

# A Gendered Analysis of Climate Variability and Change Impacts and Adaptations in Semi Arid Area Farming Systems and Natural Resources Management

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## Abstract

Climate change and climate variability is increasingly threatening the livelihoods of many Tanzanians especially those living in semi-arid rural areas. The most affected are those; with low incomes, less food, poor access to health services, unstable energy supplies, and living in fragile natural ecosystems. Generally, women and men contribute differently to climate change; likewise, they are affected differently and react differently to its impact. The overall objective of the study was to assess the impact of climate change on rural livelihoods' and how households in semi-arid areas of Tanzania adapt based on gender. The study was conducted in Iramba and Meatu Districts. The study adopted a Sustainable livelihood Approach (SLA) developed by DFID (1992) in the analysis of climate change impacts and households' adaptation. Data was collected using qualitative methods such as focus group discussions and key informant interviews, informal interviews and observations. Findings from the study show that, climate change impacts affect almost everybody in the studied communities; however, differences by gender exist. These findings thus suggest that adaptation to climate change impacts vary across genders due to differences in roles and responsibilities, power relations and access to and control over resources.

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**Key words:** Climate change impacts and adaptation, gender, livelihood

## Introduction

Livelihoods and living conditions of the poor in the global south Tanzania included are affected by both, short term and long term influence of climate change. All over the world natural climatic variability exacerbated by human-induced climate change are putting societies, particularly women, the poor and vulnerable, at greater risk (IPCC, 2001). Tanzania in its National Adaptation Programme of Action (NAPA) in 2007, identified climate change and variability as one of the pressing issues threatening everyone and the national

development in general (URT, 2007). Nonetheless, different socio-economic groups including women are impacted differently by the phenomenon; women constitute 70 - 80% of the world's farmers and those living below poverty line. Therefore, they are most likely to bear the heaviest burdens of climate change impacts and are often first to lose their livelihoods in affected communities.

Changes in the climate usually affect sectors that are traditionally associated with women. Women are more dependent.

According to FAO (2007) the profound impact of climate change on agriculture and other livelihood options combined with the low resiliency and high vulnerability of this population to shocks could severely alter their ability to manage natural resources, affecting their livelihoods, food security, and well-being. Climate change and variability in Tanzania, as is in other developing countries is threatening rural populations with low income, food insecurity, inadequate health services, unstable energy supplies, and those living in fragile natural ecosystems. The most vulnerable sectors in the country include; agriculture, water, energy, health and forestry (URT, 2007). Therefore, climate change seems to have a strong linkage to the livelihoods of the rural poor.

Although women and men are victims of climate change, they are also effective agents of change in relation to both mitigation and adaptation. According to WEDO (2007), women can be key agents of adaptation and mitigation to climate change. Their own households and community responsibilities and as stewards of natural resources better positions them to develop adaptation strategies to the changing environmental realities. Therefore, it is crucial to facilitate resilience among men and women to build adaptive capacity.

All over the world, shocks and risks such as climatic variability exacerbated by human-induced climate change are putting societies, particularly women, the poor and vulnerable, at greater risk. However, climate change has largely been conceived as a scientific and environmental issue, with limited analysis of human aspects including gender. While most research covers issues like, frameworks for decision making, cost-benefit analysis,

uncertainties, scenarios, ecological dimension and carbon sinks; gender and other social aspects are largely understudied (Denton and Parikh, 2003; IPCC, 2001). Climate change is not just a political and economic issue but also a human issue, whereby the livelihoods of numerous communities are threatened and their security being at stake. People's livelihood in Meatu and Iramba districts in Simiyu and Singida Regions respectively are highly threatened by climate variability and change as the areas are semi arid. Barrow *et al.*, (2003) argue that semi-arid conditions and the agro-pastoral land-use system exacerbate challenges faced by households in their agricultural production, consequently threatening the areas ability to sustain future livelihoods. This means that households' in Meatu and Iramba districts face several challenges in relation to meeting their household needs in particular food. In addition, since these areas receive low, erratic and unreliable rainfall (500 - 800 mm. p.a.) households' livelihood security could be at risk. For example in case of Meatu, González-Brenes (2003) has shown that the district was last in Shinyanga region in relation to production of adequate starchy foods between 1996/97 and 2004/05, only 6% of households in the district had adequate supplies as compared to the other districts: Bukombe (31 %), Kahama (23 %), Shinyanga district including Kishapu (18.5 %), Maswa (11%) and Bariadi (10 %). On the other hand, Iramba district is also faced with the challenge of enabling households to have livelihood security, the semi arid conditions experienced in the district coupled with increase in population could further aggravate this condition. According to a book edited by Kangalawe and Majule (2006) it has been shown that sustaining the

livelihoods of the people in Iramba on basis of the existing dynamics needed an integrated approach in the management of the available and varied resources. Moreover, there is a need to ensure that people adhere to environmentally sound agricultural practices. Specific questions that this paper addresses are; what are the impacts of climate variability and change to households' livelihood and how do both men and women in Meatu and Iramba Districts adapt to climate variability and change while facing other vulnerabilities?

### Study Justification

Experience shows (see for example, Bapna *et al.*, 2009, Denton and Parikh, 2003) that interventions to strengthen livelihoods and food security from external shocks are more efficient and effective when gender differences are properly understood and addressed, and yet research and policy-making have so far failed to examine extensively the gender aspects of vulnerability and adaptation to climate change (Nelson, 2005; Denton and Parikh 2003; Wendy, Undated). Analysis of gender aspects of vulnerability is important because in agricultural and natural resource-dependent communities, men and women have distinct roles and responsibilities, which give rise to differences in vulnerability and ability to

cope with changes. These differences need to be acknowledged in the adaptation process to avoid further increases in gender inequality and to ensure the success of adaptation measures and policies. A gendered analysis does facilitate an understanding of how climate change threatens livelihoods of both men and women and other vulnerable groups. In addition, such an analysis will assist in mitigating negative gender impacts and enhance positive gendered capacities for adaptation to climate change. This study provides important insights on household livelihood responses and adaptation of agricultural production methods and practices to climate change and other stressors by farmers in the studied semi-arid areas.

### Methodology

This study was carried in selected villages in Meatu and Iramba Districts from November 2011 to December 2012 for more details see Table 1 and Figures 1 and 2. Despite both districts being semi-arid, there are slight differences in terms of climatic conditions depending on agro-ecological and landscape as shown in Figure 1 and 2.

**Table 1: Villages Selected for the Study**

District	Selected villages	Village landscape and climatic conditions	Ward	Division
Meatu	Mwamanimba	Southern zone-flat terrain and dry	Mwamalole	Nyalanja
	Mwashata	Northern zone-flat terrain not dry	Mwandoya	Kisesa
Iramba	Kidaru	Western dry low lands along the Great Rift Valley zone	Kidaru	Kisiriri

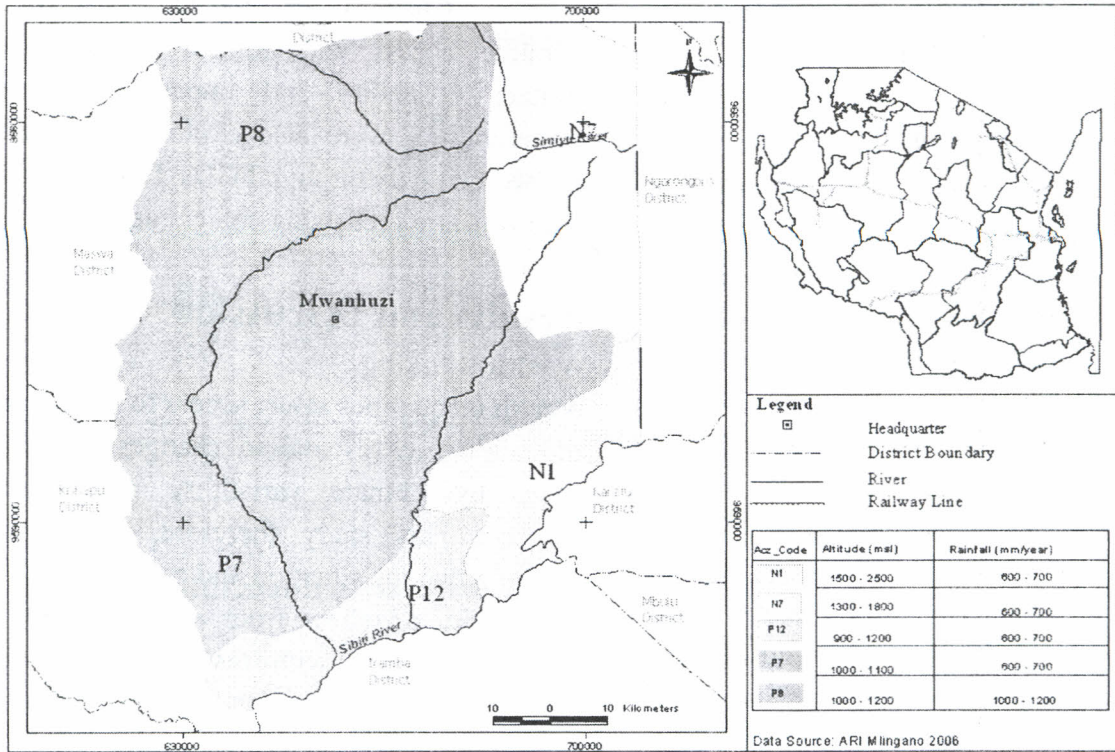


Figure 1: Agro-ecological zones in Meatu District

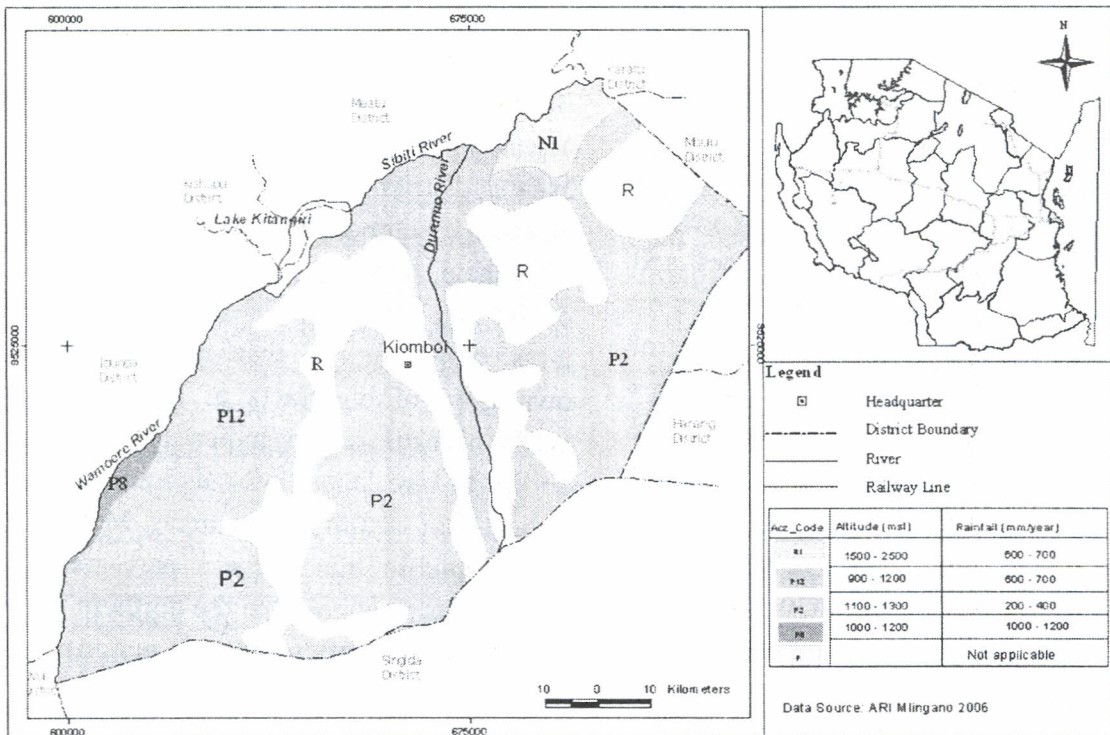


Figure 2: Agro-ecological zones in Iramba District

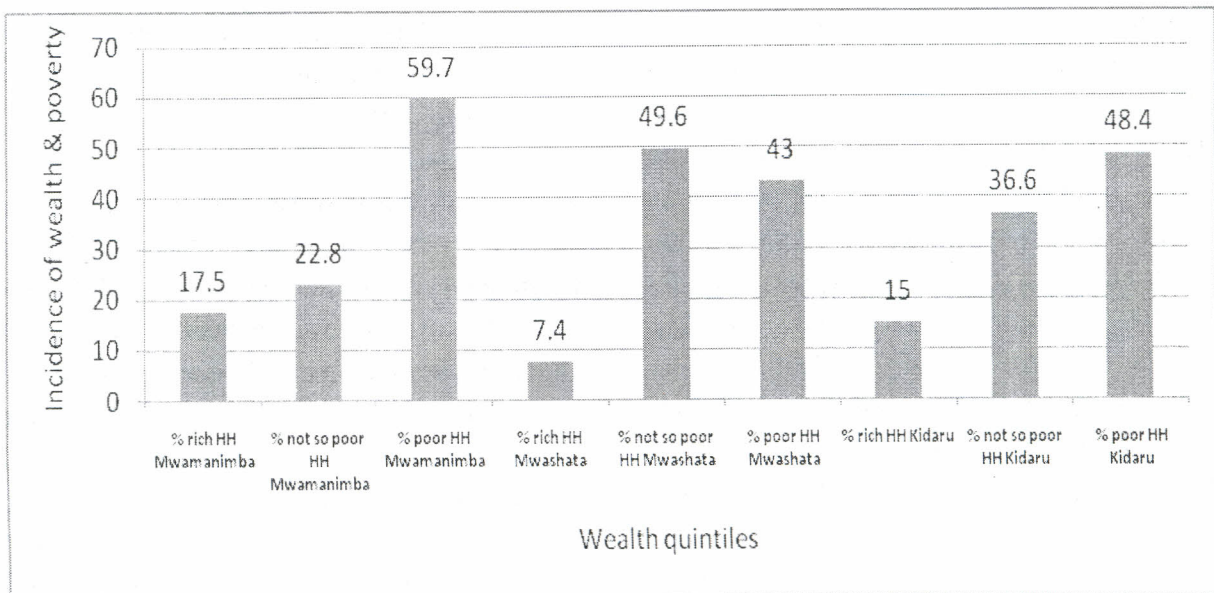
The study has adopted a Sustainable livelihood Approach (SLA) developed by DFID (1992) as analytical tool in the analysis of climate change affects rural households and their adaptation strategies. Qualitative data was collected using key informants interviews, Focus Group Discussions (FGDs), informal interviews with community members as well as observations. Participatory wealth ranking was done to find out about local perceptions of wealth and poverty, and the relative wealth levels in the village. The study used resource mapping and FGDs to collect information on gender based vulnerabilities. Examining gendered dynamics and changes in household /community required individual-level as well as community level information on various socio-economic variables. At the community level, data was collected from village leaders and key informants, women and men's focus group discussions. In addition, the Harvard framework and Gender Analysis Matrix were used to collect sex and gendered disaggregated data. Harvard framework provided both a detailed analysis of gender roles; access and control to resources and information on factors affect the genders by disaggregating their roles, access and control over resources. Moreover, activities undertaken by males (men and boys) and females (women and girls) on livelihood activities and natural resources management were identified. Daily activity tool during rain and dry season in relation to agriculture and NRM was used to determine use of time at the busiest and quietest times of the year and the variations between males and

females. Changes in gender roles and resource access and control because of climate variability and impact of other vulnerabilities were also explored for men and women only through FGDs. Discussions. Data was analysed using content analysis.

## **Results and Discussion**

### **Wealth Ranking**

Wealth inequalities affect access to resources and ability to respond to changes brought about by climate variability and other stresses. This study therefore, aimed at ensuring that the situation and concerns of all community members from different socio-economic groups with respect to climate change impacts and adaptations are known. As presented in Figure 3 out of the 315 and 470 households in Mwanimba and Mwashata villages about 60% and 43% were poor households respectively. Households categorized as rich/well off were 17.46% and 7.44 % for the two villages respectively. Based on the above observations Mwanimba village located in the south of Meatu district, which seems to be more affected by climate related factors relative to Mwashata, had relatively higher proportions of the rich group and the poor. Nonetheless, it is worth noting that in both villages ownership of big tracts of land and large herds of cattle is an indication of wealth, ability to hire labour was also an important indicator of wealth in both areas. Majority of the people in the southern part are agro-pastoralists as opposed to the northern part of the Meatu District where majority are agriculturists.



**Figure 3: Wealth Status in the Study Villages in Meatu and Iramba Districts**

Kidaru village in Iramba District on the other hand had 48.4% of the poor category and 36.6% of the not so poor. The rich constituted 15%. Regarding wealth ranking in Iramba and Meatu Districts, the definition of wealth and poverty was almost similar in the two districts. Based on wealth ranking results, the incidence of poverty was high in both districts. However, the incidence varies slightly between villages. The common feature across the villages under study is that the incidence of the poor and that of the not so poor exceed 80% in all villages. The observed percentages 48.4% (Kidaru), 59.7% (Mwamanimba) and 43% (Mwashata) is quite high when compared to levels reported for rural areas of Tanzania in the 2007 household Budget Survey (HBS). According to URT (2009), about 37.6% of Tanzanians now fall below the basic needs poverty line and 18% below the food poverty line. Nonetheless, the difference is due to the different definitions or measures of poverty used, respondents in the two districts used their local classification based on what being rich or poor meant in their locality. The

definition or conceptualization took into consideration issues such as a household's food security, ownership of assets in particular livestock, land, ability to hire labour, and general ability for the households to manage their day-to-day affairs.

### **Changes in gender relations and farming practices**

Focus group discussions (FGDs) revealed that farming systems in the communities studied were composed of livestock keeping and raising crops. A few practiced agro-pastoralism i.e. combining crop production and livestock keeping. Some differences exist between villages. For example in Mwamanimba, the majority are agro-pastoralists while majority in Mwashata and Kidaru villages are agriculturalists. In Meatu District, cotton is the major cash crop while sunflower is an emerging cash crop in Iramba District. Other cash crops are green gram, lentils, finger millet and sunflower. Food crops include sorghum, pearl millet and sweet potatoes. Maize crop, which requires 500-15000 mm of rainfall to reach its

maturity, is mainly grown in Kidaru village (Iramba) and in Mwashata in the north of Meatu District as compared to the Mwamanimba in the south. Maize is not largely cultivated in the Mwamanimba village located in the southern part of the Meatu District. This can be explained by the fact that the southern part is relatively drier than the northern part of the Meatu District. However, the varieties grown in Iramba and Meatu Districts are local varieties. It was also reported that since 1990s sweet potatoes, which used to be cultivated by women only has now turned out to be embraced by men due to its increase in importance as a cash crop.

During the FGDs, it was revealed that there has been a big increase in population in Meatu District relative to 1974 when Mwamanimba and Mwashata villages were established. The increase in population was associated with migrants in search for land for both crop cultivation and pasture for their animals. In the 1970s, the Sukuma tribe dominated both villages. Nevertheless, following migration a number of ethnic groups are found in the area. Pastoralism and farming have been the dominant economic activities. It was also observed that households were currently cultivating larger farm sizes due to on one side, the need for more output (currently households are experiencing low productivity) and secondly, due to declining soil fertility coupled with low use of improved technologies and poor weather conditions (drought). As consequence, households have to cultivate extensively to get what they used to harvest from smaller farms. For the past 30 years, good harvests were obtained from small fields but, for now, the land is less fertile hence need for more farmland. Nonetheless,

increased farm size has implication on women's workload as women perform many activities on farm.

Striga and birds were pointed out as the leading pests in the study villages. Participants in FGDs further reported that the intensity of insects, diseases and birds attacking farm crops had recently increased compared to the past. Farmers in the Meatu District started to use pesticides and insecticides in 1972, however, many lacked capacity to purchase the same. Both local/indigenous and modern/conventional pesticides are used, for example in sorghum farmers are using local insecticide known locally as '*mtundwa*'. According to the FGDs there have been slight changes in terms of use of agricultural implements, the use of oxen and tractors in land preparation was on the increase. However, participants in all three villages admitted that the hand hoe still dominates when it comes to cultivation. The use of ox plough has seen an increasing trend since 1968 in Meatu. It was further noted from the FGDs that a few farmers in Mwamanimba and Kidaru village had started practicing irrigated farming along the river valleys using generator driven water pumps following the continued unreliability of rainfall.

#### **Water availability and livestock feed (pastures)**

In the study villages, three types of water sources were mentioned; water taps, wells and rivers. Water levels in these sources fall down during August – October every year and create a serious water shortage for both human and livestock consumption. During the dry season women, dig wells along seasonal river courses to get water for domestic consumption. As for Kidaru

village, household get water from water taps and others are using rain-harvested water. Due to water shortages for human consumption and livestock, women walk very long distances in search of water for domestic consumption; men and boys search for pastures and water for the livestock far away from their villages at times in other districts and or regions. Normally they stay away for 3 to 5 months coming back during wet season. In Meatu, this practice is locally known as '*lubaga*'. Participants in the FGDs pointed out that, in the past, *lubaga* areas were readily available in neighboring villages; during these times, wives had the opportunity to visit their husbands. Currently, wives are unable to visit their spouses because *lubaga* is very far away from the villages. Women and children who left behind face a number of problems in making ends meet. Sometimes men who migrate stay away permanently. It was noted in all villages in Meatu and Iramba District that it was not feasible to set aside areas for pasture, as demand for land is very high. In addition, it was reported that whereas it was possible before the 1990s to graze livestock freely, things have now changed: currently, livestock keepers have to pay for animal feeds in the form of crop residues (maize stover, sorghum and millet remains, and beans straws etc.) in other people's crop fields. Lack of pastures sometimes necessitates the selling of animals during dry season at a very low price. This practice destabilizes households' savings as some save in terms of livestock both small (sheep and goats) and large (cattle).

#### **Food storage and food security situation**

Results from the FGDs and in-depth interviews show that villagers store their staples (cereals and pulses) using both

local/traditional and modern storage techniques. Generally, the local/traditional methods' were more popular, these are used by about three quarters of the farmers. Traditional methods commonly used include use of '*muarobaini*' mixed with ashes and manure. Despite acknowledging the effectiveness of industrial chemicals towards preserving cereals, most villagers cannot afford them. According to Mukani (2003), post-harvest crop losses in Tanzania amount to 30% of the harvest. IFAD (2011) also points out that Tanzania has high post-harvest losses (40 per cent for perishables and 20 per cent for grains) and that this and inefficient distribution systems coupled with low incomes end up contributing to food insecurity. Therefore, whereas the traditional methods may work when they fail households are higher risk and in particular those in semi-arid areas as those in Meatu and Iramba Districts.

During FGDs, it was noted that in 1980's and 1990's there was reliable and sufficient rainfall in the study areas. Shortage of rainfall was according to the FGDs, a major cause food insecurity in the study areas. Generally, November to April are known to be months where household experience food shortage. More than half of households in the study areas experienced food shortage during this time. During this period food, prices tend to go up and most households are not able to afford buying food due to their low incomes. Apart from the changes in weather condition (rain in particular), the FGDs participants reported that farmers tendency to concentrate on cash crops relative to food crops is another cause of food insecurity in the studied villages. For example, most households in the Meatu District cultivate cotton compared to sorghum or maize. In most cases, it is the older people who



cultivate. This observation suggests a number of things, first, households may not be earning enough from their cotton sales due to either low production or low prices offered by buyers; if they were then the issue of leaning on the cash crop would not be an issue. Furthermore, income from cotton can be used to buy food either from other households within the village or district or from far beyond and this would still ensure a household's food security. Secondly, older members in the studied areas may be less risk takers and that is why they are continuing to grow those crops better suited to the environment based on their numerous years of experience.

Both men and women felt that for the past 20 years households in the study areas had plenty of food because there were enough rains. The situation has changed recently as there are food shortages because of drought and land scarcity. Both men and women members in the FGDs indicated that caSUAL labour is the most common strategy used by people to overcome food and income shortages in the studied areas. Those in need are uSUALly hired to attend rich households' farms within the village for 5,000/= (TSH) wage to cultivate a 70 feet × 70 feet farmland. Other households sell livestock at a very low price (cattle TSH 120,000 and goat TSH 10,000/). Crop borrowing – to be paid with interest after harvests: one sack = 2 to 3 sacks depending on agreements. Some households lease land for only TSH 5,000/- per season. Food aid by the Government and other institutions is another food insecurity coping mechanism used in the study villages. Outmigration of male members to places where they can get work for up to 6 months is another strategy used as reported by both women and men. However, it was noted that outmigration of male members affects families. For some of the men who migrate

do not remit to their families, hence women experience difficulties in making ends meet on their own because of food, shortage households may reduce the number of meals or have no meals at all. Children of school going age miss or drop out of school due to food shortages. Consequently, some search for caSUAL jobs to earn income that may help them meet some of their needs. Engagement in non-agricultural activities has become popular way of coping with low production from agriculture. Men are engaged in brick making and selling of cash crops such as sunflower seeds. Women were reported to engage in petty trade such as selling food (*mama lishe*) and vegetables from their own gardens; selling fish, porridge, and local brew. Currently, women do not entirely depend on men for family needs as they have other source of generating income. This change is because of awareness created on gender equality but also due to interaction with people from different areas.

#### **Fuel wood collection**

In Meatu, women and children (boys and girls) are the main collectors' of fuel wood collected from far, about a 10 hours walking distance due to lack of tree around villages. In the past 20 years, women were collecting fuel wood near their homes (about ½ to 2 hours walking distance). In those years, there was no need for fuel wood collection for future use, because firewood was scattered everywhere in the villages. Due to fuel wood scarcity during dry season (September to October), fuel wood collectors have to stay in the forest for one week in order to collect enough fuel wood to be used during wet season. Ox-carts are used to transport the fuel wood collected at the cost of 10, 000/= (Tanzanian Shillings (TSH) per trip. During the FGDs, it was reported that some women encounter sexual harassment

while searching for fuel wood far away from home.

From the daily activity schedules study in Kidaru Village, it has been observed that men have more hours of rest compared to women during both the rainy (4 versus 1) and dry (5 versus 2) seasons. Currently, women spend more time fetching firewood as compared to the past. They spend more than 5 hours daily collecting fuel wood, which they keep to use during farming season (approximately 6 months). This trend has changed, in the 80's they only spent about 3 hours in a day and they used to carry the firewood on their heads. This change is because of the fact that the closest area they used to collect fuel wood is now a new settlement for emigrants. Furthermore, it is also used for farm expansion. The FGDs additionally pointed out that during the dry season, women and some men use most of their time collecting firewood. However, most of the firewood collected by men is for sale.

Coping strategies related to source of energy include control of tree cutting in farmer's field, restriction of planted trees and introduction of energy saving stove technology: In 1990s women in Meatu were trained on how to make energy saving stoves (*Majiko sanifu*) using clay. The stoves are able to preserve heat and use less firewood. It was also reported that there are appropriate technologies used to reduce heavy workload in performing day-to-day activities in the households especially for women; for example, carrying water from river using ox-carts. In Meatu, in during 2000s there was a program on trees planting conducted by HASH (Hifadhi Ardhi Shinyanga) and Investment on Children and their Society (ICS). This can partly explain why currently,

some few trees can be seen in the Mwashata and Mwamanimba villages. Table 2 shows a summary of climate change related events and adaptation strategies used by both men and women in the study villages.

## Conclusion

Based on study findings, it is concluded that poverty is high in all of the villages under study and that the incidence is over 80% in Meatu and Iramba Districts. Therefore, climate change has exacerbated other problems more so to women who in most cases do not control and own productive resources including land and livestock. Climate change is becoming a threat to the farming systems and to the livelihoods of the people in general. Both men and women in all study villages are vulnerable to multiple factors including climate change particularly drought, loss of soil fertility, scarcity of grazing land, outmigration, crop pests, human and livestock diseases. Interestingly, changes in farming system and other activities that are fundamental for the livelihoods have not come without gender implications. For example, emerging of cash crops disadvantages women because cash crops are men's crops in the study districts. In addition, increasing distance for collecting firewood and water is affecting women more as compared to their male counterparts; women are responsible for fetching water and collecting firewood. Therefore, the workload is not only increasing to the women, but also to the children especially the girl child. Impacts of climate change are also changing gender roles, as some of the female roles are now being performed by men.

**Table 2: Climate change related events and adaptation strategies**

Event	Gender Mostly Affected	Coping/Adaptation Mechanisms	Strategy Mostly Used By
No food due to crop failure	Women	Exchange of cows and food	Men
		Selling cattle at lowest prices	Men
		Feeding on only wild vegetables	Women
		-Eating only one meal a day (sometimes, pollidge or <i>ugali</i> ) -Eating dried sweet potatoes ( <i>crips</i> )	Women
		Crop borrowing to be paid at harvest with some interest	All
		Diversification to off farm activities	All
		Outmigration to other regions such as Rukwa, Mbeya, Morogoro, Singida and Dodoma	Men
		Farm lease	All
		Selling labour	All
		School dropout	Girls/boys
		Food aid (LGAs, churches and NGOs)	All
		Forming self help groups	Women
Drought		Use of small scale irrigation using generator driven water pumps - gardening	Men
		Use of improved varieties which are drought resistant	All
Shortage of pasture/ Loss of ' <i>ngitiri</i> '	Men/Women	Grazing in game reserve -Men outmigration -Sale of animals at low prices	Men
Occurrences of crop diseases	Women	-Use of local disease resistant varieties	Women
Shortage of water	Women/girls/boys	Use of ox-carts to reduce workload	Women
Death of animals	All	Sale of animals at low price	Men
Shortage of fuel wood	Women/girls	Introduction of energy saving stoves technology and solar power	Women
		Utilization of crop straws for energy (cotton, maize, sorghum)	Women
		Use of ox-carts to reduce workload	Women
		Introduction of forest reserves	All
		Afforestation activities	All
Shortage of pasture	Men	-Grazing in game reserve and outmigration -Searching for new lands -Buying hay for animal feeds	Men
Loss of soil fertility	All	Use of animal manure	All
Occurrence of human diseases	All	Use local indigenous medicines	All
Loss of forests	Women	-Introduction of forest reserve -Limited use of forest resources	

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