

Analysis of climate change knowledge and its implications on livelihood options around Naituyupaki Location, Maasai Mau Forest, Narok County, Kenya

L.N.S. KONG'ANI¹, J.M. MUTUNE¹, T. THENYA^{2,♥}

¹Wangari Maathai Institute for Peace and Environmental Studies, University of Nairobi, Nairobi, Kenya

²Department of Geography & Environmental Studies, University of Nairobi, Kenya. Hyslop Building, P.O. Box 72335-00200, Nairobi, Kenya.

♥email: tthenya@yahoo.co.uk

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Abstract. Kong'ani LNS, Mutune JM, Thenya T. 2018. Analysis of climate change knowledge and its implications on livelihood options around Naituyupaki Location, Maasai Mau Forest, Narok County, Kenya. *Asian J For* 2: 62-66. Climate change knowledge among rural communities adjacent to forests influences their response in terms of mitigations and adaptations of their livelihoods. Rural households are highly dependent on natural resources, whose base is highly indisputably threatened by the changing climate. The aim of this study was to reveal the knowledge on climate change perceived by forest-based communities around Maasai Mau Forest, Narok County, Kenya. Results indicate that 93% of the respondents were aware of climate change through life experiences. The cited primary causes of climate change by 72% of the respondents included natural causes (26%), human activities (2%) and punishment from Gods respectively. The rural communities also perceived that their main livelihood activities (i.e., agricultural production and forest products collection) were to a large extent affected by climate change. There is a need to continuously expose local community to emerging knowledge on the impact of climate change for improved mitigation and adaptations.

Keywords: Climate change, implications, knowledge, livelihoods options, mitigation

INTRODUCTION

Most rural households rely on a diverse portfolio of activities and income sources in which crop and livestock production play important contributions to household well-being. These livelihoods support systems are, however, threatened by the changing climate that is characterized by more frequent floods, prolonged drought, erratic rainfall patterns, emerging disease, and pest incidences. This scenario particularly affects communities that live adjacent to forests. Altogether with climate change, these forests have already been pressured by increased demand for new agricultural lands, dependence on forest grazing, incidences of charcoal burning, illegal logging, and demand for non-timber forest products to supplement livelihoods support gaps (GoK 2012).

While potentially adversely affecting rural communities, knowledge of climate change among such communities remains low in spite of highly publicized debate. For example, research by Dube and Phiri (2013) indicated low awareness in Zimbabwe. Similar observations were made by Onyekuru et al. (2014) on rural livelihoods in Nigeria. While studies by Boon and Ahenkan (2012) in Ghana Sui Forest Reserve, and Tambo and Abdoulaye (2013) in Nigeria savanna noted that forest provides vital resources to enable rural communities to cope with climate change.

Kenya currently has forest cover of only 6%, much lower than the Kenyan constitutional requirement of 10% (FAO 2010; GoK 2010; Kimutai and Watanabe 2016). In Kenya, there is limited documentation on the knowledge of

climate change among communities that live adjacent to forest ecosystems. It is notable that most of the studies on climate change impact on livelihood particularly in Kenya are biased towards arid and semi-arid lands (ASALs) (Macharia et al. 2012; Ogalleh et al. 2012).

The aim of this research was to document and provide empirical evidence on the knowledge on climate change among the forest adjacent communities in Maasai Mau ecosystem, Kenya and how this affects their livelihood dynamics.

MATERIALS AND METHODS

Study area

This study was carried out in a rural community around Maasai Mau Forest, Naituyupaki, Narok County, Kenya (Figure 1). The community-managed natural forest with an extent of 46,278 hectares. The forest comprises large stands of cedar (*Juniperus procera*) and Podo (*Podocarpus gracillor*) with scattered natural glades (Thenya and Kiama 2008). It has a high diversity of fauna including the rare mountain Bongo (*Tragelaphus eurycerus*). This forest forms the southern part of the Mau forest complex, Kenya's largest closed-canopy forest area. Maasai Mau forms the catchment of Ewaso Ngiro and Mara rivers that supply important water to the region like Lake Natron and world-famous Maasai Mara ecosystem.

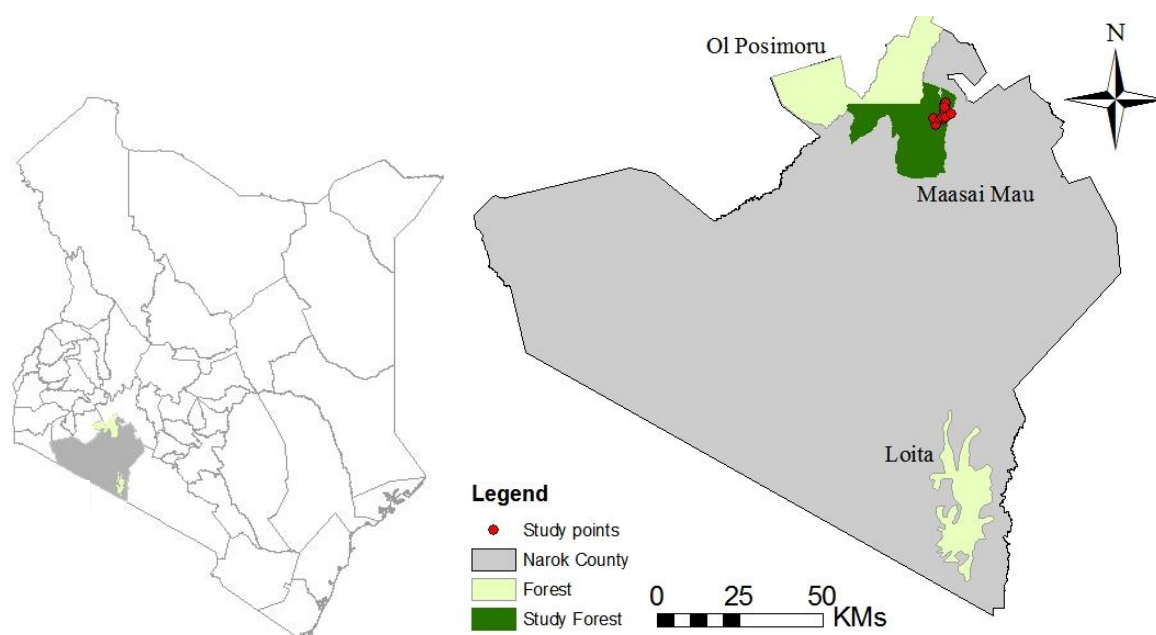


Figure 1. Map of the study location in the Maasai Mau forest, Naituyupaki-Olokurto, Kenya

The area around Maasai Mau forest is characterized by bimodal rainfall pattern that ranges between 1,000 to 2,000mm per annum. The temperatures range from 16°C to 22°C with July being the coldest month. The soils are deep, well-drained, fine-textured and of high agricultural potential (Kinyanjui 2009).

The study area Naituyupaki-Olokurto covered an area of about 527.60 km² with a population of approximately 21,045 and an estimated 3,811 households (Kenya National Bureau of Statistics 2010). The forest supports the local communities in terms of building materials, wood fuel, charcoal, herbs, pasture, fruits, honey, water and also provides an important site for spiritual and cultural purposes (Thenya and Kiama 2008; GoK 2012).

Study design, sampling and data collection

The study was conducted in the month of June 2016 in Naituyupaki, Narok County with a focus on forest adjacent communities. Naituyupaki had a total of seven villages including Naituyupaki, Sauli, Ndete, Legen/Sasimueni, Nalengoi, Esoitit, and Sagatia. Data was, however, collected in Legen/Sasimueni, Nalengoi, Esoitit and Sagatia villages, which were easily accessible. The four villages were largely dominated by the Ogieks, Maasai's and Kikuyus ethnic groups. Factors that restricted access to Naituyupaki, Sauli and Ndete villages' access included long-distance, difficult terrain, and uncooperative communities' as learned during the reconnaissance study.

The study applied blended methodologies to collect quantitative and qualitative data. From a total of 183 households in the seven villages, a sample size of 53 households was calculated at 95% confidence level as follows (N=183).

$$n = (z^2 \times p \times q \times N)$$

$$e^2 (N - 1) + (z^2 \times p \times q);$$

where: n = Sample size (being determined), N = Population size (which is known), p = Sample proportion (assumed to be 0.05, if not given), q = 1 - p, e = 0.05 (since the acceptable error (level of significance) should be 5%) and z = Standard deviation at a given CI (z = 1.96 at 95% CI). Based on the available household data, the 53 households were proportionately distributed as follows (Table 1).

The household survey was conducted using structured questionnaire that was administered to the 53 household heads with the help of four local research assistants among whom one was a village elder. The respondents were systematically selected from a list of households picking every 4th household in each of the respective villages to ensure equitable representation. To ensure equal representation of both male and female, a list was drawn indicating male and female-headed households and used for picking respondents systematically according to the proportionate villages' sample.

Table 1. Sample size distribution across four villages

Village	Total no. of households	Calculated sample size
Legen/Sasimueni	38	11
Nalengoi	55	16
Esoitit	31	9
Sagatia	59	17
Total	183	53

The household survey information was triangulated with participatory assessments and field observations. Participatory assessments included two Focus Group Discussions (FGDs) conducted at each village, each comprised seven participants. The participants were randomly selected among the households. The checklist used to guide the FGD was prepared using information generated from the questionnaire survey. Key informant interviews were also conducted with the Ministry of Environment, Water, Energy and Natural resources (MEWENR), Kenya Forest Service (KFS) - Ecosystem Conservancy, village elder and Community Forest Association (CFA) officials. The key informants were purposely selected for their ability to inform study objectives. A checklist was used for the key informant interviews. In all the interviews, no consent was given to voice record the interviews and therefore meticulous notes were taken. Field transect walk, observation, informal talks with research assistants and field contact person were also executed as an additional method to triangulate information gathered. The qualitative data were analyzed using thematic approach while quantitative data was analyzed using descriptive statistics.

RESULTS AND DISCUSSIONS

Livelihood activities

The respondents in the study area were found to depend on a variety of livelihood activities with the most important being crop production, livestock production and extraction of forests products. Other livelihood activities included petty trading and casual laborers. The household survey results indicated that 96% of the respondents mainly grew maize besides beans, peas, carrots, potatoes, cabbages and tree tomatoes. More than half of the households grew at least two types of these crops. About 14% of the respondents raised livestock either as their main livelihood activity, which included cattle, sheep, goats, donkeys, and chicken. All the respondents were found to rely heavily on forests for firewood, charcoal, building materials, honey, and fruits. Agricultural production in the area was purely rain-fed, which rendered the communities more vulnerable to changes in climate.

Knowledge of climate change

Results from the household survey indicated that 93% of the respondents had heard or knew about climate change, which was confirmed in the FGDs where most of the participants held the same opinion. About 43% of the respondents had experienced climate change effect on livelihood disruption. Some of the sources of information on climate change according to about 23% of the respondents were via radio, public meetings, and hear-say from other farmers, agricultural extension agents and seminar.

A number of observed evidence and understanding of climate change in the area was noted as freezing morning hours, prolonged hot/dry period, and reduced rainfall than earlier years. Others were increased worry and observation

of crop failure each season due to unpredictable rainfall patterns, and increased diseases and pest attacks on crops leading to food insecurity. Flash floods and prolonged drought were reported to have become more severe. The farming seasons had changed from what the communities knew with increased flash floods, prolonged and frequent droughts leading to livestock mortality and crop losses.

Similar findings were documented by Egbe et al. (2014) in Nigeria where local community had made similar observations. In Kenya, a study by Kuria (2009)'s in Kereita forest recorded that local community knowledge and perception of climate change was high at 87%. Dube and Phiri (2013) study in Matobo and in other parts of Zimbabwe also found that about 51% of their respondents had never heard about climate change, in contrast to the findings in the Maasai Mau forest where 93% had heard of climate change. This demonstrates the probability of inadequate information and knowledge among some communities although they were aware of the significant changes taking place in their environment. Like in Zimbabwe, report by Muhumuza et al. (2011) in Rwenzori region suggested that climate change subject was not well known to most of the respondents and particularly to those with less exposure to external knowledge.

Causes of climate change

About 72% of the respondents cited natural causes as the primary cause of climate change, while 26% and 2% cited human activities and punishment from Gods respectively. This result agrees with Debela et al. (2015), which found that 78% of the respondents in South Ethiopia mentioned natural forces as the primary cause of climate change and 16% cited human activities. The results also corroborate the findings of Caribbean Institute of Media and Communication (2012) report on climate change knowledge, attitude and behavioral practice survey, which observed that 43% of the respondents cited natural causes. The respondents' perception of natural causes as the primary cause of climate change may have been contributed by the communities' lack of adequate information and knowledge about the scientific understanding of what natural causes are. According to Nwankwoala (2015), the natural causes of climate change included volcanic eruptions, solar radiations, biotic processes and even ocean currents, which is contrary to the likely understanding of forest adjacent communities in Maasai Mau ecosystem.

Participant observation during transect walks recorded anthropogenic activities, including charcoal burning and clearance of forest to pave way for crop production in Maasai Mau, that could have contributed to prolonged drought spells, floods, erratic rainfall patterns, increased pests, and diseases incidences. Some of the respondents either lived in the forest land or were connected to people living in the forest. Thus, the respondents might have concealed information as regards their activities that could be attributed to decreased forest ecosystem changes for fear of eviction. Scientific findings by the IPCC, 5AR (2014), demonstrated that human activities are the primary cause of climate change as observed in the study area. The

communities depend largely on their own observations and experiences as sources of information as noted by 93% who had observed changes taking place in the environment, which is inadequate. The respondents' knowledge of the primary cause of climate change is still limited as access to such information is limited. This finding strengthens the GoZ-UNDP/GEF (2010)'s report, which suggested that most of the people in the less developed countries are not adequately informed of climate change. Climate change information is largely limited to research institutions in these countries coupled with little dissemination. In Maasai Mau forest, only 2% of the respondents were reported to have received training related to climate change from the Government's extension officers thus demonstrating limited efforts in dissemination of climate change information among the FACs. The communities' strategies in dealing with any climate-induced risks and opportunities are undeniably influenced by their knowledge on the same as also observed by Bryan et al. (2009) and Komba and Muchapondwa (2012) in Ethiopia and Tanzania, respectively. The acquired knowledge contributed largely in determining what livelihood practices communities adapt to climate change as also observed by Nzeadibe et al. (2011) findings in the Niger Delta region of Nigeria. It is likely that the communities' knowledge of climate change as established will stagnate and or even be lost if it is not aligned with scientific knowledge thus increasing communities' vulnerability to climate change impacts.

According to Ozor et al. (2015) observation regarding perceived punishment from Gods as a cause of climate change is common in most rural areas. Some communities across the globe believe that some evil deeds trigger Gods' wrath that can alter the normal climatic patterns thus affecting livelihoods activities as also observed by 2% of the respondents in the study area, thus suggesting low links between climate change causes to perceived Gods punishment among communities.

Climate change implications on livelihood activities

All the respondents indicated that they had experienced climatic variations in the past ten years, which had consequently affected their livelihoods. The communities attributed the changing climate to increased drought incidences (15%), drying up of streams (8%), irregular rainfall patterns (6%) and increased pests and diseases occurrences (37%) that all resulted in poor crop yields (34%). Notably, pests and disease incidences caused crop failure rendering the communities more vulnerable to food insecurity in the study area. According to Hartter et al. (2012), for the local communities in most of the tropics, precipitation bears much significance regarding impacts as compared to temperature changes. The change in rainfall quantity and distribution pattern affects agricultural production and forest conditions as also observed in the study area, which is also likely to continue while impinging on communities livelihoods.

The findings by Onyekuru et al. (2014) in Nigeria observed that diseases incidences are linked to declining agricultural crop production. Similarly, Agrawala et al. (2003) study in Tanzania found that the growing of crops

such as maize, finger millets, beans, cowpeas, and groundnuts was reported to have declined following the effects of increased incidences of pests, diseases, and vermin. According to the IPCC's Fifth Assessment Report, global agricultural production has already declined by 1-5% per decade as result of climate change effects (IPCC 2014). Dinesh et al. (2015) noted that crop pests, exacerbated by the rise in temperatures, are already a major factor influencing farm productivity in the continent, and about one-sixth of the field production is lost to pests. This confirms the fears of the communities in the study area as they cited increased incidences of diseases and pests as a sign of the changing climate and food crop losses that are likely to increase food insecurity among the households.

In conclusion, the Maasai Mau Forest Community had some knowledge on climate change that they believed was primarily caused by their own activities including charcoal burning, logging, and clearing of forest for agricultural production. At the same time, it is noted that rural communities have limited access to formal means of gaining climate change information. As the effects of climate change are likely to increase over time, there are high chances that communities around Maasai Mau forest are likely to experience more vulnerability to their livelihood. Therefore, government and civil society organizations should increase access to information on climate change and customization of scientific data on climate change that could help the local communities participate in mitigation and adaptation of climate change accordingly. Such action could be facilitated through agricultural extension systems linking livelihood and climate change information that is currently missing.

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