

# The Impact of Climate Change on Agro- Pastoralists' Livelihoods in Tanzania: A Case of Arumeru District, Arusha

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**Abstract:** This study aimed at finding the impact of climate change on the livelihoods of agro - pastoralists in Arumeru district. The study used questionnaires, structured interview and focus group discussion as data collecting tools. The sample included 130 respondents. The findings show that the livelihoods of the local communities are diversely impacted by climate change. Among the impacts discovered are health problems, decline of agriculture and food security, and loss of land, human displacement, and shortage of clean and safe water.

Furthermore, the study concludes that poor local people in the study area need external help and support to effectively cope with changing climate and adapt to current and future climate change. It was discovered that adopting seasonal water harvesting practices, such as roof water harvesting and water catchments would be particularly beneficial to poor local people. Educating agro - pastoralists through training and workshops would be an important step towards efficient mitigation measures. The study recommends effective and sustainable livelihoods for the local agro - pastoralists so that they can be fully involved in planning and making decision on how to curb the climate change impacts on their livelihoods.

**Keywords:** Climate Change on Agro- Pastoralists, Structured Interview and Focus Group Discussion.

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## 1. INTRODUCTION

### Background:

Climate<sup>1</sup> change is an issue of great importance for human rights, public health, and social equity because of its profound consequences and its potentially disproportionate impact on vulnerable and socially marginalized populations (Thomas, 2005). Community vulnerability to climate change<sup>2</sup> is determined by its ability to anticipate, cope with, resist, and recover from the impact of major weather events (Meena, *et al.*, 2006). Climate change has altered the timing, pattern and levels of rainfall and temperature across the globe. Poor communities depend on natural resources and ecosystem services which are especially sensitive to such change.

It has been accepted by climatologists that adaptation to climate change has some role to play in responding to impacts of climate change as seen in recent policy declarations through the United Nations Framework Convention on Climate Change (Eriksen *et al.*, 2005). Without proactive measures and investigations, climate change will likely reinforce and amplify current, as well as future socio-economic disparities, thereby leaving minority and low-income groups with fewer economic opportunities; and, additionally, health burdens and social conflicts on agro - pastoralists 's livelihoods<sup>3</sup> (Adger *et al.*, 2003).

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<sup>1</sup> The long- term average weather condition at particular location

<sup>2</sup> Any change in climate over time, whether due to natural causes or as a result of human activity.

<sup>3</sup> The situations in which things and services that makes human life easily manageable, this include services like health, water, education and transport and communication network.

High levels of vulnerability<sup>4</sup> in the developing world are linked to a range of factors, including a high reliance on natural resources. Whatever the effects of climate change will be (sea-level rise, increased floods, drought, disease), the most vulnerable groups will be the poor who depend on nature and whose ability to withstand against environmental shocks and stresses to their livelihoods is low (Adger *et al*, 2003; Thomas, 2005).

**Purpose of the study:**

The objective of this study was to explore impacts of climatic change on local communities' livelihood and to come out with mitigation and coping mechanisms to attain agro - pastoralists 's sustainable livelihoods despite climate changes in the area (in this case, Arumeru District).

## **2. LITERATURE REVIEW**

The researcher navigated through works of various scholars who have done studies on climate change. This was done for in-depth understanding of the magnitude of the climate change and the related theories as climate change and climate variability does not only pose an entirely new threat to the livelihood of the agro - pastoralists in the place of occurrence but also adds to the existing stresses. Climatic changes have serious implications for water resources, food security, and the spread of disease, the productivity of natural resources, sea-level rise, and desertification (Thomas, 2005). Large-scale events (such as the ongoing drought in the Horn of Africa, the 1998 floods in East Africa and the 1997/8 and 2000 floods in Mozambique) illustrate ways in which many communities are already suffering from less predictable and more extreme weather patterns hence a great impacts on human's livelihoods (Thomas, 2005).

## **3. MATERIALS AND METHODS**

A number of approaches and methodologies were used for data collection, which included literature review, questionnaire survey, key informants interview, focus group discussions and field observation (Kothari, 2004).

## **4. RESEARCH DESIGN**

Qualitative and quantitative approaches were used in this work being represented by a *case study design*. This design was chosen because it gives a rich description of the case in point in order to have as broad understanding of the issues involved as possible, a fairly exhaustive, flexible in data collection and it saves both time and costs (Bryman, 2004; Saunders, 2000).

Furthermore, during data collection stage, the researcher used both documentary and first hand strategy to obtain data. Documentary method (secondary data) was used to enable the researcher to navigate through information that has been done by other scholars and passed through statistical process (Mills, 2011; Creswell, 2012) hence the identification of potential facts and knowledge gaps in the study.

Moreover, primary data collection strategy was used whereby tools such as questionnaire method, field study and focus group discussion and interview was used (Kothari, 2004; Mills, 2011). The groups involved in the study were youth, women, adults, and elders, village officers and district officials, making a total sample of 130 of respondents. The reason for the involvement of the all categories of agro - pastoralists was for measurement and analysis of climate change intensities to each individual in the study area.

**The Study Location:**

The study was carried out in four villages, viz: King'ori, Ngongongare, Mbuguni, and Kisimiri Juu which are administratively in Arumeru District. Arumeru District is located between longitudes 35° 37' and 35° 47' East and latitudes 3° 17' to 3° 27' South. It borders Simanjiro District to the east, Hai District to the northwest, Kiteto District to the south, and Monduli District to the north. In the case of villages, Mbuguni is found at 3° 34' 0" South, 36° 57' 0" East and King'ori is at 3° 17' 0" South, 36° 59' 0" East, while Ngongongare which is located at 3°18'S and 36° 51' E is found in the east part of the District.

**Climate of the Area:**

The study area receives an annual rainfall ranging between 500 mm – 1,200 mm. The areas have bimodal type of rainfall, for example short rains (*Vuli*) fall from November to January and long rains (*Masika*) fall from March to June (Thompson

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<sup>4</sup> The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes

et al., 2002). There is usually a long dry spell towards the end of January or early February. Two peaks of rainfall are experienced in December and in April (*Ibid*).

## 5. RESULTS AND DISCUSSION

Results indicate that, about 98% of the households had been affected by climate change in their livelihoods, while 2% couldn't see any effect on their livelihood. The noted effects on climate change in the study area included human health problems, shortage of clean and safe water, agriculture and food insecurity, loss of land, human displacement and loss of income. This is in line with (Senbeta, 2009) who observed that climate change increased drought, floods, diseases and famine (See Table 1).

**Table 1: Effect of climate change on livelihood of agro - pastoralists**

Impacts of Climate Change on agro-pastoralists	Villages				
	Ngongongare n=30 (%)	King'ori n=30 (%)	Mbuguni n=30 %	Kisimiri Juu n=30 %	Average %
Human Health	60.1	22.6	30.2	15.3	32.0
Shortage of Water	15.0	50.2	51.0	3.5	30
Agriculture and Food insecurity	9.9	20.2	16.0	60.1	27
Loss of Land and human displacement	5.0	3.0	0.5	1.5	3.4
Loss of Income	10.1	4.0	2.6	2.0	4.6

Source: Field Data, 2015

Results indicate that the effects of climate change on livelihood varied from one village to another. For example, in Ngongongare village the most effect perceived was human health problems. In King'ori and Mbuguni they observed shortage of water as a critical effect, while in Kisimiri Juu they noticed agriculture and food insecurity as a critical effect.

### Effects on Human Health problem:

On human health problem, the local communities (32% n=30) argued that the frequency of occurrence of diseases such as malaria and water born diseases could be a consequence of climate change. They further argued that climate variability and extreme weather events, such as high temperatures and intense rainfall events, are critical factors in initiating malaria epidemics in the area. Also, it was revealed that malaria was not a pandemic disease in Arusha region during 1960s to 1980s but currently, (2012) it is a common disease. According to Thomas, (2005) "the survival of mosquito vectors (*Anopheles* spp.) and the mosquito parasite that causes malaria (*Plasmodium falciparum*) are influenced by climate change" Temperature affects the development rates of vectors and parasites, while rainfall affects the availability of mosquito breeding sites".

### Shortage of Clean and Safe Water:

Respondents argued that ponds and rivers have been drying, due to climate change. This has caused them to walk very long distances of about 10 Kilometres in search of water particularly during the dry season. Due to shortage of water, local communities have been using unclean and unsafe water as exemplified by fetching water in ponds. In other villages, e.g. Mbuguni, Kisimiri and Ngongongare, water is now (2013) sold at Tsh. 2000 per bucket (20 litre capacity).

### Impact on Agriculture and Food Insecurity:

According to household respondents, agriculture and food security have been affected (27%) and consequentially this has led to decline of food security. Available data indicate maize production in the last three seasons in (kg/ha) in 2006/2007, 2007/2008, and 2008/2009 standing at 3447, 4731, and 2000, respectively. For sorghum production (kg/ha) in 2006/2007, 2007/2008 and 2008/2009 it was 2215, 4300, and 1000, respectively. Yanda and Mubaya (2011) contend that climate change has indirect and direct impacts on development. For instance, higher atmospheric concentration of CO<sub>2</sub> has direct impacts on crops by altering photosynthesis and the efficiency of water use. In contrast, mean temperature affects crop duration (Senbeta, 2009) whilst extreme temperature during flowering can reduce the grain or seed number.

### **Mitigation measures and Coping mechanisms:**

Field results indicate that the mainly suggested measures to mitigate climate change were saving strategy (food saving) (27.4%), dam construction (25%) and afforestation (22.5%). As they are explained below.

#### **Saving strategy (resources saving):**

Field data suggest that saving strategy (27% n=30) is among the main coping mechanisms in the study area. According to the views of the households, saving is limited to food only. However, a study by Senbeta (2009) revealed that there are two ways of saving: the first one is called *during impact saving* - using less amount of available resource during climatic crisis such as eating less food, using less feed and reducing purchases. The second type is *pre-impact saving* - households keep sufficient assets (crop, forage, livestock, money or other forms of asset) that help them to bridge hardship times. In addition to managing household food consumption, to pay-off expenses and to fulfil household financial requirements the households could sell livestock instead of food crop (*ibid*).

#### **Dam construction:**

Dam construction was also perceived (25% n=30) by the households that it could be the best coping mechanism to climate change as it is water reservoir which can be used during dry season. Water shortage being one among the effects of climate change, presence of dams in the study area could serve water shortage crises. However, dam may not be a sustainable solution in prolonged drought condition.

#### **Afforestation Strategy:**

The study revealed that *afforestation as a strategy for mitigation of climate change effects as it was identified by* (22% n=30). Possibly this is due to the importance of forests in ecosystem. Forests play a great role in hydrology as they help to protect water sources and rain formation. They also regulate climate (i.e. temperature) as they control the amount of Green House Gases (GHGs) which may contribute to the rise in global temperature. However, this should be an integrated measure beyond local vicinity, since the services provided by the forests in ecosystem cannot be limited locally. Furthermore, it is a long-term mitigation measure as it takes a couple of years for ecological restoration to take place.

#### **Policies and Bylaws:**

Those policies and by-law reforms are necessary for curbing the impact of climate change. It was noted that to have village by-laws which limit free grazing on cropland is very important. By-laws should be reinforced through fines, where the enforcement is to be done by community leaders by making sure laws are adhered to when promoting zero grazing and reducing of group size of livestock. The *Tradition approach* used is to let animals graze after harvest so as to protect soil from being eroded, while, at the same time, protecting crops grown from being damaged by animals. Formation of by-laws is not only enough, but also should accelerate policy formulation which conforms to the local situation, hence making it easy to curb impacts of climate change. Policy lobbying and advocacy for integration of climate change in development planning and policy process at national and local levels is important as it can associate resources allocation to support climate change adaptation actions at the local level (Watson, 2001).

#### **Intercropping Approach:**

Intercropping is another adaptive strategy perceived by discussants as one of the coping mechanisms against impact of climate change. Although the strategy is common among the small-scale farmers who maximize land with diverse crops (Mkenda, 1997), it was revealed that the approach could be used to minimize the risk of crop failure. In line with field data, a study by FAO (2002) showed that "indigenous practices intercropping pigeon pea, soyabeans, sweet potatoes and pumpkin, which act as cover crops after the main crop is harvested, provide a good canopy if densely planted". Therefore, the strategy should be applied by other communities impacted by climate change as the coping mechanism of protecting soil erosion in their farms, while at the same time it works as a strategy of improving food production in their households.

## **6. SUMMARY OF THE STUDY**

This study aimed at assessing the impacts of climate change on local communities' livelihood in Arumeru district. Specifically, the study identified the effects of climate change and the mitigation and copying strategies. The major identified effects of climate change to local communities' livelihood included human health problems (i.e. diseases like malaria, typhoid and diarrhoea), shortage of water, decline of agriculture production and food insecurity, whereas the minor effects included loss of land and human displacement, as well as loss of income.

In order for the local communities to mitigate or cope with climate change effects various mechanisms have to be applied. The mechanisms include saving strategy (i.e. saving resources like food to bridge them in hardship time), dam construction, afforestation, building strong houses and awareness creation among the local communities.

## 7. CONCLUSION

A climatic change impact in Arumeru District is a big problem and is associated with many challenges in relation to the livelihoods of agro - pastoralists in the District. It was found that the District's livelihoods have been affected greatly by climate change and the main impacts are on health human, shortage of water, loss of land and human displacements, impact on agriculture and food security and failure of savings.

## 8. RECOMMENDATIONS

The study recommends the following:

1. The need to fully involve local communities in planning and decision-making on how to effectively mitigate measures and application of coping strategies on climate change impacts on agro - pastoralists s' livelihood;
2. More capacity building efforts are needed to train climate scientists in Tanzania in the development and application of down-scaling techniques as well as in the use of multimodal approaches;
3. Transparency in the fund provision to the affected agro - pastoralists to establish other economic bases is needed so as to motivate local agro - pastoralists hence effective and efficiency participation in climate impacts controlling;
4. Move from awareness raising to "proof of concept" with the climate change debate gradually moving from a focus on awareness raising about the problem to the development of actual adaptation responses, there is a need for developing so-called "proofs of concept" examples of agricultural decision makers that have successfully drawn on climate change projection data to make decisions that have improved agricultural productivity or human well-being.

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