



Original Article

Practices in agriculture of smallholder farmers for climate change adaptation in *El Slam* Locality –West Kordofan, Sudan

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Abstract

Climate change events could influence poverty by affecting agricultural productivity through continues decline in crop yield, increase of disease, increased livelihood insecurity and raising prices of staple foods that are important to poor households in developing countries. This study was conducted in *Elslam* locality, West Kordofan. The major objective of this study is to identify the indigenous knowledge and practices of smallholder farmers in managing the climate change variability and impact in study area. Specifically, the research seeks to assessing and documenting local knowledge of adaptation practicing by potential farmers, to perceive the climate change in mind of farmers. The study based on simple random sampling and considers 68 respondents (8%) as sample of study. Quantitative and qualitative information was obtained using different data collection methods such as in-depth individual interviews and focus group discussions for key informants as well as secondary data collection. The data fit to computer and statistical package for social sciences (SPSS version 16) were applied using descriptive analysis. Results revealed that widespread indigenous knowledge using by farmers such as sowing in dry (*Ramail*), planting in different direction (*sherreik*), cropping pattern (i.e. adjusting planting dates), change in crop variety (*Elkhifafa*), and diversifying income through off-farm activities. Results of farmers' perception of the trend in crop productivity over the last three decades indicate that a significant majority of the farmers (89.7%), (80.9%) report that rainfall and crop productivity have declined over the last decades respectively, and highlighted certain problematic climate related events such as floods and droughts. (100 %) of the farmers acquired their local knowledge from their intimates and local environment. Finally, the study come out to recommend that more attention should be given to develop and encourage the fit and effectiveness practices and adjusting the "where, when, and how" of unsuitable practices using to enhance resilience and reduce vulnerability in a rapidly changing climate.

Keywords: indigenous practices, climate change, adaptation, poor households, resilience, vulnerability, Sudan.

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Introduction

Traditional knowledge, Indigenous knowledge, traditional ecological knowledge generally refer to knowledge systems embedded in the cultural traditions of regional, indigenous, or local communities. Indigenous knowledge has been defined as experiments of original population, practices and representations maintained and developed by people with extended histories of interaction with the natural environment (Sheikheldin, 2011) local communities have devised way and measures to maintain homeostasis and adapt to changes. Developing countries, especially Africa will be the worst hit and their poor population is the least capable of depending themselves. This situation is attributed to the interaction of multiple stress including; land degradation, desertification, decline runoff from water catchment, inadequate government mechanisms and lack of finance, low adaptive capacity due to factor such as extreme poverty, frequent natural disasters i.e. drought and floods (IPCC, 2007). The impact on each region depends mainly on the degree of vulnerability that natural ecosystems and human-made infrastructure have to changes in climate and extreme meteorological events, as well as on the coping and adaptation capacity toward new environmental conditions (Ibarrarán, Malone, & Brenkert, 2010) People living in poverty are more vulnerable to environmental changes (Omolo, 2011) Rainfall is extremely important to agriculture (Lobell & Burke, 2008). The impacts of climate change on agriculture are being witnessed all over the global but countries like Sudan are consider more vulnerable in view of the large portion of population dependent on agriculture, pressure on natural resource and poor coping mechanisms. Many studies have recorded phenotypic changes in natural populations and attributed them to climate change (Merilä & Hendry, 2014) and takes stock of current knowledge of climate change and the response to this major problem affecting the environment and economic development(Winkler, 2005).

Objectives of the study

The overall objective of this study is to discover the indigenous knowledge and practices of smallholder farmers in study area in managing the climate change variability and impact. **Specifically**, the research is going to assessing and documenting local knowledge of adaptation practicing by potential farmers in the area, to find out the perception of respondents toward climate change adaptation and to suggest recommendations for further improvement.

Research Methods

The study area

The greater Kordofan region lies between latitudes 9.5 and 16.4 norths, and between longitudes 27 and 32 East with a total area of 380000 square Km. Rural sedentary populations represents 63%, the nomads 24% and only 13% are urban population. The annual rainfall in the region ranges between 150 mm in the north and 800 mm in the south. Millet, groundnuts, sesame and watermelon are the main agricultural crops grown in West kordofan region, in addition to gum Arabic and different types of livestock such as camels, cattle, sheep and goats (El & Muneer, 2008).

Sample selection and data collection

The target community was farmer's household in *Elislam* Locality. 8 % from the total number of household (850) were selected. 68 farmers were selected randomly. The data was collected through face to face interviews (for households) using a questionnaire that was pre-tested and validated and focus group discussions for key informants. The questionnaire included questions about the farmers' socioeconomic characteristics and farming practices perception. Also secondary data collections were used from references and scientific journals. Frequency

distribution and percentages were used to analyze the data using the Statistical Package for Social Science (SPSS version 16).

Results and discussion

The quantitative and qualitative results revealed that:

The respondents' some socioeconomic characteristics: indicates that a high percentage (48.5%) of the respondents are of young age (≤ 40 years) compared to about (31.0%) who exceeded 60 years of age. young farmers have been found to be more innovative than their older counterparts (Rogers, 1993). On the other hand, it has been found that (54.4%) of the respondents did not attend any formal education, While about (42.6%) of the respondents had small families that are composed of five or less members, only 17.6% of them had large families that consist of eleven or more members. As the family is the source of farm labor in this part of Sudan, farming system demands more labor, larger families are expected to be more innovative than small families. The majority (45.6%) of the farmers possess medium size farms that range between 6 – 10 Mukhamas in size Results showed that the most indigenous knowledge practiced was highlighted below:

1. Sowing in dry (*Ramail*), farmers belief that each crop has a suitable planting date based on certain astronomical measure. Since ancient times some crop, millet in particular, is sowing in dry i.e. before the one set of rain. Currently *ramail* is applied to other crop such as sorghum, sesame, and even ground nut. Crops other than millet are usually planted during the first two weeks of july, during this period adequate rain are expected. Farmer tend to plant crops on dry to have the advantages of expected rain, however, such practice is risky. In other words, if this rains is not sufficient enough for germination the planted seeds are exposed to rotting.

2. Planting in different direction; in place characterized by high variability of rainfall, farmers tend to plant in different directions known locally *sherreik*. Here farmer perceive that such practice reduce risk of planting ion one direction.

3. Cropping pattern; farmer have reduced area under pearl millet and increased area under sorghum due to frequent failure of millet crop caused by variability of rainfall and pest infestation namely head warm *Nafasha*. Appearance of *Nafasha* is associated with existence of dry spells which has become more frequent for the last three decades.

4. Change in crop variety; Farmers change varieties of a given crop depending on the rainfall condition. Changes mainly concern a shift from long to short duration varieties (*Elkhifafa*).

5. Diversifying income through off-farm activities; Households diversify income from different sources particularly from off-farm activities. These include petty trading (charcoal selling), poultry production, and engaging in unskilled labor (go to the Golding-place).

Result extend to showed that farmers' perception of the trend in crop productivity over the last three decades indicate that a significant majority of the farmers (89.7%), (81%) report that rainfall and crop productivity have declined over the last decades respectively, and highlighted certain problematic climate-related events such as floods and droughts. (100 %) of the farmers acquired their local knowledge from their intimates and local environment Table 1, 2).

Table (1) Frequency distribution of socioeconomic characteristics of the respondents

Socioeconomic characteristics	Frequency	percentage
Age:		
≤ 40	33	48.5
41-60	21	31
≥ 61	14	20.5
total	68	100
Years of formal education:		
No formal education	37	54.4
Primary education (1-4)	19	28
Intermediate or higher education (≥ 5)	12	17.6
total	68	100
Family size:		
Small family (≤ 5 members)	29	42.6
Medium family (6-10 members)	27	39.71
Large family (≥ 11 members)	12	17.6
Total	68	100
Area of land owned:		
Small farm (≤ 5)	20	29.4
Medium farm (6 -10 Mukhamas)	31	45.6
Large farm (≥ 11 Mukhamas)	17	25
Total	68	100

Table (2) Frequency distribution of farmer's perception

Farmers perception	Frequency	Percentage
Crop productivity:		
Increased (last 5 years)	7	10.3
Declined (last 5 years)	61	89.7
total	68	100
Rainfall:		
Increased (last 5 years)	13	19.1
Declined (last 5 years)	55	80.9
total	68	100

CONCLUSION AND RECOMMENDATIONS

Results of the study show that most farmers in the research area belonged to the relatively younger age less educated group with agriculture as the main source of income and livelihood. Smallholder's farmers have several indigenous knowledge (adaptation strategies) to cope with climate variability and change which enable them to survive. Rural communities, particularly farmers perceived a decreasing trend of rainfall over years associated with a reduction in crop productivity, perceptions of seasonality and climate variability similar mainly according to ages and gender.

This research work recommends encouraging effective indigenous knowledge and Build up of resilience and adaptive capacity in order to help vulnerable communities meet the challenge of climate variability and climate change. Strengthening networks, partnerships for climate technology transfer, working with national stakeholders to build or enhance indigenous capacities.

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