

*Research article*

# **Influence of Distance to Water Source on Socio-Economic Factors in Tiva Catchment, Kitui County**

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Lack of water in Arid and semi-arid lands (ASALs) result to inability to meet other human needs such as education and investment. In the arid Kitui county, education and livestock numbers are important social economic that are often hindered by lack of water. The objective of this study was to determine whether distance to a permanent water source had influence on attainment of education and livestock accumulation. The survey was carried out through interviews using a questionnaire. Results showed the level of education achieved by the residents is weakly correlated to distance to a permanent water source ( $R^2 = 0.13$  and  $R^2 = 0.006$  for secondary and tertiary level education respectively) for the children. For the fathers, the distance to a water source played a role in the level of education they attained. The level of education influenced the kind of livestock kept by the residents with the more educated preferring smaller livestock. There was likelihood other factors influenced the level of education sought by the residents for their children.

**Key words;** ASALs, distance, water source, education, livestock

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## **INTRODUCTION**

Arid and semi-arid lands (ASALs) in Kenya make up 89% of Kenya (GOK, 2011). ASALs are fragile environments due to water shortages. Challenges of water access in ASALs put residents at a great disadvantage towards achieving other positive social economic indicators. Kitui County where this study was based is located in a typical ASALs region. The county receives little and unreliable rains that occur in intensive storms that are poorly distributed in time and space. Problems of access to water in Kitui County is best defined by rainfall totals which average 500mm per annum against potential evapotranspiration of 1800 to

2000 millimeter a year (Kuria et al, 2012).The high evapotranspiration rates are occasioned by high temperatures that can rise up to 34°C in the hottest month of September (AWEMAC, 2018). Rainfall amounts range from 1200mm pa in the north to 200mm in the South of the County. Rainfall distribution is poor even in the more humid regions making crop failure in the County a chronic problem requiring regular interventions.

Water resources in Kitui County are scarce. The County lack adequate water for both domestic and agricultural use as there are limited surface and ground water resources. The main water resources include seasonal rivers with majority drying up soon after the rains. This is with the exception of Tana and Athi which

form the North and Southern county boundaries respectively. Some seasonal riverbeds also act as water sources for prolonged periods of time. They comprise of Rivers Nzeeu, Tiva, Mwitwa Syano and Thua. Other sources include sand dams, earth dams, water pans, shallow wells, boreholes, and springs (Ngigi, 2003). Access to water is always a challenge with over 60% of Kitui households taking approximately one hour to reach a water source; average distance to the nearest water source range from 4km in Kitui Central to 29.9km in Kitui South with county average of 7km (CGK, 2018). The 7km is 14 times longer than maximum recommended by sphere standards for water access (SPHERE, nd) and longer than 6km average distance in search of water in Africa by 2010 (UNHR, 2010). According to CGK (2013) just 4,774 households have roof harvest rainwater systems despite the high potential as 76.4% of households have used corrugated Iron sheets roofs appropriate for rainwater harvesting. The majority of the population depends on surface and sub - surface dams which often do not hold sufficient water. Long walking distances have been proven to negatively affect other social economic indicators including education, investments, health and incomes leading to increase in poverty (Amy and Jennifer, 2012) which has also been reported for Kitui County by Zolnikov and Blodgett (2017).

The County land area covers 30,496.5 km<sup>2</sup> including 6,302.7 km<sup>2</sup> occupied by Tsavo East National park (CGK, 2013). Total county's population was 1,012,709 during the Population and Household Census of 2009 and was projected to grow to 1,086,599 by 2015 (KNBS, 2010). Population density in Kitui is sparse in relation to other regions; was 33 persons per Km<sup>2</sup> in 2009 compared to a national average of 66 persons per Km<sup>2</sup>. Within the county, Kitui Central has the highest density at 219 persons per km<sup>2</sup> with the density reducing to 30 and 27 for Kitui South and Kitui East respectively (CGK, 2018). Population growth rate of the county stood at 2.1% which was slightly lower than the national rate of 2.6% while the average size of land holding in the County is 0.12 km<sup>2</sup> per person (12 ha per person). (CGK, 2013). It is expected large parcels of land and limited rainfall relative to other parts of the country should put Kitui residents at an advantage in relation to investment in livestock keeping. Taking up livestock as the main economic activity would be desirable as it would be easier to manage pasture growth compared to crops such as maize that must reach maturity to act as food source or have economic benefits against the poor rains.

As a consequence to poor rains in most of the county, there are high poverty levels with 60% of the inhabitants living below the poverty line (CGK, 2013). The purchasing power parity (PPP) in US dollars is also lower at 828 compared to the national level at 1436 (CGK, 2018). Poverty lock people into coping mechanisms that are often disastrous to other social indicators such as

health and education and also to the environment which is often the case in Kitui and other arid regions in Kenya (GOK, 2011). Poverty negatively affect literacy, further compounding the problem. In Kitui County, literacy level is lower (at 63.2%) than the national level which stand at 70.5% (CGK, 2018). This study seeks to find out the extent access to water influences other wealth indicators of education and livestock.

Livestock rearing in most ASAL environments in Kenya like Kitui County is favored by the large parcels of land. Overall livestock are good social economic backbone with those who have more enjoying better economic standings (AWEMAC, 2016). Livestock absorb shocks resulting from droughts that are common in the ASALS. At the height of drought, pasture is still available in form of standing hay and the animals are driven to the few remaining water sources even though they could be far away. As such, livestock survive while crops fail and the farmers are able to obtain milk as well as sell the animals and their products to buy other foodstuffs. Those with none or just a few livestock are poor and highly vulnerable, unable to properly feed themselves or meet other basic necessities such as health and education expenses. Other than access to water, rearing livestock in remote parts of Kitui face other challenges such as marketing of livestock products due to poor marketing infrastructure. The intensive search for water negatively affect children's access to education.

Poor infrastructure in arid regions of Kenya remains a major drawback to the livestock industry. The road network is poor in most parts of Kitui County with the southern side not having roads with bitumen surfaces. By 2013, the County had just 225km of bitumen road surface, all on the northern side of the county, (CGK, 2013). On the southern part of the county where rainfall is poor which means keeping livestock is more viable, most of road networks remain in poor state and impassable during the rainy season (CGK, 2014). It is also on the southern side of the county where size of land per person is highest as population density increases with rainfall amounts which is further to the north (CGK, 2018). This implies that while farmers in the more arid southern parts of the county could benefit from keeping more livestock, such benefits are limited by the poor infrastructure. This implies the large number of livestock does not result to better ratings in socio economic indicators.

In response to shocks emanating from droughts, governments and other development partners often result to food aid on the short time and building of water resources. While else education is considered a worthy achievement, rarely is it considered as a more sustainable solution to water problem.

The question this research sought to answer was whether nearness to a water source has any influence on the socio-economic indicators of wealth which include family size, education and number of livestock. In

addition, this study related these factors to each other to find out how they influenced one another. It will also answer the question on how the government and other development partners should package aid.

## METHODOLOGY

### *Description of study site*

The study site was within Tiva catchment of Kitui County. Tiva river is one of the many seasonal rivers found within the County. Kitui County is located on the South eastern part of Kenya and is found between 1° 10' and 3° 0' South and 37° 50' and 39° 0' East. The elevation above sea level ranges between 400 and 1800 m. There are two rainy seasons; the short and long rainy seasons received in November-December and April-May respectively. Rainfall failure is common in both seasons. The rainy seasons are highly erratic, unreliable, usually falls in a few intensive storms and there are wide variations from year to year (Lasage, 2008). Rainfall reliability is 40% for the long rains and 66% reliability for the short rains (CGK, 2013). The inhabitants engage in various social economic activities that include crop growing and keeping livestock. Crops grown include maize, cowpeas, beans, pigeon peas, mangoes and pawpaw. Other activities include beekeeping, small-scale trade, ecotourism, charcoal burning, brick making and basket weaving (Ngigi, 2003). These social economic activities vary from the North which receives the highest amount of rainfall of over 1000mm to the South that receives the least of about 200mm (GOK, 2013).

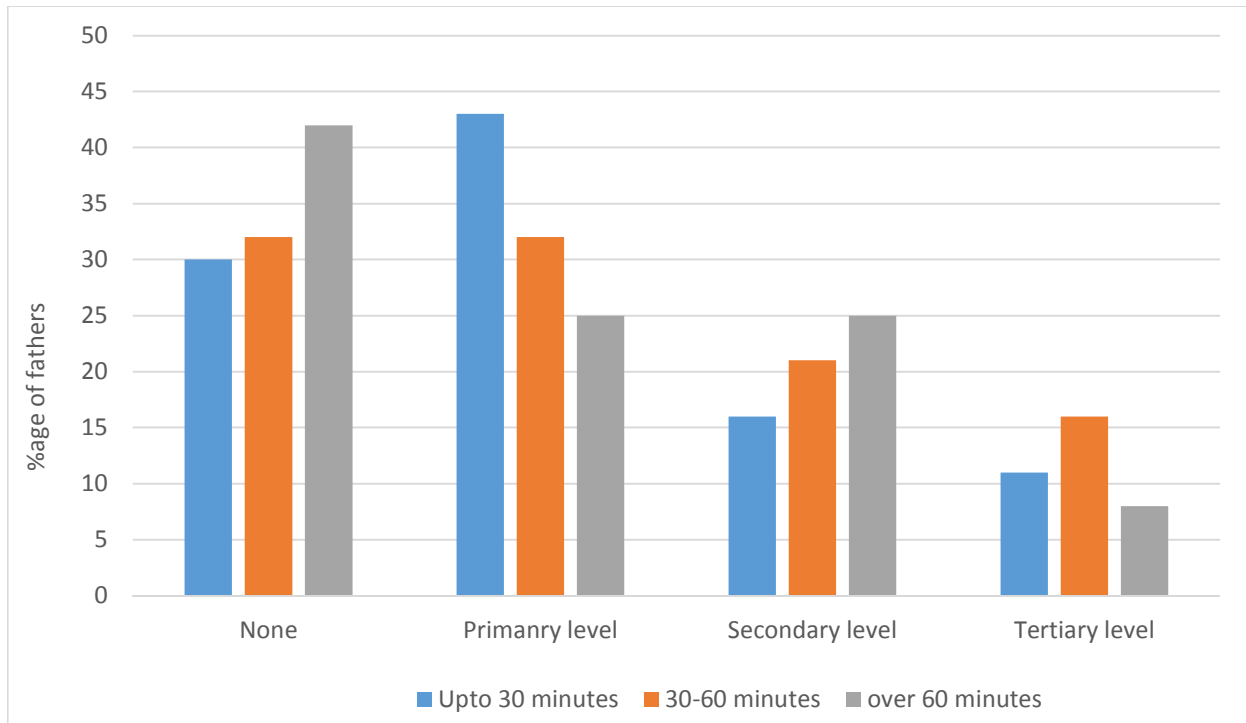
### *Research method*

One hundred inhabitants of Tiva catchment were interviewed using a questionnaire. This took place in October 2016 for being the driest month of the June to October drought period. The respondents were selected randomly within the entire catchment. The questionnaire focused on nearness to the nearest permanent water source. The source of water was the nearest permanent water source which could have been borehole, well, spring or sand dams or earth dams. The amount of time taken to reach a permanent water source was evaluated against social indicators of wealth which included education level (of the highest ranking family member and children) and livestock numbers. Distance to water sources was correlated to level of education and number of livestock. The level of education was also correlated to investment in number and type of livestock. Those interviewed were adults in the age categories of 20-29 years (10%), 30-39 years (18%), 40-49 years (29%), 50-59 years (22%), 60-69 years (10%), 70 and over (11%).

Data analysis included measure of central tendency, correlation and cross tabulations using SPSS and excels software. Two resource transmission mechanisms were identified corresponding to the practices build around the water resource.

## RESULTS

Among the respondents, 75% were fathers 59% of whom lived within 30 minutes walking distance to a permanent water source. In this category, 30% had no formal education, 43%, 16% and 11% had primary, secondary and tertiary level education respectively. Another 25% of fathers walked between 30-60 minutes. In this category, 32% had no formal education, 32%, 21% and 16% had primary, secondary and tertiary level education respectively. For 16% of fathers respondent who walked over 60 minutes, 42% had no formal education, 25%, 25%, and 8% had primary, secondary and tertiary level education respectively. In the category of up to 30 and 30-60 minutes walking distance, 2% and 5% had attained university level education respectively different while in the over 60 minutes walking distance, the highest level of tertiary education was certificate holder by 8% respondent. Figure 1 below shows the influence



**Figure 1.** Influence of walking distance to a water source on education for fathers

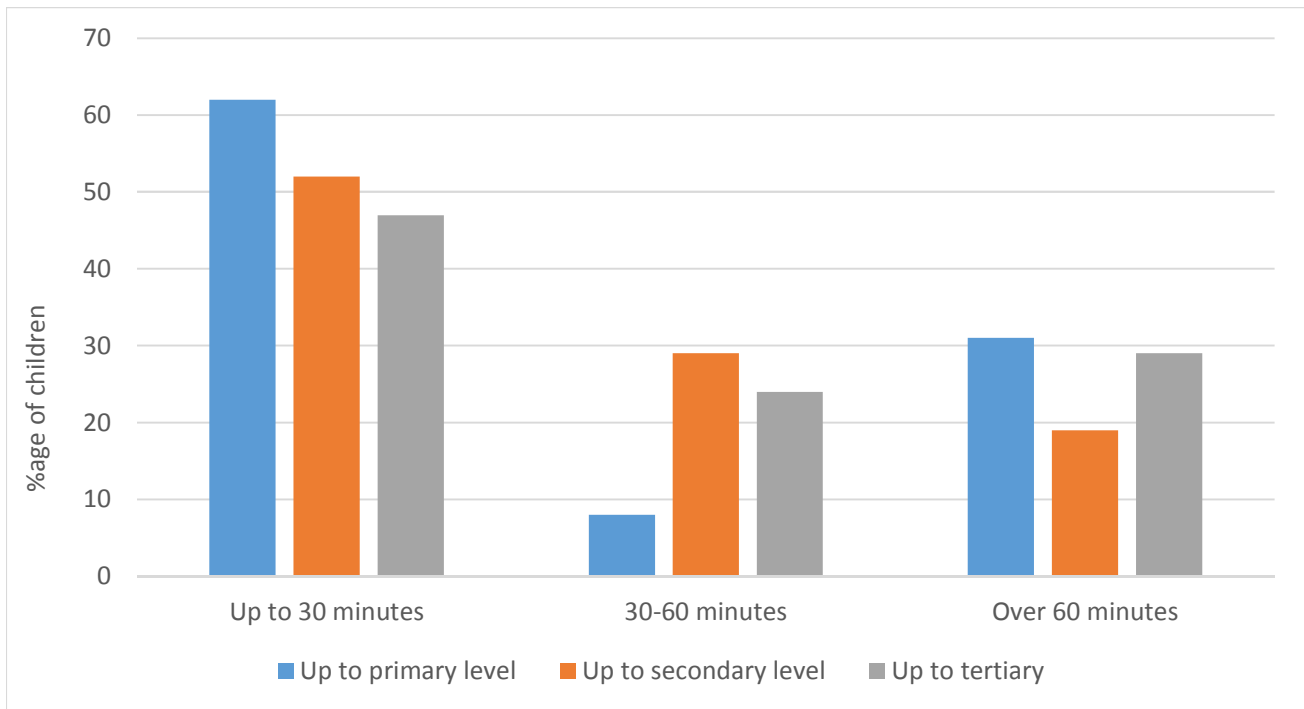
From figure 1 above, those who did not enroll to school increased with increase in distance to a water source while those who attained primary level education reduced with increase of distance to a water source. Distance to a water source determined whether fathers enrolled to school and attainment of primary level education.

The level of education for children within the various age cohorts were also assessed against walking distance to a near permanent water source. This assessment considered children starting from 15yrs and above also secondary going age group. Below 15 years, children are expected to be in primary school which is currently compulsory in Kenya and the respondents would not disclose if they had children not going to school due to legal implications. 15% of the families had children aged 15 to 21 of which, 55% had just primary level education, 36% had joined secondary education and 10% had joined a tertiary institution. Walking time to a near permanent water source was not a determinant to level of education attained by the children of secondary school going age. In-fact there was very weak correlation between education level attained and walking distance to near permanent water source ( $R^2 = 0.13$ ).

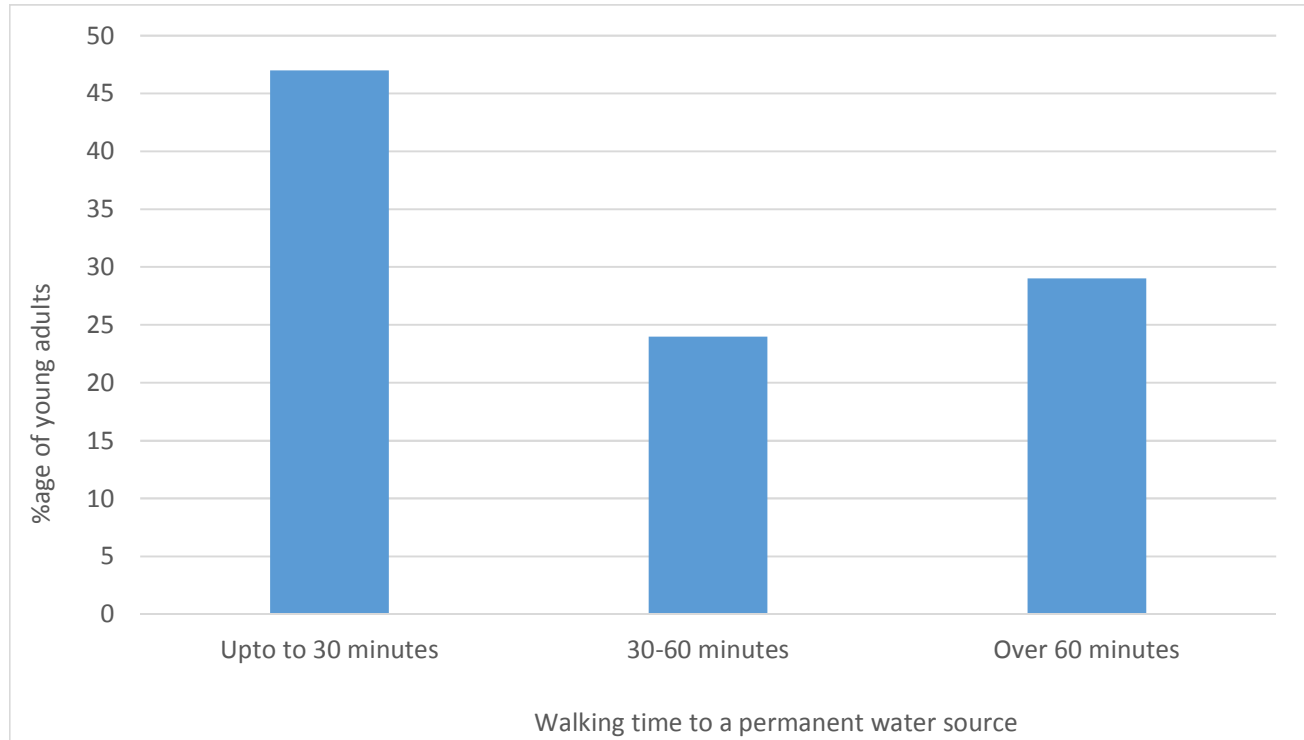
68% of the families had children older than 21 years implying old enough to have started tertiary level education. Out of this 25% did not have any of their

children with more than primary level education. Out of the 25%, walking time to a permanent water source was within 30 minutes for 62% families, between 30 and 60 minutes for 8% family and 31% families for more than 60 minutes. Another 41% had no child with more than secondary education. For this group, walking distance was within 30 minutes for 52%, between 30 – 60 minutes for 29% and more than 60 minutes for 19% of the families.

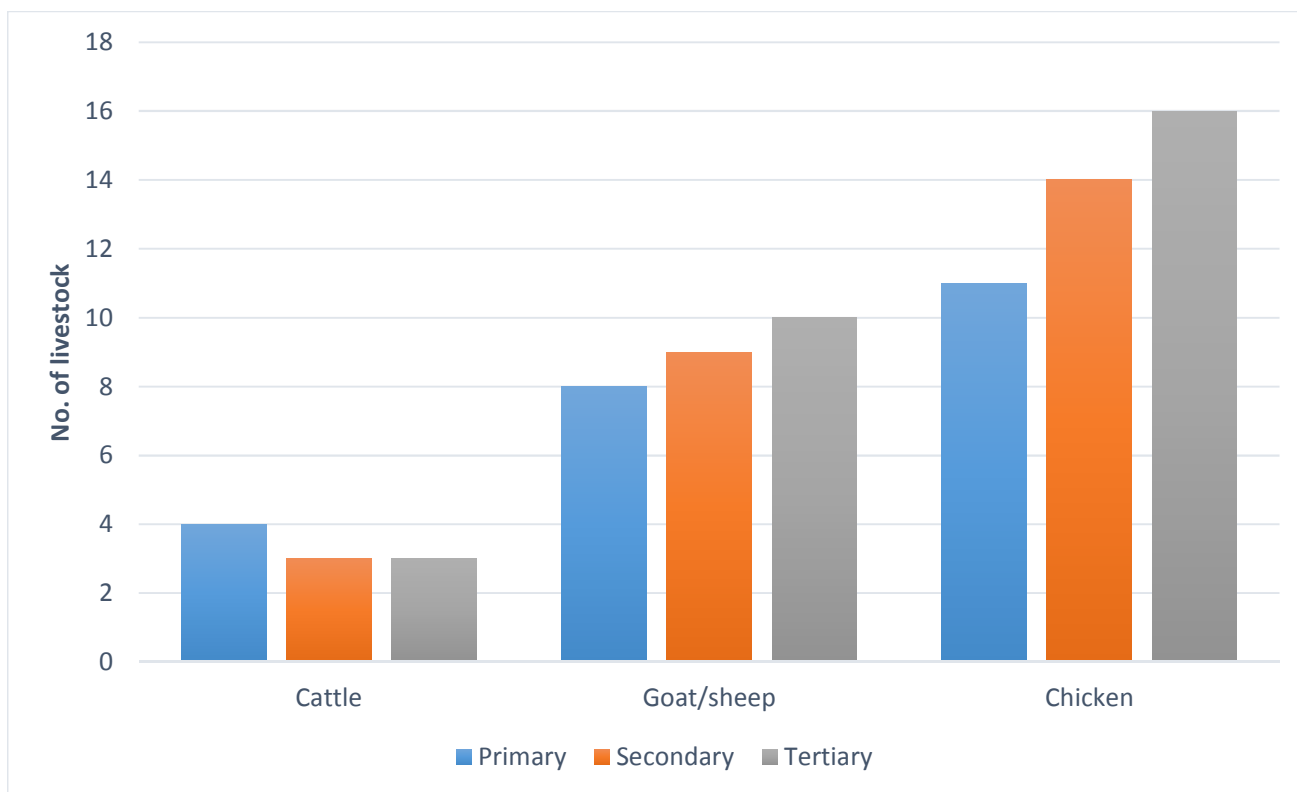
33% of the families had children who had attained tertiary level education, of which 47% walked for up to 30 minutes, 24% up to 60 minutes while 29% walked for more than 60 minutes. The correlation between level of education and walking distance to a permanent water source for families with children of 21 years and above was also rather weak ( $R^2 = 0.005$ ), implying the distance to the permanent water source did not determine level of education attained. This was attributed to affirmative action forcing parents to make sure children get at least basic education.



**Figure 2.** Influence of Walking Distance To A Permanent Water Source For Children



**Figure 3.** %Age of Children above 21 Years with Tertiary Level Education



**Figure 4.** Relationship between Education Level and Livestock Ownership

In regions where water was nearby, households owned fewer cattle compared to regions where water was far away. This clearly indicates the farmers' preference for keeping more livestock where water was scarce because there was less likelihood for other economic activities from the land. It is expected such households owned larger land parcels compared to those where water was more readily available.

The number of livestock was influenced by education of the highest ranking family member (figure 1). The smaller the livestock size, the higher the level of influence. Ownership of small livestock (goat, sheep and chicken) is strongly correlated to level of education while cattle ownership is negatively correlated.

Family sizes were also compared where there was water and where there was no water. The average family size where there was water and where there was no water was 5.69 and 6.25 persons respectively. A t-test showed the two means were not statistically significant at  $\alpha$  level of 0.05.

## DISCUSSION OF RESULTS

From the results, it is clear fathers who lived near water

sources had a higher chance of attaining education at all levels of education compared to those who lived further away. They also had a higher chance of attaining skills by proceeding to the tertiary level compared to those who walked further away. In this case, a near water source exposed beneficiaries to better life options due to exposure resulting to better education and skills. It is expected this trend was created in the past as it is not maintained in the case of children.

Intervention by NGOs or government may introduce other benefits other than water which exposes the residents to education opportunities. This could have been the case for areas that received water sources that were permanent such as sand dams, wells and boreholes from either NGOs or government. This is probably the reason areas with permanent water sources registered the same patterns towards education achievements in children. It implies presence of strangers or people foreign to a region may act as incentives to attaining education. The incentives could be in form of financial benefits as the local people are usually engaged in paid employment or children getting motivated to study more by presence of NGO/government workers. This is a positive sign which shows residents will react to other forms of interventions to trigger interest in education.

It is not clear why lack of water lead the residents to seek more education for their children. Obviously, the perception that where water is less people spend too much time looking for water and may miss on education opportunities may not be entirely true, at least for the study area. Improved water supply to schools in Zambia did not result in increased enrolment, reduced drop outs and repletion according to Agol et al (2017). It is possible for this study, lack of water and the accompanying poverty lead people to seek better lives through education.

The common perception that distance to a water source negatively influences education in arid regions like Kitui County cannot be confirmed by this study. It is likely this could be attributed to the long term presence of NGOs as well as government interventions in assisting residents in the more vulnerable regions within Kitui County. Government interventions include relief food and free lunch in primary schools which have successfully kept children from vulnerable homes in class (WFP, 2016). In addition, the county has a large presence of NGOs that work to assist the families meet the basic necessities in vulnerable families. Mwasi, 2014 reported 487 NGOs out of 8000 registered in Kenya as being operational in Kitui. However, this study did not assess whether the distance travelled to access water affects the grades attained by the learners and recommend such a study to be undertaken.

At higher education levels especially at tertiary level, it is expected people have probably attained a career which they depend on such as paid employment or private investment. This would imply they are not fully dependent on livestock for survival. This may also imply they cannot dedicate all their time and energy to livestock rearing. This may explain why they may avoid keeping large livestock such as cattle which require all day of grazing. Small livestock on the other hand do not need much labor and can even survive on less water making it easier to keep for farmers with limited time. For the less educated families who may lack skills to engage in alternative activities or paid employment dedicating all their time to rearing livestock can be successful and they have the opportunity to keep large livestock such as cattle in semi-pastoral system.

The implication is being emphasized on the need to develop the livestock industry in the more arid regions of Kitui where crop production is not an easy option. In regions where grass grows quickly to escape the drought, livestock keeping is a viable option that needs to be properly developed. Unfortunately, with the county poorly developed transport infrastructure, marketing for livestock products still put the residents at a great disadvantage. Further to the south, the roads network remains poor with no tarmac at all which means the livestock and their products cannot easily gain easy access to the markets.

The study also highlights the need to do research on

how to package aid given to the poor and vulnerable by government and NGOs. Education seems to assist in better informed investment options such as small livestock that will make families absorb shocks due to droughts. Any aid packages to the poor should give education priority as it offer more sustainable poverty eradication skills.

### **Water related resources transmission mechanisms**

To improve on wealth positive indicators two resource transmission mechanisms were identified with proposals for their improvement. This focused on those regions where (a) residents have a near water resource (less than 30 minutes) and (b) where the water resource is far away (more than 30 minutes).

#### **a) Near reliable water source**

Farmers living near reliable water source are risk evasive. The reliable water source is restricting as in most cases can provide only enough water for portable use and a few livestock. Such water resources offer security and restrictions; the owners of such resources have security of water albeit little that inhibit them to invest in prosperity in form of irrigation or better livestock breeds and large numbers. They are likely to end up poorer with time unless they invest on improving access to more water. They however have more time because they move less in search of water enabling them easy access to education for their children. Lack of money is not a hindrance in education attainment due to government policy of free basic education for all children where basic education has been defined to include secondary level. Improved access may be found in more permanent water resources such as boreholes but this water comes at a cost implying they will still fail to engage in wealth building activities.

To improve on access to more resources, the farmers in this scenario must invest in improved access to water. This can be done through government investment in large earth dams or boreholes coupled with water distribution pipelines. At the individual level, the farmers should invest in water storage facilities including water tanks and wells to mitigate periods when the rainy seasons may fail as this is common in the asals of Kitui County.

#### **b) With far water sources**

In this scenario, the residents lack a water resource near their households. They take risks of keeping large livestock herds despite the knowledge water can only be found in far-away places. They move out in search of water risking their access to education. They own large

parcels of land that is of low productivity due to persistent droughts. They have to move with their livestock to faraway places, something that keeps them away from home for several days. This affects the education performance of their children as they are carried away to provide the much needed labor. It also affects family nutrition as they move with the milking animals. These farmers may also have access to permanent community water resources that are far but come at a cost which forces them to travel further in search of free water.

The proposed model for (b) above is to have the farmers move with their children but school enrolment is dynamic, placing the children in schools near their current location. This will require a change in school enrolment practices and policies as well as harmonization of syllabus coverage by all schools identified to benefit such families. Barriers to their implementation such as school uniform and other bureaucracies should be mitigated to facilitate access.

## CONCLUSIONS AND RECOMMENDATION

The high level of poverty occasioned by lack of water in Kitui County may have affected education standards relative to the rest of the country. However, disparity in water access within the county has not affected access to education for the children. Distance to a permanent water source affected parents' access to education but not their children. It is suspected interventions by NGOs and government agencies may have contributed to the more vulnerable regions achieving better education for their children contrary to general perception that struggles that accompany accessing water in arid areas negatively affect other socio-economic achievements. The disparity between parent and children education could be due to the timing of interventions by the government/NGOs interventions. It is recommended that these agencies stay in place until such a time water is within easy access by the residents to prevent falling back on poor education standards.

Limited access to water may affect choices of livestock kept by the residents of Tiva catchment in Kitui county. More educated families preferred smaller livestock such as goats, sheep and chicken compared to less educated who showed preference for cattle that are more labor demanding. It is recommended that more effort is put in place to increase access to water in order to offer more choices of livestock to the more educated families.

For farmers with a water resource near their home, it is recommended that this resource is improved, enhanced and protected to supply more water that can aid in building prosperity. For those that have to move to far away permanent water resources, school rules should be modified in the region to allow access to education in all involved schools both at primary and secondary level.

For institutions that offer aid to the marginalized including government and the civil society, it is important to note education offers more sustainable solutions to shocks due to drought as such people are able to make better investment options that are drought evasive.

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## Statement of Competing Interests:

The authors have no competing interests

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