

LIVELIHOODS UNDER CLIMATE VARIABILITY AND CHANGE: AN ANALYSIS OF THE ADAPTIVE CAPACITY OF RURAL POOR TO WATER SCARCITY IN KENYA'S DRYLANDS

Abstract

Climatic variability has affected livelihoods of people in many ways chief among them being the dwindling water resources. Water is the most limiting factor in crop and livestock production in arid and semi-arid lands (ASALs) of sub-Saharan Africa. Rainfall which is the only source of water in these areas shows very high spatial and temporal variability. Effects of climatic change are already being experienced in these areas and global changes in climate are expected to further exacerbate the inherent vulnerability of communities living in such ecosystems. Communities have to deal with more uncertain weather, with extreme events occurring more frequently. For ecosystems in the rangelands, crop, forage and livestock production closely follow rainfall trends thus putting livelihoods of a number of households at risk. Farmers in these areas have adopted practices to cope with the climatic change and reduce their vulnerability.

This study was carried out by administering questionnaires and the study area comprised of two administrative Districts namely Kibwezi and Kajiado, predominantly occupied by agro-pastoralists and semi-nomadic pastoralists respectively. The study area is located in the semi-arid southern rangelands of Kenya. The altitude of the area varies from 600m to 1,100m above sea level. The average annual rainfall, evaporation and temperatures are in the order of 600mm, 2,000mm and 23⁰C respectively. For over four decades, the study area has been experiencing increasing climatic anomalies.

In the agro-pastoral areas, mixed farming of crops such as maize, green grams and pigeon peas is the main source of livelihood, whereas livestock production is the main activity in the pastoral areas. Most (98%) of the respondents mentioned increased dry conditions occasioned by recurrent droughts as the main unusual climatic events experienced over the years and the extended dry conditions are experienced almost every year. The extreme weather conditions have affected the agro-pastoralists more than the pastoralists. The impacts of the climatic change are also reflected in increased crop failures; change of type of crops grown and livestock species kept; low crop, forage and livestock productivity; poor health of crops and livestock; reduction in land under cultivation; change of planting time; reduced daily food consumption; increased livestock and human diseases; and change in livestock management plans.

In response to climate variability, households had developed both short and long term coping/adaptive mechanisms which includes planting of drought tolerant and early maturing crops, run-off harvesting, water harvesting using micro-catchments, early or dry planting, increased migration of men to urban centers to seek wage employment, de-stocking of herds, change of herd structure. The study shows that the main response to water scarcity for crops is run-off harvesting and drilling of boreholes.

Background of the study

Dry land areas which includes arid and semi-arid areas receives annual rainfall of less than 1500 mm. Around half a billion people live in such areas, where water is an unavoidable constraint on everything they do (Winpenny, 1991). Global warming with its influence on climatic change is rendering the climates of some regions dryer and all more variable and unpredictable (Parry, 1992). The arid and semi-arid of sub-Saharan Africa (SSA) are characterized by limited water supply, low and highly variable rainfall, and recurrent droughts. Even where surface waters accumulate, they are not easily retained due to high temperatures and intense precipitation that cause water to be lost to evaporation and run off, respectively (IIRR. 2002).

Dry land communities are in greater need of external support because their crops are failing and their herd sizes are being reduced to less than the minimum required for subsistence. High herd mortality has mainly been due to severe and persistent droughts which have led to tremendous human suffering (IPCC, 2007). These communities have gained experience trying to adapt to the changes in climatic conditions. For example, in west and east Africa, dry land communities have developed traditional water harvesting systems in response to the increasingly frequent droughts (Jama et al., 2009). Techniques such as half moon pits and contour stone bunds are popular among farmers. In Turkana area of Kenya for example, farmers who practice water harvesting are able to grow food crops like maize for household consumption and even for sale in local market (Nyangito et al., 2008).

Water harvesting in dry lands has resulted in more vegetation cover, due to increased infiltration rate resulting from slowed water movement on land. Such outcomes have been demonstrated in west Africa (e.g. Niger) and east Africa (Musimba and Nyariki, 2004). Improved runoff farming techniques has enabled vegetable production to meet household requirements and to provide surplus for sale to augment household incomes. In addition, farmers are able to diversify their crops from the traditional maize and beans to include potatoes, carrots, onions, soya beans, millet, bananas and fruit. This diversity has contributed to food security and wider nutrient base in these communities (Nyariki et al., 2005).

Water harvesting has contributed to land rehabilitation enabling communities to adapt to drought/highly variable climate, with the subsequent reduction of poverty (Orindi et al., 2008). African continent is characterized by vast dry land areas, land degradation, poverty and hunger, and it still remains a research agenda whether water harvesting has reduced vulnerability of households and communities to drought and to what extent (Musimba and Nyariki, 2004). The overall objective of the study was to analyze the impact of climate change on the dry lands farming system using a case study approach.

The specific objectives were to:

- Collect and analyze data to provide an overview of the typology of primary measures undertaken at the community and household levels to adapt to variable and changing climate in Kenya's dry lands.
- Work with selected households/communities and partners to analyze whether water harvesting practices have had impact on the livelihoods in the dry lands.

- Identify the drivers of effective rain water harvesting in dry lands as an adaptation to frequent droughts, and characterize the effective water harvesting methods.
- Build capacity in climate vulnerability assessment, mitigation and decision making at various stakeholder levels (household, community, private sector, government) using the results.

Materials and methods

The main activities carried out were;

- In-depth review of primary literature on the impacts of climate change on pastoral and agro-pastoral livelihoods in the dry lands of Sub-Sahara Africa, with particular focus on Kenya.
- Conducting case studies to identify and review coping mechanisms including successful water harvesting initiatives among target communities
- Conducting case studies on selected households practicing water harvesting and determining the relationship to reducing poverty and hunger.
- Data mining: Collecting and collating all available information from the case studies - their economic and ecological environments and indigenous knowledge on climate change.
- Evaluation of the factors behind the effectiveness of successful water harvesting techniques / methods in the local environment:
- Analyzing the social assets (human, social and political capital), and material assets (physical, financial and natural capital) to provide information and contribute to knowledge for formulating and supporting policy decisions for dry land livelihoods support.
- Capturing community indigenous knowledge on climate change.
- Construction of family portraits of selected families practicing water harvesting.
- Development of site-specific guidelines and information tools on adaptation to climate change and suitable water harvesting techniques for use by farmers, extension agents and development specialists.

Results and discussions

The study showed that the main agricultural activity in the study area is mixed farming with crop production being preferred in the agro-pastoral areas, while livestock production forms the main source of livelihood in the pastoral areas. The main crops grown in the area are maize, green grams, pigeon peas, and beans in that order. Livestock species kept in the area include cattle, goats and sheep, in order of importance.

Over 89% of the farmers reported the presence of unusual events in terms of weather patterns within the last 2-3 years being evident that the area has been experiencing the effects of climatic change. The reported unusual events have resulted in the drying up of water resources complicating the lives of communities in these areas. The unusual events have affected the water management strategies by the farmers in an effort to cope/adapt to the situation. Most (90%) of

the farmers responded to this water stress by construction of dams to conserve water. Farmers had to buy water and overall, the quality of the water was affected with reported cases of waterborne diseases. Livestock was also affected by the lowered water with high salt levels resulting to poor health of the livestock as reported by all the respondents interviewed.

The main unusual climatic events reported by the farmers were drought and only 23% of the farmers reported increased floods associated with torrential rains as a climatic anomaly. This shows a decline in precipitation thus aggravating the problem since 100% of the respondents are dependent on the rains even for their dams and the few rivers present are seasonal.

The extreme weather conditions have affected the agro-pastoralists more than the pastoralists. This is due to the opportunistic strategy of nomadic pastoralism, which enable pastoralists and their stock to track forage and water in space and time (IIRR, 2002). Pastoralism involves highly fluid production systems responding flexibly to variable and unpredictable arid and semi arid rangeland environments. Herd mobility allows pastoralists to escape natural shocks therefore making them less vulnerable to climate variability (Nyariki et al., 2005). This renders nomadic pastoralism to the best adapted production system in the ASALs.

Farmers in the study areas had developed both short and long term mechanisms to cope with the adverse dry conditions brought about by the climate variability in an effort to alleviate food insecurity. These measures are meant to cope with the inherent seasonal variability and planned strategies to cope with the predicted long-term anomalies. For agro-pastoralists, measures such as early or dry planting, planting of drought tolerant and early maturing crops, water harvesting using micro-catchments, terracing, planting trees and reducing water use had been adopted. When food is scarce, households resort to skipping one meal in a day (51%) or buying food from the local markets (50%) to supplement their farm produce. The study showed that the main response to water scarcity for crops was run-off harvesting and drilling of boreholes.

Pastoralists' response to climate variability is characterized by increased migration of men to urban centers to seek wage employment, destocking of herds, change of herd structure. Goats are increasingly being preferred because they are more drought tolerant and suited for the browse species that survive extended dry conditions and droughts (Musimba and Nyariki, 2004). A number of farmers are taking up rain water harvesting as a coping strategy with 34% of them having constructed dams for the purpose. Ways of coping with water scarcity for livestock in the study area include rainwater harvesting using roof catchment, sinking of boreholes, and digging shallow wells in dry river beds. The water harvesting measures are being done at both household and community level for both agro-pastoralists and pastoralists communities.

Majority (87%) felt that the measures being taken to ameliorate the water problem especially during prolonged droughts were unsuccessful. They cited that, this had a negligible effect on reducing diseases, crop failure and livestock death. Some of the measures taken to cope with

water stress conflicted with other household operations by diverting of resources as was reported by 69% of the respondents. The government intervention was mainly targeted at community level and 88% of the respondents expressed that the government was not doing enough to ameliorate/alleviate the problem and these measures were largely unsuccessful.

The unusual events brought about by the climatic variability has taught and influenced farmers in a great way. All the respondents acknowledged on the need to conserve water and 55% expressed need for a water reservoir, and farmers expressing realization to the need of growing resistant crops, sinking bore holes and water recycling were 47%, 54% and 36%, respectively. All the farmers expressed that they had heard about climatic change and they were already being affected by the unusual events it has brought about. Majority (92%) cited erratic rainfall as the main effect of climate change they have experienced with others reporting drying up of rivers (100%), strong winds (91%), floods (72%) and incidences of more diseases (53%) as other effects associated with the climate change.

All the respondents were in agreement on the need to take up measures individually and collectively to address the problem of water shortage with all of them indicating that planting of trees should be the first priority. Over 89% of respondents felt that the burning of charcoal should be outlawed to conserve the forests and 73% expressed the need to construct dams to harvest the runoff and use this water during the dry spell.

Conclusions and way forward

The effects of climate change are already being experienced by the farmers and especially those in dry lands and other fragile ecosystems and there is need to upscale the technologies of rain water harvesting to alleviate the water scarcity problem. Since most of the farmers are resource poor, there is need for injection of capital to help the farmers construct reservoirs for rain water harvesting. Training is needed to equip the farmers with other inexpensive, locally tested ways of run-off harvesting which is already in use by some of the farmers. Re-forestation programmes are needed and drought tolerant tree seedlings made available to the farmers.

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