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Transforming livelihoods through irrigation and water-use efficiencies in semi-nomadic agropastoral system: A case of Kalobeyei community, Turkana County, Kenya

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Abstract
The study aimed at assessing how Kalobeyei community in Turkana County, Kenya is adopting crop farming in an agropastoral system. Specifically, it sought to determine irrigation and other water-use efficient strategies used in building resilience in growing crops among the community. The study adopted a descriptive survey design. Data was collected from key informants working with the DanChurchAid (DCA) and the local community leaders. Similarly, qualitative observations were also used to inform the study conclusions. Pastoralism alone cannot sustain livelihoods due to climatic vagaries, animal pests and diseases. The County government of Turkana is collaborating with Non-governmental Organizations (NGO's) in teaching the locals on ways of building resilience in crop farming using shade nets, cone gardens and vertical gardens. These techniques are not only addressing food security in the area but also diversifying diet of the locals where acute malnutrition among children under the age of five is prevalent. The study concluded that the study area has great untapped potential in adoption of crop farming despite harsh climatic conditions and unsettled nomadic lifestyle. Therefore, there is a need to promote multi-sectoral engagement to effect synergy in the change. This study recommends targeted and deliberate agriculture extension that is guided by remapping and designing of feasible and sustainable integrated outreaches.

Keywords: Agropastoral system, resilience, climate vagaries, food security, diet diversification

1. Introduction

Investing in food security is a national and global agenda, as discussed in the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). As the world embrace global partnerships in fighting climate change in the quest for zero hunger, food security remains a top priority, with insecurities becoming more prevalent in the developing countries.

Historically, the Turkana community, part of the larger Nilotic group, is predominantly known for pastoralism. Mutai (2020) [7] noted that although pastoralism among the Turkana community is a culture-centred livelihood activity, it has failed to guarantee food security among the Turkana community. Kalobeyei, found in the west of Turkana County, lies in an arid and semi-arid lands (ASALs) of the Northwestern part of Kenya, where nomadic pastoralism is predominant. Turkana county, typical in any Africa's ASALs, is affected by gradual and sudden climate-related disasters such as animal and crop pests, droughts, famine, small arms proliferation, floods, and armed conflicts arising from cattle rustling which lead to socioeconomic turmoil (Simula *et al.*, 2020; Mkutu *et al.*, 2019; Lind, 2018) [10, 6, 3].

In Turkana West, the government has for long been allocating resources in terms of relief aid interventions, building resilience in both animal and crop production with the aim of increasing food security. However, significant resilience has not been built in the study area and this has led to a vicious cycle of government aid and relief. The Turkana County Government (2013) noted that while majority of the people in Turkana (62%) practiced pastoralism, only 20% of the remaining population practiced agro-pastoralism. Cattle rustling, insecurity, droughts and farming and effects of devolved government functions are some of the factors that are pushing the locals to transit from pure pastoralism to semi-nomadic agropastoral system, where crop farming is being practiced. Water is a scarce resource in Turkana West and therefore to support this transition, the locals have to device irrigation and water-use efficiencies that can support crop farming.

1.1 Objectives

a. To assess irrigation and water-use efficiencies adopted by the community in their semi-nomadic agricultural systems, and
b. To give recommendations and policy implications of such transformation.

1.2 Conceptualization of Crop Farming in Turkana County

Crop farming (CF) in Turkana County was conceptualized

based on a set ecological factors (EF), cultural factors (CF), and political factors (PF).

Thus, Crop Farming = f (EF, CF, PF) as indicated in Figure 1 below.

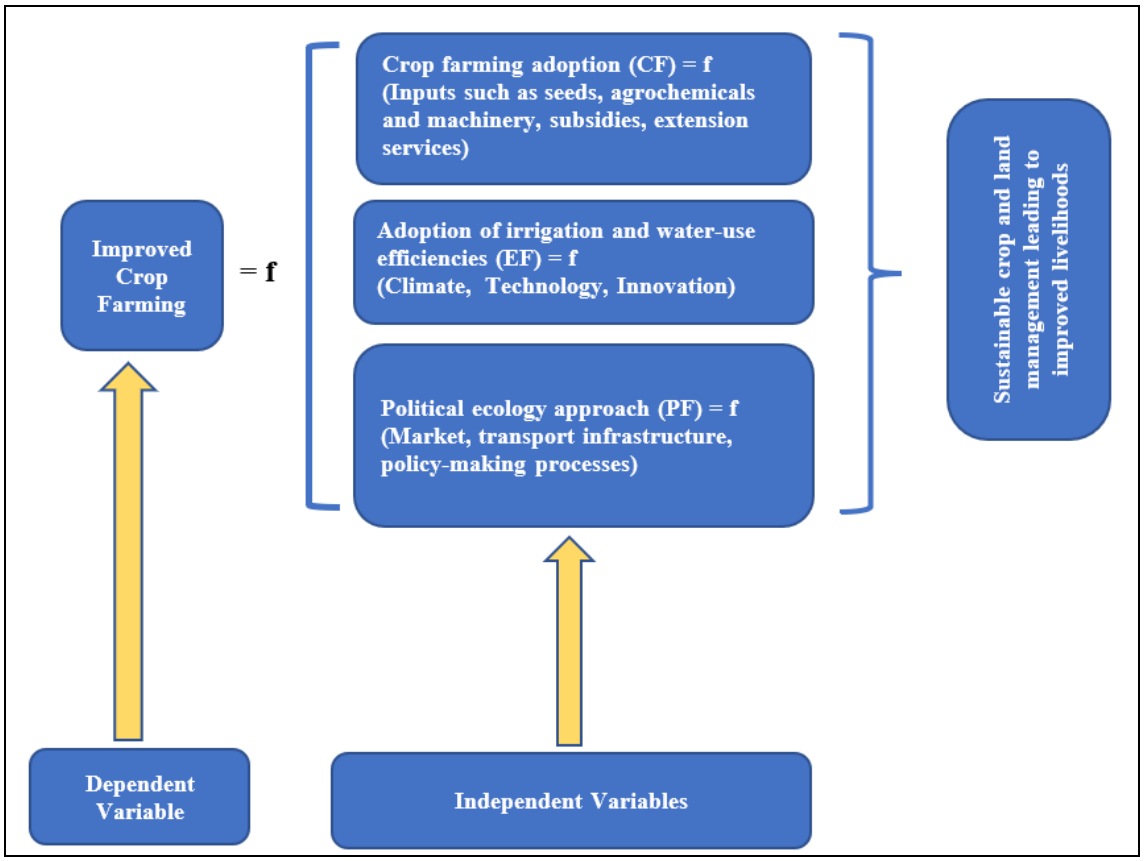

Fig 1: Conceptualization of crop farming among the pastoral Turkana community

Ecological factors are environmental factors that affect crops such as temperature, precipitation, humidity, and edaphic factors. Cultural factors are related to the historical orientation of people based on their traditions and norms which deter or encourage people of same culture to take part in crop farming. Mutai (2020) [7] noted that most people in Turkana county are not able to shift from unsustainable pastoralism to crop farming due to their cultural inclination, and not their technical feasibility. The unsettled life of the Turkana pastoralists makes it hard for them to settle for crop cultivation (Sirma, 2013) [11]. Political factors include leadership and governance systems that support crop farming in the area. The political ecology approach expounds the relationship between man and nature through analyzing forms of utilization, regulation and impacts on environmental health and sustainable livelihood of the people (Pankaj, 2016) [9]. The Northern part of Kenya, where Kalobeyei is situated, has been greatly considered in the country's infrastructure development (Lind et al., 2020; Mossley & Watson, 2016) [4]. Example of such projects includes geothermal exploration, the Lamu Port-South Sudan-Ethiopia Transport (LAPSSET) transport network, natural energy resources, water aquifers discovery, refugee, and military camps (Mkutu 2020; Mkutu *et al.*, 2019 & Opiyo *et al.*, 2015) [6, 5, 8]. All these projects compete for community land and therefore proper policies are needed to ensure no land-based disputes, land grabbing as well as ensuring highly potential areas are conserved for agricultural purposes.

2. Materials and Methods

The study used descriptive survey design. Lukesh (1994) noted that descriptive survey research is used to get precise state of affairs concerning variables as it exists at present. Kothari (2004) adds that this type of design provides precise description of information about the variables in the study. Data collection was done using qualitative observational method where phenomena of interest was observed and whose findings informed the study conclusions. The study was conducted in Kalobeyei community, Turkana West sub-county, in the Turkana County, Kenya.

3. Results and Discussions

3.1 Resilience building towards agricultural activities

Resilience is the crop system's ability to withstand climatic shocks which leads to the long-term adaptation to a fast-changing environment. It is estimated, through modelling, that there will be a sharp decline in the number of days for crop farming in some parts of East African region and changing biomes will cause fluctuations in yield (Thompson *et al.*, 2015) [12]. However, climate-smart strategies can help to build intrinsic resilience within their agro-pastural systems.

Fig 2: Herds of cattle die because of drought and famine in Turkana West (PHOTO: James Ekapolon).

DanChurchAid (DCA) in partnership with other organizations such as SAPCONE (St. Peter's Community Network, LWF (Lutheran World Federation), and KSC (Kenya Seed Company) are collaborating in teaching the locals on water-use efficiencies in their agricultural systems. For instance, Kenya Seed Company is responsible for providing suitable planting seeds for the locals. Some of the major crops grown in these agropastoral system includes; - vegetables, maize, and sorghum. Unavailability of water is one of the main challenges facing the Kalobeyei community. However, the locals have improvised innovative technologies to address the challenge. The following three irrigation and water-use efficiencies were identified to be key in the facilitation of crop farming in the agropastoral system within the study area.

a. Shade-house gardens

In Turkana, the hot dry winds create very harsh conditions for vegetables because they increase the rate of transpiration. Within the study area, conserving water for animals and plants is their top priority. To achieve this, the locals are using shade-house gardens, which are structures made of perforated clothing or nets to allow the needed amount of light, air, and moisture. The structures are normally covered with shade cloths to keep off excessive heat, dryness, and destructive pests.

Several advantages of these shade houses were reported among the locals. They are easy to construct and inexpensive as they use locally available materials. Besides, they conserve water and can be used for a variety of crops. The locals reported low disease and pest infestation in crops grown under shade nets as compared to those in the open. Elad *et al.,* (2007) [1] noted that disease development is negatively affected by intensity of shading and light quality.

Fig 3: Shade-house vegetable garden in Kalobeyei community (PHOTO: James Ekapolon).

The principle behind the shade nets is that they create a suitable and controlled microclimate for the grown crops by regulating environmental variables such as air temperature, solar radiation, leaf temperature, and relative humidity. In a controlled trial, shade nets were found to reduce harvest losses caused by tomato cracking by 50% as compared to those without the nets (Kittas *et al.*, 2012) [2].

b. Cone gardens/ Multi-storey gardens

Cone gardens involves profiling of soil layers in a conical shape above the ground to create more surface where crops can grow. Normally, the cone gardens are made up of polythene or plastic sheeting/materials. Cone gardens offers more space for planting crops, and they are easy to manage such as weeding. Also, they are economical as they save water in water-stressed areas such as Turkana. In addition, cone-gardens have high concentration of nutrients, and ensures diversification because different vegetables can be grown in different layers.

Fig 4: Cone-gardening saves water, ensures crop diversification, ensures greater nutrient concentration, and are easy to manage.

Apart from improving food security, cone gardens support diversification because several crop species can be grown on one such platform. A 2019 Integrated Phase Classification (IPC) showed very high levels (IPC Phase 4-GAM 15-30%) of acute malnutrition in children below five years in Turkana (County Government, 2019). Therefore, these cone gardening are increasing food diversification at household-level in Kalobeyei community.

c. Vertical sack gardening

Sack gardens are economical as they save water and space as a sack 1-meter long can be used to grow about 100 crops vertically at ago. They also utilize nutrients efficiently and are easy to manage for example they ensure easy weeding. This strategy for water-use efficiency is substantially practiced in Kalobeyei community and uses 20L in 7 days. It is less labor-intensive and utilizes locally available materials.

Fig 5: Vertical sack gardening at Kalobeyei, Turkana West.

Within the study area, sack gardening has played a key role in diet diversification and has ensured self-reliance from among the locals cutting down cost of buying vegetables.

4. Conclusion and Policy Implications

Kalobeyei community in Turkana County lies in the ASAL region in North West parts of Kenya, where pastoralism is the main activity. Climatic conditions are marked by hot weather, reduced vegetation cover and pastoralism is highly unsustainable. Cultural and social factors are the main challenges facing adoption of crop farming. The unsustainable, unsettled traditional pastoralism in Kalobeyei community is making people to look for alternatives of sustaining livelihoods. The DanChurchAid (DCA) and other organizations are working with the locals on building resilience in crop farming using water-efficient shade nets, cone, and sack gardening. Apart from bringing together multi-sectoral consensus on the introduction of crop farming in the Kalobeyei semi-nomadic system, the cultural, political, and ecological factors need to be harmonized.

Therefore, the following are recommended to enhance adoption of crop farming in Kalobeyei semi-nomadic community; -

a. Resilience strategies for the community and other ASALs – multi-sectoral engagement and collaboration in all areas of food production and climatic resilience, including prevention, preparedness, adaptation, mitigation, response, and recovery.
b. Capacity building – equipping the local people with the ability to access relevant information, good agronomic practices, and enlightenment to form partnerships and effect intervention.

c. Structural changes – engaging in institutional activisms such as globalization, climate change, demographic growth, and development to promote innovations.
d. Remapping and redesigning of customizable agriculture policies – strategic and smooth transition from nomadic pastoralism to semi-nomadic agropastoralism, community development, resource management, rural extension, and conflict prevention.

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