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Farmers' Awareness and Understanding of Climate Change and Variability in Central Semi-arid Tanzania

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Abstract

This study investigated the farmers' awareness and knowledge of climate change and variability farmers in Tanzania. The study applied a qualitative approach in data collection and analysis. It used interviews and focus group discussions as data collection methods. The study population comprised of farmers. The qualitative data was subjected to content analysis. Key findings show that farmers are aware of climate change and variability and have coping and adaptation knowledge. Despite being aware and practicing adaptation farmers still do not have a clear understanding of climate change and variability. The factors, which affect farmers' awareness and understanding, are the types of media used in communication, communication gaps, unreliable and untimely information, low income and budget constraints. As such, the study recommends intensive awareness and sensitisation, timely access to information and frequent contacts between researchers, extension officers and farmers.

Keywords: Awareness, information, knowledge, climate change, agricultural development

Introduction

In Tanzania agriculture provides 85 percent of the exports, employs 85 percent of the workforce, contributes 75 percent of foreign exchange earnings and contributes about 25.8 percent to the national Gross Domestic Product (URT, 2008). To improve agricultural production, coping and adaptation to climate change and variability, farmers need timely, relevant and reliable information. Information with such qualities has the potential of facilitating the farmers' choices and decision-making. The understanding of climate change and variability is essential for adopting innovations and embracing initiatives developed for coping and adapting to climate change and variability (Dhaka, Chayal, & Poonia 2010). Considering that 70 percent of the income from rural areas of Tanzania—who mostly are farmers—depend on agriculture (URT, 2006), climate change and variability awareness and understanding is critical for the livelihood existence.

Jamison (2010) noted that climate change first emerged as an issue of public concern issue in the 1970s and 1980s and grew into political significance in the 1980s and 1990s. It became a topic on the international political agenda in 1992 at the United Nations Conference on Environment and Development in Rio de Janeiro where it was declared an environmental problem. From the 1990s to 2000s the International Panel for Climate Change (IPCC), through its assessment reports, raised more awareness and drew the attention of the public to climate change which had become an extensive political problem. Ensor and Berger (2009) further noted that climate change became a crucial element in development in the early part of the twenty-first century.

To promote education, awareness and understanding on climate change and variability issues globally, the United Nations Framework Convention on Climate Change (UNFCC) formed a legal framework to ensure that countries adhere to the laws and regulations set and agreed upon by member states. Article Six of the UNFCC and Article Ten (e) of the Kyoto Protocol are exemplify the commitment of member states to espouse climate change and variability. The two articles stress the necessity of developing and implementing educational and public awareness programmes on the effects of climate change and variability, promoting public access to information on climate change and variability and its effects, strengthening national institutions and training scientific, technical and managerial personnel (UNFCC, 2012).

To address issues on awareness in Tanzania and Malawi, a Climate Change Adaptation Africa (CCAA) project was established. CCAA was a jointly managed project by the two countries, which began in 2007 and ended in 2010. Its goal was to promote farmers' adaptation by disseminating information, facilitating access and using new innovations while creating awareness among farmers on climate change and variability.

Ensor and Berger (2009) noted that farmers' ability to adapt to changed circumstances and adopt different livelihood strategies is limited because they have little access to resources, new knowledge and opportunities for learning new skills. To increase harvests, improve farming and hasten efforts in adaptation and fathoming climate change and variability, frequent education,

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awareness, knowledge become critical components in improving farmers' understanding (Lorenzoni, Nicholso-Cole, & Whitmarsh 2007).

Despite the role of awareness and understanding in adaptation, there are contradictory findings on farmers' awareness in Africa. Deressa, Hassan, Ringler, Alemu and Yesuf (2008) and Orindi and Murray (2005) observed that awareness of climate change and variability was generally low in Ethiopia and East Africa, respectively. Contrary to the findings of these studies, other studies such as the BBC World Service Trust (2010), Jonge (2010), and Mertz, *et al.* (2008) indicated that farmers were aware of changes in climate in respective African countries.

Although farmers in Maluga and Chibelela villages in Tanzania receive information and education on climate change and variability from extension officers and researchers through the CCAA project, their level of awareness, understanding and factors affecting their awareness and understanding of climate change had not been ascertained. This study, therefore, investigated the farmers' awareness, understanding and factors influencing awareness on climate change and variability.

Methodology

This study was part of a broader PhD research (Elia, 2014) which investigated how access to, and use of, information enhances the adaptation to climate change and variability in the agricultural sector in Central Tanzania. Data were collected from farmers in Maluga and Chibelela villages in Singida and Dodoma regions, respectively. The two study villages were randomly sampled from the four villages (including Laikala and Sanjaranda), which had been exposed to the CCAA project in the Dodoma and Singida regions.

Eighty-four (84) farmers from the two villages were chosen using purposive, convenient and snowballing sampling techniques to participate in the interviews. Thirty-six (36) respondents were from Maluga village whereas 48 respondents were from Chibelela. Two Focus Group Discussions (FGDs) with eight (8) respondents each were conducted in each village. The FGDs

involved respondents who were randomly chosen from a list of households available at the village office. The study focused on farmers who engage mainly in crop production.

In this study, qualitative research approaches were used to collect data. Interviews and focus group discussions (FGDs) were tools applied in collecting data from respondents. The study population was made up of farmers. Both interview guides and FGD checklists were used to collect information from the farmers on various issues related to the awareness and knowledge to adapt to climate change and variability. Data collected were analysed qualitatively. Qualitative data from the interview schedules and FGDs were arranged into themes.

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Findings of the Study

The section has three sub-sections which present results on farmers' awareness, factors influencing awareness and understanding and farmers' understanding on climate change and variability.

Awareness on Climate Change and Variability

Farmers were asked to indicate their awareness of climate change and variability. Findings from the interviews and FGDs indicate that farmers were aware of the term "climate change and variability". In fact, the majority 78 (93%) of farmers who took part in the semi-structured interviews were aware of climate change and variability and only six (7%) were not. The in-depth interviews with district extension officers also indicated that the farmers were aware of climate change and variability. However, the farmers were more familiar with the terms "weather changes", "rainfall" and "drought" rather than "climate change and variability". During the FGDs, when the farmers were asked whether they aware of climate change and variability, one farmer responded: "Yes I am aware, I have heard about it, climate change is related to low rainfall and increased heat." Another farmer said: "Facilitator, I am aware of it. It is the change of weather; it causes prolonged drought and erratic rain". The interview and FGD findings of both sets of farmers, that is those who had received training and those who had not, showed that they were aware of climate change and variability.

Factors Influencing Awareness and Understanding

During FGDs with farmers and in-depth interviews with extension officers, the participants were asked to explain the factors which affected their level of awareness on climate change and variability. The farmers identified late response from extension officers, unreliable seasonal forecasts, extension officers, researchers and village leaders' misleading information were factors that affected their level of awareness. Elaborating on these factors, one farmer said, "Extension officers delay giving us information on what to do, you may try to consult them but you may fail". Another farmer said, "These days we receive weather forecast information but it is not reliable. You fail to trust such information as it comes. It is different from how it was

previously". Furthermore, a farmer commented, "Our village leaders sometimes don't have a clear understanding of climate change. They give us information which is different from that the extension intended to give". With regard to the timing of awareness programmes, a farmer narrated, "Yes, sometimes it is a challenge. Some experts come to create awareness but we find ourselves busy with farming activities".

On the other hand, the extension officers reported attitude to change, low income/wealth; inadequate government budget, ignorance, a lack of preference for educational and awareness-raising radio programmes and presence of farmer groups greatly affected farmers' level of awareness of issues related to climate change and variability. An extension officer from Chibelela narrated, "Our farmers still embrace old farming practices. They have a negative attitude to new farm methods and inputs such a seeds. Most of the farmers tend to ignore newly-introduced research-based innovations and continue with their conventional farming methods". He further explained, "You can call them to a meeting to inform them on new agricultural innovations, only few turn up." Another extension officer said:

> *Mr. Researcher, you have to understand that most of our farmers are poor. They don't generate enough income to use for basic needs and purchase farm inputs. To receive their attention and create more awareness farmers need to know how they will benefit from us. So if you don't give them free farm inputs they won't see the essence of even participating in meetings. They therefore end up not receiving new information and awareness.*

The extension officer further explained that when they convened meetings with farmers, "Some don't come as they are engaged in other economic activities to earn a living. That makes it difficult to reach farmers to create awareness and impart knowledge. We thus mostly use farmers' associations and groups to deliver the message". Another extension officer expounded, "The government sets a very low budget for extension services and information dissemination. We, therefore, can't go frequently to villages when farmers want consultations. We were able to reach the farmers in this village because of the project". The extension officer also said, "Despite having researchers and projects coming to rural areas, radio is still the most preferred media in creating awareness to farmers". The extension officer further narrated that "these days our

farmers, especially young ones less prefer agricultural-related programmes which are educative. They mostly prefer entertaining programmes such as music".

Furthermore, a documentary analysis reveals various factors which affect the farmers' awareness on climate change and variability. These factors include the kind of media used, communication gap, culture, inadequate education among farmers and difficulties inherent in accessing information on climate change and variability. Some of these factors were reported by the extension officers. One of them said, "…exposure is still a problem to many farmers as many of them haven't witnessed ways of adapting to climate change and variability from other people". Another officer said, "We need more feedback, knowledge and updates on climate change and variability at the district level". Another extension officer narrated, "Farmers are used to the culture of receiving subsidised agricultural inputs from the government and most of the farmers have not changed their cultural farming attitudes: they prefer free agricultural inputs for their farming practices".

Farmers' Understanding of Climate Change and Variability

Farmers were asked to explain their understanding of climate change and variability. From interviews and FGDs it emerged that the farmers understood climate change and variability as a change in the environment and vegetation cover, reduced availability of water, increased drought, deforestation, disappearance of endemic tree species and increased wind velocity. Other described climate change and variability in terms of increased population, reduced soil fertility, increased insects and diseases and use of pesticide in farming. One farmer explained, "Climate change and variability is related to weather and temperature". Another farmer said, "Climate change and variability is associated with high temperature and drought". The other farmer stated "Climate change and variability is linked to deforestation, erratic rainfall and increased wind".

Farmers described other factors which are directly associated with climate change and variability. These are environmental pollution, industrial pollution, increased heat, temperature and rainfall. Many of the farmers believed that erratic rainfall patterns were a caused by deforestation and it was the cause of climate change and variability. Other factors highlighted by

farmers, as extensively contributing to unpredictable rainfall, included climate change and variability, were overgrazing, farm expansion and population increase.

The study findings also indicate that only a few farmers could associate climate change with increased carbon dioxide pollution from factories. Findings showed that those who could relate, understand and explain more explicitly climate change and variability seem to have initially been exposed to advanced training, workshops or who had an advanced level of formal education.

During the FGD in Chibelela village, a farmer, stated, "You know, Mr. Facilitator, despite education and awareness programmes that have been done, still most of us are not in a position to clearly understand and interpret issues related to climate change and variability". The complexities of farmers' understanding of climate change and variability emerged when another farmer, asked rhetorically, "Why there are areas with forests but still the same areas don't receive enough rainfall?"

Findings from both the interviews and FGDs showed that most of the farmers in the study area associated climate change and variability with erratic rainfall and drought/famine. Farmers designated a good and bad year based on the amount of rainfall received, the drought and harvesting, which, to a greater extent, described their understanding of climate change and variability. Supporting the findings, one of the farmers in Chibelela village stated, "In the past, we used to throw seeds such as tomato, peas and maize on the soil without adding fertilizer or pesticide and have a hefty harvest, but these days one cannot plant that way and expect harvest". This was a view that the majority of the villagers upheld.

These research findings indicate that farmers' awareness, understanding and adoption of adaptation strategies towards climate change and variability is, to some extent, influenced by incidences of drought, food insecurity, water scarcity and reward from an innovation, NGOs and government interventions.

Discussion of the Findings

This section discusses issues on farmers' awareness and knowledge on climate change and variability and factors affecting the awareness and understanding of climate change and variability among the farmers in the study areas.

Farmers' Awareness and Knowledge

Findings of the study revealed that farmers in the study areas were aware of climate change and variability. These findings are similar to those of Mertz, *et al.* (2008), the BBC World Service Trust (2010), Jonge (2010), Kadi, *et al.* (2011).The farmers' awareness could have been created by the training carried out under the CCAA project. Training is one of the effective climate change information communication strategies which foster learning. Such training gives farmers a platform for seeking clarifications and feedback on farming activities related to climate change. Patt (2005) found that farmers in Zimbabwe, who received training, were better placed to adapt farming methods than those who had not.

Although the farmers were found to be aware of climate change, only a few of them understood what climate change and variability entails. The study findings indicate that the farmers who seem to understand more on climate change and variability appeared to be more exposed to and in one way or another had direct contacts with researchers and/or extension officers. These findings confirm those by Rogers (2003, pp. 171,172, 222, 288-291), who observed that an individual's level of awareness can affect one's ability to acquire knowledge and adopt innovations.

Few reviewed studies of Mbow, Reenberg and Diouf (2008) in Senegal and Barbier *et al.*(2009) in Burkina Faso, Nhemachena and Hassan (2007) in South Africa, Mengistu (2011) and Deressa *et al.* (2008) in Ethiopia, Hisali, Birungi and Buyinza (2011) in Uganda, Chayal and Poonia (2010) in India, Elia (2014), Mongi, Majule and Lyimo (2010) and Lyimo and Kangalawe (2010) in Tanzania, indicate that farmers have acquired farming knowledge which helped them adapt to climate change and variability. On the basis of the findings of these studies, it can be argued that farmers seem to be aware of changes in weather and climate but largely fail to

contextualise a clear relationship between global warming and the envisaged impacts in their respective localities.

The findings of this study corroborate with that of a research conducted by BBC World Service Trust (2010) in 10 African countries (Democratic Republic of the Congo, Ethiopia, Ghana, Kenya, Nigeria, Senegal, South Africa, Sudan, Tanzania and Uganda). The study found that public understanding of climate change and variability was low and that people could not link climate change with increasing levels of green-house gasses. It remains complex and difficult for farmers to understand under what circumstances the pollution done in developed and highly industrialised countries contributes to the global warming in another different area in a different continent. This might be attributed to the complexities in understanding climate change and variability by ordinary farmers, which according to Ensor and Berger (2009), is influenced by their level of education.

Understanding climate change and variability issues encompasses high cognitive scientific knowledge, which mostly researchers and scientist possess. This calls for more efforts to unpack and repackage scientific information on climate change and variability to the level of understanding of ordinary farmers. Difficulties in contemplating climate change and variability by farmers in Tanzania are not exceptional. A study by Ashworth *et al.* (2011) in Australia showed that people were aware of climate change and variability but were uncertain and lacked adequate knowledge and understanding of its causes.

However, to hasten efforts to promote adaptation, attain sustainable development goals and ultimately alleviate poverty, farmers need to understand and internalise as well as continuously embrace good conservation and agricultural practices. Understanding climate change and variability is essential as farming practices will continue changing. As such, farmers need timely information and feedback on what they should do in a particular season to have adequate harvests. Climate change and variability is still not well known to many and is less articulated by most of the farmers.

Farmers' attitude ought to change for them to cope with the climate change and variability effect. To facilitate the change in attitude towards understanding and effective adoption on new agricultural practices, the use of interpersonal sources such as farmer groups, farmers' networks and associations is crucial in knowledge acquisition, transfer and learning from early adopters. These sources are more engaging and, to a large extent, can promote changes in a society especially in rural areas where access to resources and literacy levels remain low. The channels build trust, understanding and connection between farmers towards a common goal of adapting to climate change and variability. The combined effect of using mass media and interpersonal media is supported by the Diffusion of Innovations. According to Rogers (2003), awareness and knowledge is effective when the mass media and interpersonal communication channels are use in communication to influence change.

This paper contends that, for climate change and variability adaptation efforts to have a positive impact on farmers, researchers and policy-makers should capitalise on two trends observed: The increased farmers' awareness levels, and the adverse effects of climate change and variability observed and experienced in various locations of Tanzania. In recent years, farmers have observed recurring incidences of adverse impacts of climate change and variability. Their personal experiences with climate change impacts are important in communicating and raising awareness among the farmers. Farmers, who have recently faced frequent drought, floods or diseases, are more likely to listen and/or accept new farming practices knowledge from experts than those who have not gone through such experiences. Rogers (2003), Lorenzoni and Pidgeon (2006) and Dhaka, Chayal and Poonia (2010) found personal experience and knowledge to be crucial factors in improving awareness and knowledge.

The findings of this study affirm that, although farmers do not adequately understanding climate change, they are adapting. Education to increase their resilience and for them to embrace effective mitigation and adaptation measures should be aimed at fostering their understanding and interpreting climate change indicators which are more discernible to farmers in their locale and less provision of scientific indicators which are hard to fathom. In this regard, Lee,

Markowitz, Howe, Chia-Ying Ko and Leiserowitz (2015) noted that, among other predictors, changes in temperature were important in creating awareness on climate change and variability among people in many African countries. Recently erratic rainfall pattern has been evident in most of the African countries, hence making it a crucial factor to be considered in efforts aimed to raise awareness and understanding on climate change.

Factors Influencing Farmers' Awareness and Understanding

Despite findings showing farmers were aware of climate change and variability, they did not understand climate change and variability in earnest. The findings of this study help to categorise factors affecting farmers' awareness and understanding as media and communication agents; inadequate government budget, low income, inadequate knowledge and culture.

Poor communication was one of the factors influencing farmers' awareness and knowledge on climate change and variability. These findings are similar to those by BBC World Service Trust (2010), which showed that information on climate change and variability is not well communicated to the people. Communication barrier entails two distinct forms. The first form is associated with the service provider (government or private) media not being able to reach all the intended people due factors such as poor signals or budget constraints. Poor signals are infrastructural barriers which affect farmers' access to information. Studies by Anderson (2009), (2009), Boykoff (2008) and McBean and Hengeveld (2000) further attest to the challenges in how the media affect farmers' awareness and understanding.

This scenario can also be a result of low understanding of climate change and variability issues from information disseminators such as media practitioners or extension officers (Corner, 2011; Mutekwa, 2009; McBean & Hengeveld 2000). Low understanding can be caused by farmers treating the climate change problem as a distant problem (Ashworth *et al.*, 2011; Orindi & Murray, 2005) or propaganda and exaggeration (Ashworth *et al*., 2011; Hengeveld, 2000). As a result, poor communication slows down the change in cultural barriers such as die-hard attitudes.

The other form is farmers' low income levels. Low income levels prevent the farmers from purchasing gadgets and reliable electricity/batteries to receive the information from the media. In the rural areas of most developed countries, farmers lack access to reliable power; they depend on other sources of energy such as batteries or solar. Lack of these sources of electricity prevents them from accessing information on climate change and variability. This situation necessitates farmers to seek information from other sources such as neighbours who can easily be reached and transfer the 'technical know-how'. Nonetheless, neighbours may also distort the information they give to the farmers with limited access to information sources as climate change and variability is still not comprehensible to many farmers. This study, therefore, contends that even with the availability of radio and TV, a farmer can still fail to access valuable information on climate change and variability as a result of low income. This situation calls for the provision of affordable, reliable and relevant information from information sources to the farmers to induce them to change their attitude towards climate change and variability. Attitude change can promote the adoption of scientific information disseminated and engender effective adaptation among the farmers in the localities.

Conclusion and Recommendations

There has been progress in creating awareness on climate science and predictions of rainfall rates (Ensor & Berger, 2009). Despite an increase in awareness and farming knowledge practices, farmers still fail generally to adequately understand what climate change and variability entail. Education and awareness programmes on climate change and variability should be intensified to create a link between climate science and its impacts on farmers. In this regard, farmers should be given ample time to adopt innovations on climate change as the decision to adopt and adapt to new practices is complex and needs adequate time (Rogers, 2003). The study further concludes that farmers are currently adapting and have been adapting to changes in climate since then.

To overcome the challenges in farmers' awareness and knowledge acquisition, the study recommends the intensive use of both of mass media and interpersonal channels of communication. Proper use of interpersonal channels such as social networks will give farmers

an opportunity for sharing information and knowledge and experiences in a form of participatory learning. Besides, the packaged information to be communicated with the farmers should be appropriate, well-structured and clear for ordinary farmers to understand and utilise. The study further recommends regular awareness and sensitisation programmes through education and dissemination of information on climate change and variability from the government, researchers and scientists to other agricultural stakeholders such as extension officers, village officers, journalists, news editors, farmers, civil societies and NGOs. The research also suggests the provision of easy-to-use, timely, and relevant information through media and government agencies, infrastructural set-up and market information to empower farmers economically.

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