  $p<0.001$ ). This implies that increase in SLM practices such as agro forestry; composting,

mulching etc. will definitely have a great significant influence on food security of women smallholder farmers. These findings are in agreement with Pretty (2015) who found out that sustainable land use practices models including conservation agriculture ensure maximum food production on a small piece of land. The National Environment Policy (2013) also found out that SLM is the cure to environmental degradation in Kenya, leading to non-expansion of human activities into marginal areas such as forests and wetlands.

The study concluded that women small holder farmers practice SLM approaches on their respective farms to increase productivity and ensure food security at the household level. However, their accessibility to land and lack secure of land tenure derailed their effectiveness in practicing the SLM approaches for improved soil fertility and productivity.

The study recommended that, policy influencers integrate gender perspectives into mitigation and adaptation actions. Climate change actions need to be based on consultation with women, to build and incorporate their skills and knowledge, and to provide opportunities for improving livelihoods.

### Areas for further research

Comparative studies to be conducted in other Sub-Counties and Counties on the impact of climate change mitigation and adaptation strategies on food security of women smallholder farmers.

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