

Local Community Perceptions on Causes of Climate Change in Dry Areas of Rombo District, Tanzania

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Abstract: *The study assessed community perceptions on the causes of climate change in the drought area of Rombo District in Tanzania. Corroboration of the research findings were made by employing different methods of gathering data including questionnaires, focus group discussions and interviews. While quantitative data were analysed by statistical package for social science software to generate descriptive statistics, qualitative data were analysed thematically. Data were mainly presented by using tables, figures and the participants' narrations or voices. Results indicated varied perceptions on the causes of climate change that are shaped by levels of education, age, sex, marital status and possession of communication facilities. Despite the varied perceptions on the causes of climate change, the anthropogenic factors were frequently mentioned by the study participants. Thus, the study recommends on creating awareness among members of the studied community through education on the actual causes of climate change for effective intervention measures.*

Key words: Climate change, community perceptions, drought area

Introduction

There exist different schools of thought on the causes of climate change. A report by the Intergovernmental Panel on Climate Change (IPCC, 2007) attributes the current climate change primarily to human activities and secondarily to natural processes. In this regard, Singer (2008) also observed that climate change is a natural phenomenon. The difference between human and nature-induced climate change has also been reported by Cunningham and Cunningham (2004) that human-induced climate change takes place rapidly, whereas nature-induced change takes place gradually. Probably, this distinction was not taken into account when Singer (2008) considered the current climate change just as a natural phenomenon.

Conversely, local people relate climate change to social and spiritual causes. The Maori of New Zealand, for example, believe that climate change is induced by lack of spirituality, cruelty and selfishness (King *et al.*, 2008). A reviewed literature by Kemausuor *et al.* (2011) on the perceptions of causes of climate change revealed that people perceived hailstorms as punishment

from God which tends to happen particularly when young women aborted their pregnancies. The review further indicates that increased temperature is caused by the sun coming closer to the earth. A study by Speranza *et al.* (2010) in semi-arid areas of the former Makueni District in Kenya also indicates that communities treat drought as God's plan and, therefore, cannot be mitigated.

Moreover, Orlove *et al.* (2010) found that the indigenous of Southern Uganda believed that everything including climate is controlled by God. Similarly, Mertz *et al.* (2009) reported that farmers in the Rural Sahel perceive weather as a divine intervention over which they were powerless. Prabhakar *et al.* (2009) also reported that local people in Japan believed the actions of other communities in their locations were more responsible for changes as the study could not find any poor management practices within the local community which would have contributed to the global problem such as climate change.

Similarly, Egeru (2012) asserts that Iteso people in Eastern Uganda believe that they were not responsible for inducing climate change as they regarded themselves as peace-loving, generous and socially responsible people. These characteristics, according to them make Iteso people steer away from God's or ancestral punishment. This is because they believe that climate change is a punishment from God and ancestors for failing to love each other. Tambo and Abdoulaye (2012) also revealed that farmers in the Nigerian Savannah have a belief that climate change is a punishment from God because of sin as well as disobedience and unfaithfulness to Him.

Studies by Fundisha *et al.* (2016) revealed the existence of climate change in Rombo District evidenced by increased temperature and wind, decreased and unreliable rainfall and recurrent droughts. Mushi and Mamkwe (2015) also found that drought and unreliable rainfall were the main effects of climate change in Rombo District. The recurrent drought in the lowlands of Rombo District caused food insecurity, water shortages and pasture deterioration (Mongula, 2000).

However, none of these studies attempted to assess the perceptions of local community on the causes of climate change. Therefore, this study assessed the perceptions of local community on the causes of climate change for appropriate intervention measures.

Methodology

The study was conducted in the drought area of Rombo District in Kilimanjaro Region, Tanzania (Figure 1). The figure shows that the district is naturally divided into two agro ecological zones: lowland (drought area)

and highland. The drought area of the district receives average annual rainfall and temperature of about 400 mm and 30 °C respectively (Meena and O’Keefe, 2007).

This condition creates semiarid like conditions with recurrent droughts. The dominant crops grown are those adapted to little rains which include sunflower (*Helianthus annuus*), groundnuts (*Arachis hypogaeae*) and sorghum (*Sorghum bicolour*). The drought area was chosen with the idea that her dwellers are more aware on the causes of climate change due to prolonged exposure to the recurrent droughts.

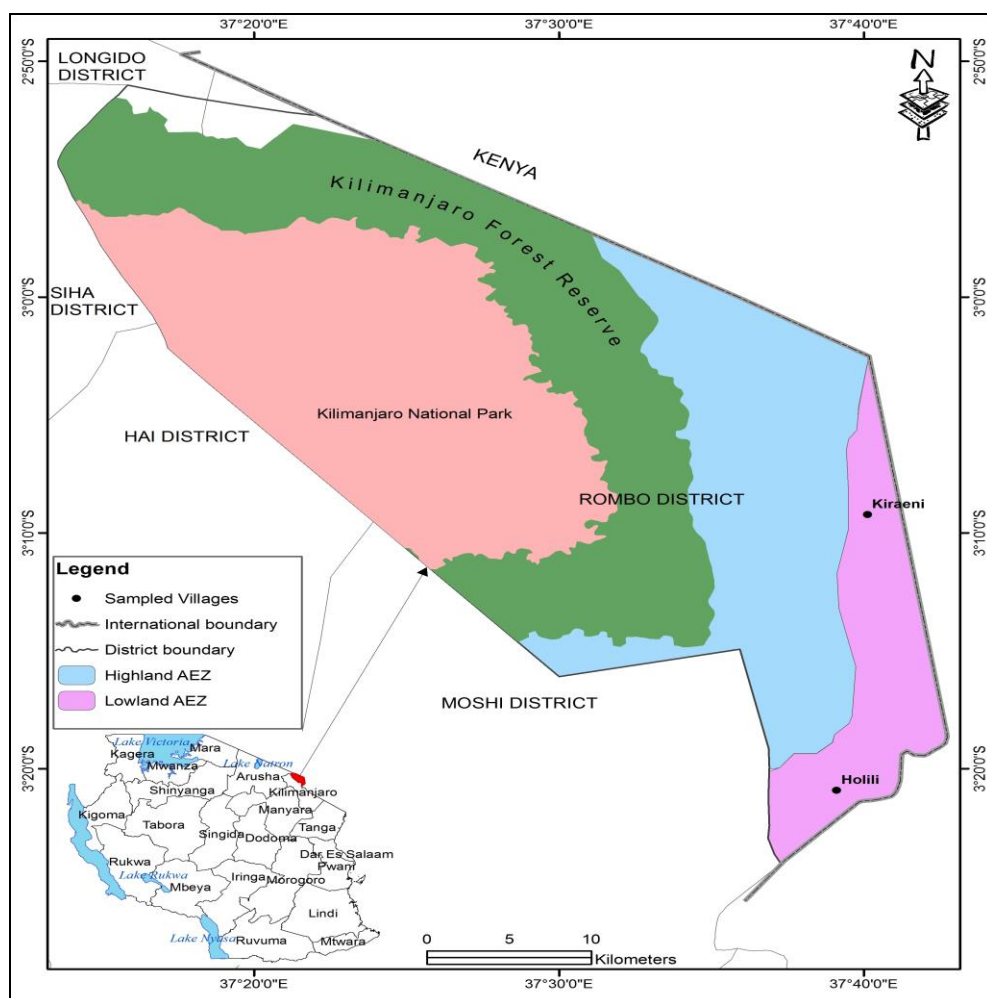


Figure 1: Map of the study area

Primary data were collected using questionnaires with open and closed questions, in-depth interviews and focus group discussions (FGDs). A total of 113 respondents were involved in the study. Among them, 107 were heads of households, of which 55 and 52 were from Holili and Kiraeni

villages respectively. The villages were randomly selected from 18 villages found in the drought area of Rombo District.

The sample also included 6 key informants: 2 Agricultural Extension Officers; 2 Village Executive Officers; and 2 religious' leaders. While heads of households were randomly selected, key informants were purposefully selected. Sixteen individuals participated in the FGDs, eight from each village, were selected from heads of household who participated in filling in the questionnaire to enable the researcher to identify the resourceful persons with knowledge of climate change. This technique helped to consolidate and clarify controversies encountered in the administration of questionnaire.

Qualitative data from the questionnaire, interviews and FGDs were organised into themes and presented by narrations or voices of the participants. Quantitative data, on the other hand, were organised into independent and dependent variables and analysed with the help of the Statistical Package for Social Sciences Version 16 to generate frequencies and percentages. Frequencies and percentages were further cross-examined with the selected characteristics of heads of household (i.e. to include agroecological location, age, gender, marital status and level of education) to determine their relationship. These data were presented in the frequency tables and graphs to simplify interpretations.

Results

Characteristics of the respondents

The characteristics of respondents are summarised in Table 1. The table indicates that respondents who participated in the study from two villages had different levels of education, age, sex, marital statuses and in possession of different communication facilities. The aim was to establish the relationship that would exist between the characteristics of the respondents and their perceptions on the causes of climate change.

Table 1: Characteristics of respondents (N=107)

Variable	Percentage of respondents (%)	
Village	Holili	51.4
	Kiraeni	48.6
Education	Primary	79.4
	Secondary	12.1
	Post secondary	3.7
	No formal schooling	4.7
Age	15-24	1.9
	25-34	15.9
	35-44	17.8
	45-54	19.6
	55-64	30.8

	65+	14.0
Sex	Male	81.3
	Female	18.7
Marital status	Single	6.5
	Married	82.2
	Separated	3.7
	Widow	6.5
	Widower	0.9
Communication facilities	Radio	1.9
	Mobile phone	33.6
	Radio/mobile phone	50.5
	Radio/mobile phone/TV	9.3
	NIL	4.7

Perceptions about the causes of climate change

Table 2 indicates that majority of the respondents believe that climate change is mainly caused by anthropogenic factors. This is, however, with exception of the development of science and technology. The anthropogenic factors referred to were mainly associated with clearing of vegetations over the earth's surface in what is termed as deforestation mainly through indiscriminate tree felling.

Table 2: Perceptions on the causes of climate change (N=107)

Perceptions	Percentage of respondents (%)
1. Anthropogenic factors	
Indiscriminate tree felling	82.0
Development of science and technology	10.5
Burning of forest	7.7
Population increase	4.9
Free ranged livestock	2.8
Blasts in stone quarrying	1.5
Not burning forest	0.2
2. Supernatural factors	
God will	11.3
Failure to make sacrifice	3.9
Increased sinners	3.1
Witchcraft	1.1
3. Natural factors	
Earth's revolution	2.9
Absence of mountain	0.7
4. Don't know	
	8.0

The results from Table 2 imply that, whereas some heads of household believed that burning of forests induces climate change, others had an opposite opinion. This was noted when administering questionnaire to heads of household in Kiraeni Village where one respondent believes that droughts are the result of not burning forests. The view of this respondent was based on the belief that burning of forests stimulates cloud formation that would bring rainfall. It was further noted, from the same respondent, that it was common to experience rainfall whenever there was fire in the Kilimanjaro National Park.

Deforestation was another cause as it was mentioned during in-depth interviews with religious leaders and during FGDs as a factor that induced climate change. The FGD participants and religious leaders claimed that Tanzania government should be charged with inducing climate change for poor forest management. They cited Rombo district forest reserve as a focal point where poor forest management gained momentum in the post-independence period. The participants explained that in 1952 the colonial government started to clear natural forests in the eastern slopes of Mt. Kilimanjaro by offering three acres to each native resident to cultivate crops (maize, beans, Irish potatoes) for the three subsequent years and then planted exotic trees (cedar, spruce and pines) instead. When the trees grew up well to render cultivation of crops underneath was difficult, as a result, farmers were given three more acres somewhere else in the natural forests to open new land for cultivation. This practise was; however, changed after independence when a few rich people were given natural forests to open up land for cultivation with no specified timeframe and sustainable land use agreements as it was the case under the colonial government in the 1950s.

Furthermore, the FGD conducted in Kiraeni Village cited the absence or presence of only a few tree nurseries to limiting afforestation and reforestation programmes. It was noted that there existed many tree nurseries during the British administration which facilitated tree planting programmes. They also cited lack of emphasis on environmental education for the citizens as part of the problem that exacerbated environmental degradation that induces climate change. It was further revealed that the prohibition of collecting firewood and livestock fodders in the natural forests had also contributed to climate change. The respondents commented that the prohibition created anger among the riparian people, which made them reluctant to participate in controlling forest fires whenever they occurred. Commercial logging was also cited as one of the causes of climate change. The government as well as some households sold immature planted trees simply because of the growing market and demands for timber. Wanton tree felling was also mentioned during interviews with the key informants. One of the key informants elaborated by associating

indiscriminate tree felling with the use of chain-saw tree-cutting machines as attributable to the development of science and technology in timber industry. Chain-saw machines were becoming increasingly common in the timber industry in the study area, the practice, which victimised several trees as they were turned into timber within a short period. Formerly, timber preparation was mainly done using hand-saws. The interview with the key informant from Kiraeni Village established further that the year 2012 marked the first time in which many people were engaged in the preparation of timber from mango trees.

Blasts in stone quarrying were perceived to induce climate change by individuals in Holili Village where there was stone quarry. This indicates that most of the causes of climate change which were mentioned by the heads of household are rooted in the local environment and, hence, site-specific.

The development of science and technology as a contributing factor that induced climate change was also mentioned during the FGD in Kiraeni Village. The FGDs cited the use and testing of bombs; increased number of automobiles, mobile phones, the internet and industries as the causal factors that had nothing to do with the local communities. One of the FGD participants raised concern over the effects of telephone waves on the atmosphere that:

"I am concerned that the increasing number of mobile phones must have contributed to the climate change observed because each family has a minimum of two mobile phones; leave aside radios and televisions"

The above statement implies that the FGD participant had a concern that the electromagnetic waves produced by communication facilities do interfere with variables of the climate thereby influencing their characteristics and patterns. The Earth's revolution was also cited during an FGD session in the Kiraeni Village by a retired primary school teacher as being a cause behind climate variability. This was associated with the incidents of droughts, which occurred at the intervals of 10 to 11 years. The years which ended with '4', especially 1974, 1984 and 1994, were cited to be characterised by droughts.

On the contrary, one of the Roman Catholic Priests interviewed believed that the failure of human beings to follow God's directives induced climate change. The priest cited the book of Genesis chapter 2 verse 15, which reads: *"God took the man and settled him in the Garden of Eden to cultivate and take care of it."* The priest associated the care the man had in the Biblical Garden of Eden and the current environment in which no one seemed to take care of it. He further associated it the failure to take care of the environment, and so

implored followers to care of the environment as doing so is an order from God. A similar concern was raised during the FGD sessions and through questionnaire-based results (Table 2) as a factor that increased climate change and so, constituted a punishment list from God for the increased sinners. In this regard, they associated the increased rate of corruption, prostitution, abortion, theft, and excessive consumption of alcohol with increased climate change.

Climate change, particularly unreliable rainfall, was associated with the failure to offer sacrifices in the study area. It was further noted during an interview with a head of household at Kiraeni Village that it was common for many clans in the study area to offer sacrifices at the beginning of each agricultural year, which begins in September. Male animals, particularly cattle, goats or sheep were slaughtered at areas deemed sacred known as *Kiungu* amongst locals. *Kiungu* commonly known were located where footpaths crossed the river (*Iruko*). Most of the *Kiungu* have been abandoned following the introduction of Christianity and Islam, which forbid any practice associated with ancestral worship and traditional deities under the long-established traditional cosmology.

Furthermore, during an interview with a head of the household at Holili village, it was established that climate change were caused by witches and wizards with an intension to make the livelihoods of others difficult. Other heads of household believed that rainfall had ceased to fall on time because tomato growers prevented it to avoid damage that could be unleashed to their tomatoes afield during heavy rains. In this regard, one participant said:

“Do you think the growers of tomatoes enjoy losses? They must make sure that the rainfall does not come earlier to destroy their tomatoes.”

The results on the major causes of climate change were triangulated against layers of education levels of the heads of household to determine whether or not a relationship existed between the two variables. The results are presented in Figure 2. The figure shows that all the responding heads of household with post-secondary education believed that climate change is solely caused by anthropogenic factors. It further indicates that the heads of household with no formal education outweigh others in believing that supernatural power induces climate change. These results imply that there is a relationship between a level of education attained by heads of household and their perceptions on the major causes of climate change.

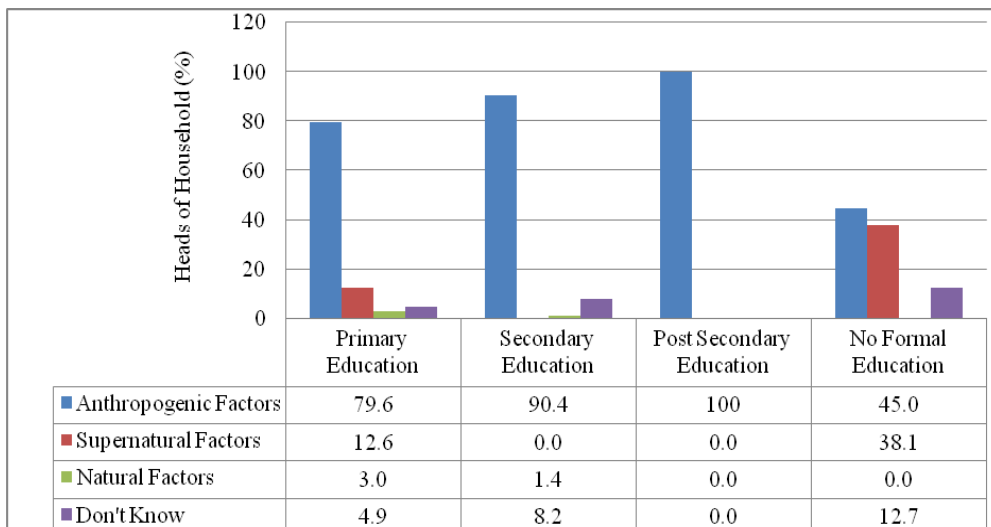


Figure 2: Education and the major causes of climate change

The phenomenon was also attested using age groups of the heads of household to establish whether a relationship exists between the two variables (Figure 3).

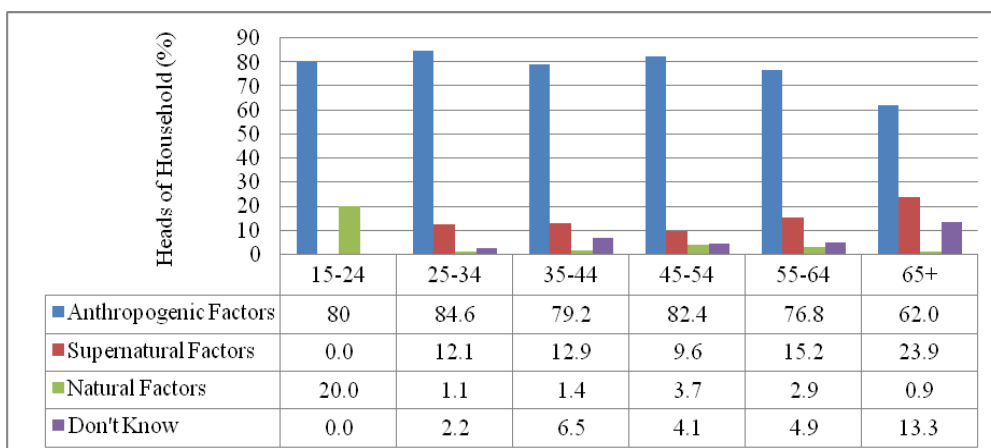


Figure 3: Age groups and the major causes of climate change

Figure 3 shows that although anthropogenic factors dominated in all age groups, the heads of household aged 65+ dominated in believing that supernatural factors induce climate change. Comparatively, there were no heads of household in the age-group of 15-24 who believed in supernatural factors as causes of climate change and in providing “Don’t Know” responses. The relationship between the gender of the heads of household and the major causes of climate change is indicated in Figure 4. On one hand, the Figure shows that males dominated in believing that climate

change are caused by anthropogenic and natural factors. On the other hand, the females dominated in supernatural factors and in not knowing the real cause of the climate change.

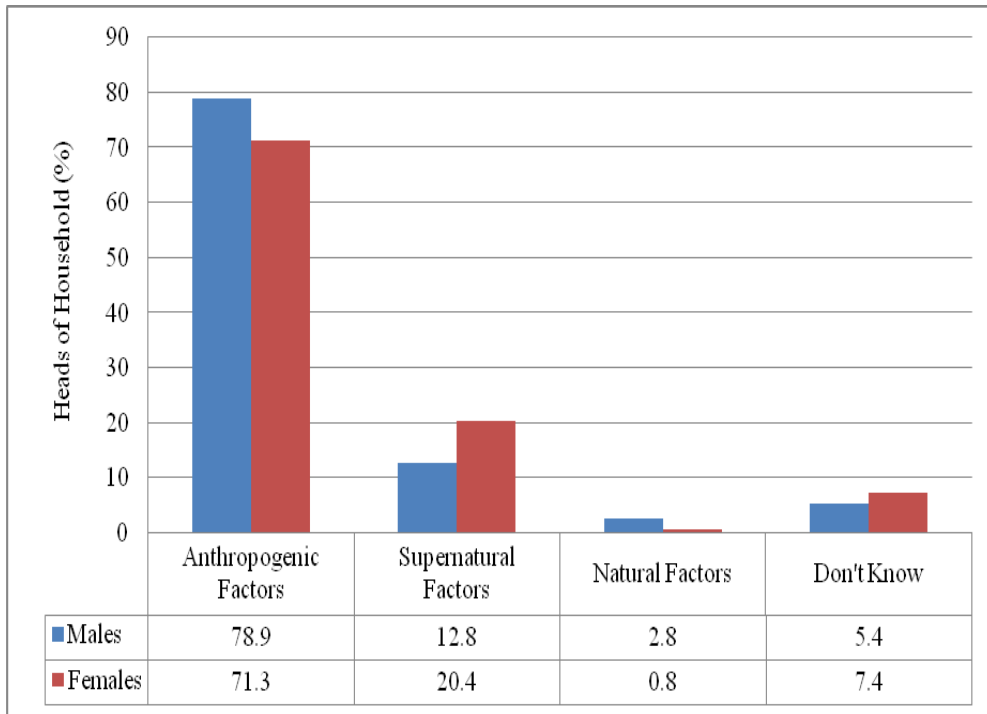


Figure 4: Sex and the major causes of climate change

The marital status of the heads of household was cross-tabulated with the major causes of climate change to determine their relationship. Results are presented in Figure 5 and they indicate that anthropogenic factors dominated in all groups and the rate was so high with divorced heads of household. Furthermore, the Figure shows that widowers believed that climate change was more induced by supernatural factors than other factors. Only married and separated heads of household believed that climate change was induced by natural factors.

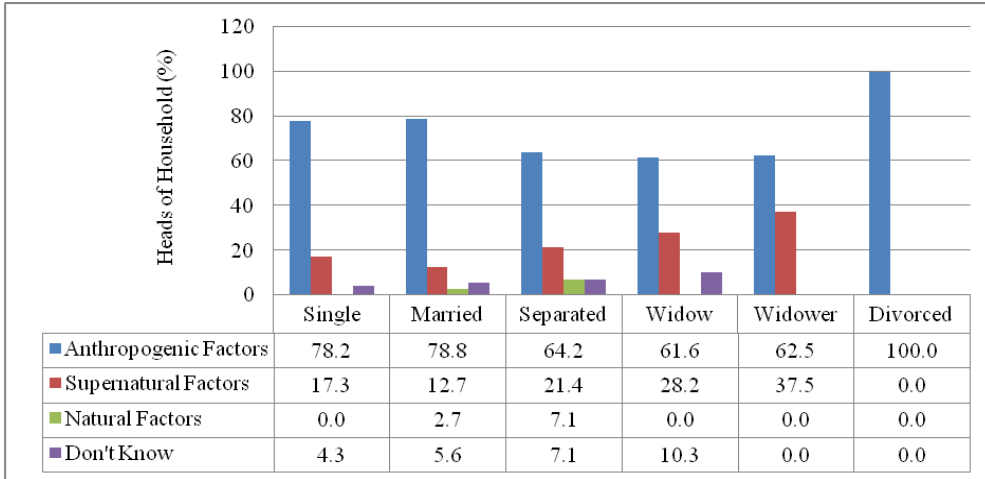


Figure 5: Marital statuses and major causes of climate change

The relationship between the possession of communication facilities and the major causes of climate change are presented in Figure 6. The figure shows that all the heads of household believed that anthropogenic factors are major causes of climate change, with the majority among these respondents, being those who possessed radios, mobile phones and televisions. On the contrary, the heads of household who did not possess any type of communication facilities overshadowed others in believing that supernatural factors were responsible for inducing climate change. Nonetheless, the Figure shows that the percentages of the heads of household who did not know the causes of climate change decreased with the increasing number of communication facilities, but not for those without any communication facility. This implies that acquisition of knowledge on climate change is not only determined by possession of communication facilities but also by experience and information sharing.

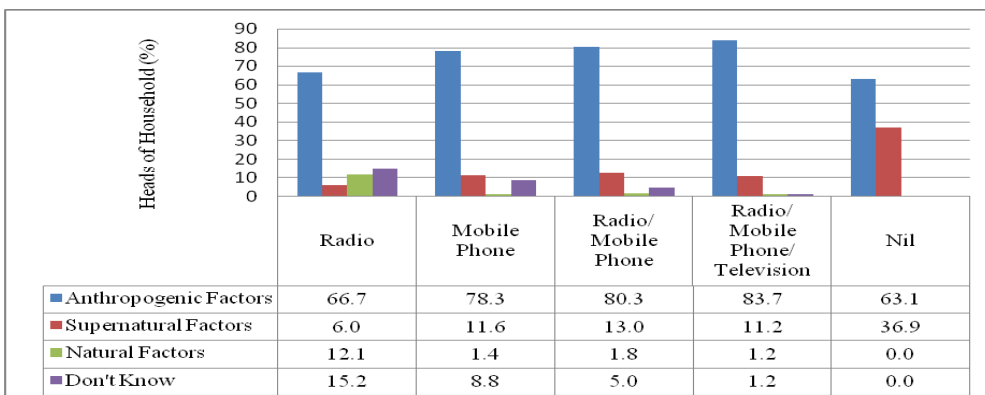


Figure 6: Possession of communication facilities and major causes of climate change

Discussion

The major contribution of the emissions of GHGs in developing countries including Tanzania is through land use change and forest-related sources (Shemsanga *et al.*, 2010; Nyong *et al.*, 2007). In developing countries, forests are cleared for building materials, firewood, agriculture and settlement. The present study (see Table 2) and those by Srinivasan (2004); Speranza *et al.* (2010); and Tambo and Abdoulaye (2012) cite deforestation as the main cause of climate change. The IPCC has estimated that between one-quarter and one-third of anthropogenic CO₂ emissions in developing countries are due to deforestation (Bast, 2013). Tree felling in the present study area is not caused by land preparation for agriculture but by the need for firewood, building materials and for income generation. In this regard, the explanation given by the key informant is corroborated. The key informant said that because of the growing market for timber, many individuals were attempted to prepare timber from mango trees, the practice which was not common in the previous years cited in the study.

The participants who were involved in FGDs do not believe they were culpable for the development of science and technology which induces climate change; hence, implying the externality of these changes. Similarly, the findings by Prabhakar *et al.* (2009) and Egeru (2012) also reveal that local people claimed not to be responsible for inducing climate change but other people somewhere else. Various reasons can be considered as a cause for climate change regardless of who is responsible as the ozone layer is essentially shared by both the developing and the developed countries. The developed countries contribute to economic growth in developing countries through trade, aid and tourism (Goklany, 2007). In this sense, both developing and developed countries induce climate change.

The findings that more heads of household with no formal education believed that climate change were induced by supernatural factors (Figure 2) concur with the one by Tambo and Abdoulaye (2012) which was conducted in Nigeria's Savannah which found that high illiteracy level of farmers was a major contributing factor to the low level of knowledge on the causes of climate change. Kemausuor *et al.* (2012) also report that many subsistence farmers, who are by definition, often poorly educated, resort to superstition to explain natural events because that is their only source of information. The same was found for the age group of 65+ respondents (see Figure 3), females (Figure 4), widowers (Figure 5) and heads of household who did not possess communication facilities (Figure 6). They believed that climate change was induced by supernatural factor provided by these groups primarily due to lack of information. In particular, females are deprived of their right to access information because they are tied with family chores, which limit them to access information from various sources such as watching TV, listen to radio and attending social and political

gatherings (Codjoe *et al.*, 2012; Eriksen *et al.*, 2006). With the exception of family cores, the females are tied with, other groups such as age group of 65+, widowers and those without communication facilities as they all get along. The perceptions from the present study that failure to make sacrifice induce climate change concurs with studies by Rancoli *et al.* (2002) and McDowell and Hess (2010). This kind of practice might be deteriorating in the study area because of the growing modern religion which considered being atheism and the failure of traditional practices to bring intended results. For example, communities in Bolivia had eased on offerings for rainfall due to long practice without promising results (McDowell and Hess, 2010).

The perception that climate change is a punishment from God for the increased number of sinners concurs with the findings by Tambo and Abdoulaye (2012), as well as studies by Speranza *et al.* (2010); Orlove *et al.* (2010); Mertz *et al.* (2009); Falaki *et al.* (2013) and Bacha *et al.* (2018), which established that climate is controlled by God. Eguru (2012) also found that the indigenous people of the Teso subregion in Eastern Uganda believe that climate change was punishment from God and ancestors for the rebelliousness and selfishness that some people had adopted. The findings that climate change is caused by natural factors such as the earth's rotation and absence of mountains corroborate with Barry and Chorley (2003) and Cunningham and Cunningham (2004) who also provide evidences on the natural causes of climate change. They associated it with the periodic changes in sunlight intensity, resulting from Milankovitch cycles. Similar to the Milankovitch cycles is the occurrence of severe droughts reported in the present study to occur at regular intervals of ten to eleven years especially years that end with 4 in their right.

Conclusion and Recommendation

The study has shown that majority of the respondents were aware of the fact that climate change is mainly caused by anthropogenic factors, which would sound a scientific thought. Indeed, any intervention measures to climate change should focus on either to increase sinks of greenhouse gases through afforestation and reforestation programmes or technological changes that lead into reduced emission of greenhouse gases. However, there appeared to be varied views on the causes of climate change among the heads of household, the perception that was associated with different individual characteristics ranged from level of education, age, gender through marital status. Thus, the difference in perception on what would be the cause of the climate change in the studied area compels the need to raise awareness through education among members of the community about the actual causes of climate change to appropriately mitigate the drought in the area.

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