THE EFFECTS OF WATER SCARCITY ON THE LIVELIHOODS OF NOMADIC PASTORALISTS: A CASE STUDY OF KATHILE SUB-COUNTY, KAABONG DISTRICT

BY

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DECLARATION

I **Maraika Amabile,** declare that this dissertation is my original work and has never been presented anywhere for any award of any other university.

Signature.....Date.24th/09/2014.

APPROVAL

This is to certify that this dissertation has been done under my supervision and submitted to the Department of Biological and applied sciences for examination with my approval.

SUPERVISOR:

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Sign. .....

Date. 24th SEPT 2014

DEDICATION

This report is dedicated to my beloved parents Mr. Lokwang Daniel and Mrs. Lokwang Maria Loido and, my siblings for the love and feel of belongingness, the courage they bestowed to me which has devoted me to the completion of this course.

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List of acronyms

ACF	Action against Hunger
AED	Alternative Energy Development
CPC	Climate Prediction Center
EEA	European Environment Agency
ENSO	El Niño Southern Oscillation
ERL	Environmental Research Letters
FAO	Food and Agriculture Organization
HDR	Human Development Report
IPCC	Intergovernmental Panel on Climate Change
NEPAD	New Partnership for Africa's Development
NGOS	Non Government Organization
NOA	North Atlantic Oscillation
NPAD	New Partnership for Africa Development
UN	United Nations
UNECA	United Nation Economic Commission for Africa
UNECA	United Nations Economic Commission for Africa
UNV	United Nations Volunteers
UPPAP	Uganda Participatory Poverty Assessment Project
W H O	World Health Organisation
WSSCC	Water Supply and Sanitation Collaboration Council

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ABSTRACT

The study aimed at establishing the effects of water scarcity on the livelihoods of the nomadic pastoralists. The study was guided by three objectives that is to say to determine the factors contributing to water scarcity, to identify the challenges nomads face due to water scarcity and to examine the adaptation strategies the nomadic pastoralists have adopted to counter water scarcity. The study was conducted in Kathile Sub County in Kaabong district where the country has got most cases of water scarcity on nomadic pastoralist. The study covered a period of three months to effectively cover all the objectives..

The study employed a descriptive survey design where both qualitative and quantitative designs of data collection were used. The study used self administered questionnaires and interviews to collected primary data from the field. The study used a sample of 80 respondents selected from 100 nomads who were the main respondents in for this particular study.

The finds showed that Kathile sub county is highly affected by water scarcity that affects all their operations and livelihood of the nomadic pastoralists since pastoralist is the main activity carried out in the area. The study found out that there are a number factors causing water scarcity in the area these included climate changes, deforestation, poor water management which is rampant in the area. Water scarcity poses a lot of challenges in the area such as affecting the health of people, affecting agriculture and mainly nomadic pastrolism. The study however established a number of adoptive strategies used to overcome the water scarcity problem in Kathile Sub County. The strategic measures include, digging wells, managing and controlling water resources, positioning animals and conservation of water resources.

The research recommends all the concerned parties to ensure proper water resource management, this can be through preventing the deforestation, ensuring diversification in the sources of livelihood like through crop production. The study also recommends the government to improve water harvesting techniques and enhancing dams' capacities through the removal of seasonal sedimentation.

CHAPTER ONE

1.1Background of the study

Moderate water scarcity first appeared around 1800, but it commenced in earnest from about 1900 when 2% of the world population experienced chronic water shortage (with access to) less than 1000 cubic m/capita/year) Kummu (2010). Water shortage increased extremely rapidly from 1960 onward, with the proportion of the global population living under chronic water shortage increasing from 9%, or 280 million people, in 1960 to 35% (2,300 million) in 2005 Environmental Research Letters, ERL (2010).

The United Nations Economic Commission for Africa (2005) estimates that 300 million out of the 800 million people who live on the African continent live in a water-scarce environment. Specifically in the very north of Africa, as well the very south of Africa, the rising global temperatures accompanying climate change have intensified the hydrological cycle. About 66% of Africa is arid or semi-arid and more than 300 of the 800 million people in sub-Saharan Africa live in a water-scarce environment meaning that they have less than 1,000 m^3 per capita (NEPAD, 2006). Water scarcity as a relative concept that can occur at any level of supply or demand resulting from the consequence of altered supply patterns stemming from climate change has hardened the livelihoods of the nomadic pastoralists for long and the problems of water related diseases is so pronounced and their agriculture too decreased in the terms of production(Mooney, 2006).

North Eastern Uganda comprises of mainly the pastoralist communities. The region is characterized by a fragile ecosystem – ravaged by the effects of climate change which has further increased need for mobility susceptible to insecurity due to regional ethnic and political inter-play within the Kenya-Uganda-Sudan a borderlands. The region is also drought prone, a situation that has depleted livestock, water and pasture. These conditions create an increased need for mobility – further and further a field for the survival of pastoralist livelihoods. More so those dependent on agriculture face a challenge of dwindling agricultural livelihoods because the region is already among the most water stressed areas. The dependence on rainfall rather than irrigation as the basis for agriculture puts these areas at much greater risk of crop failure.

In central Uganda, along the Ankole cattle corridor which is occupied by the cattle herders most especially, water scarcity is a problem which is also resulting in drought and is drying up watering holes and causing grasslands to die or disappear. This is contributing to overgrazing and causing herders to travel further to find land to feed their cattle. Furthermore, water scarcity and the lack of food security have contributed to many social and cultural conflicts as well (Steece, 2011).

There is a temperature increase of 0.3°c already in the Ankole cattle corridor which is causing severe droughts coupled with more erratic and scarce rainfall (Bifubyeka, 2009). Rising ocean temperatures have caused prevailing winds to heat up and therefore shift the regular annual rainfall in the region and contribute to desertification (Bifubyeka 2009). It's important to note that the region is already considered semi-arid grassland so the sensitivity of the area to differences in rainfall is already heightened. For this reason, herders are also sensitive to any shifts in rainfall because of their reliance on regularity.

In Kaabong, water scarcity is increasing and is resulting to the escalating poverty, persistent poor harvest as a result of dry spells and droughts, cattle rustling and insecurity, animal death, poor farming practices, ill health and disability, high bride price for marriage, limited sources of income, and landlessness (UPPAP, 2002).

1.2 Problem statement

Water scarcity in Kathile has been an every one's problem since 2007 up-to-date with a majority of the populace struggling to access safer drinking water provided by ten boreholes scattered to the different villages of Kathile. This is evidenced by research reports written by Olandason Wanyama (2013) as per the district local government authorities estimating 15 people to have suffered from waterborne diseases like jiggers and Hepatitis E due to accessing water from dirty water sources like wells, water ponds, river streams among others. It is also observed that over 100,000 people moved out of Kaabong district in the last five months in search of food for survival as a result of water scarcity due to prolonged droughts.

Long dry spells have hampered many families from cultivation resulting into serious famine since the last two years that the community has not had any harvest; death rates of animals due to absence of green grass to feed on but on the ever drying grass is alarming.

Although Oxfam and ACF Non Government Organizations (NGOs) initiated the construction of dams, few constructed dams have dried out though some still contain so little water and more so they have not been managed well. Water scarcity still remains a threat to the livelihoods of the nomadic pastoralists in Kathile as evidenced by the long distances they always move looking for water to provide their animals, food insecurity problem, water related diseases, conflicts from other communities, and education interference.

It is therefore basing on these observations that the researcher intends to carryout research on water scarcity so as to find out practical solutions to the problem by different stake holders including the researcher.

1.3 Objectives.

1.3.1 General objective

The main objective of the study is to assess the effects of water scarcity on the livelihoods of the nomadic pastoralists

1.3.2 Specific objectives

i. To determine the factors contributing to water scarcity in Kathile sub-county.
ii. To identify the challenges nomads face due to water scarcity in Kathile sub-county.
iii. To examine the adaptation strategies the nomadic pastoralists have adopted to counter water scarcity in Kathile sub-county.

1.4 Research questions.

The research was guided by the following questions

i. What factors contribute to water scarcity in Kathile sub-county?
ii. What challenges do the nomadic pastoralists face due to water scarcity in Kathile sub-county?
iii. What adaptation strategies have the nomads adopted to counter water scarcity in Kathile sub-county?

1.5 Scope of the study

1.5.1 Geographical scope.

This study was conducted in Kathile sub-county Kaabong district North Eastern Uganda. Kathile sub-county extends over 2,213 square kilometers, consisting of mainly 9 parishes. Kathile is mostly a semi-arid plain with harsh climate and low annual rainfall. . It is largely savannah, covered with seasonal grasses, thorned plants, and occasional small trees. The average elevation of the plain of Karamoja lies at around 1400 meters (4500 feet) above sea level. The respondents were sampled randomly from the nomadic pastoral communities in Kathile sub-county.

1.5.2 Content scope.

The primary area of concern in this research was focus at the different factors contributing to water scarcity, the challenges the nomads face due to water scarcity, and the adaptation strategies the nomadic pastoralists have adopted to counter the problem of water scarcity. These helped me to determine the relationship between rapid urbanization and environmental quality.

1.5.3 Time scope.

The study was for three months that is May to August 2014.

1.6 significance of the study

This research acts as a base line to all academicians, future researchers, the supporting organizations and politicians.

The researcher herself was able to get knowledge about water scarcity and the livelihoods of nomadic pastoralists as it on the ground.

This research also provides more knowledge to all other interested readers about water scarcity and livelihoods of nomadic pastoralists. Gaps left for the future researchers are also clearly identified.

The supporting organizations could be able to know what affects the livelihoods of nomadic pastoralists. It would also help them to identify some adaptation strategies as measures that could be used to improve the livelihoods of nomadic pastoralists as well as encountering the problem of water scarcity.

To the politicians, it can help them to realize that there are pressing issues of water scarcity on the livelihoods of the nomads and this helps them to address the needs of the nomadic communities and most especially creating projects that avail water.

1.7 Operational definitions.

Water scarcity is when an individual has no enough and safe water for domestic use, for drinking, and affects the livelihoods of individuals

Water scarcity refers to long-term water imbalances, combining low water availability with a level of water demand exceeding the supply capacity of the natural system European Environment Agency (2005).

A livelihood may be defined as the sum of ways in which households obtain the things necessary for life, both in good and in bad years. These necessities include food, water, shelter, clothing and health care (with education often included too). Pertinent activities can include crop and livestock production, fishing, hunting, gathering, bartering, and other endeavors and income generating activities (including off-farm work).

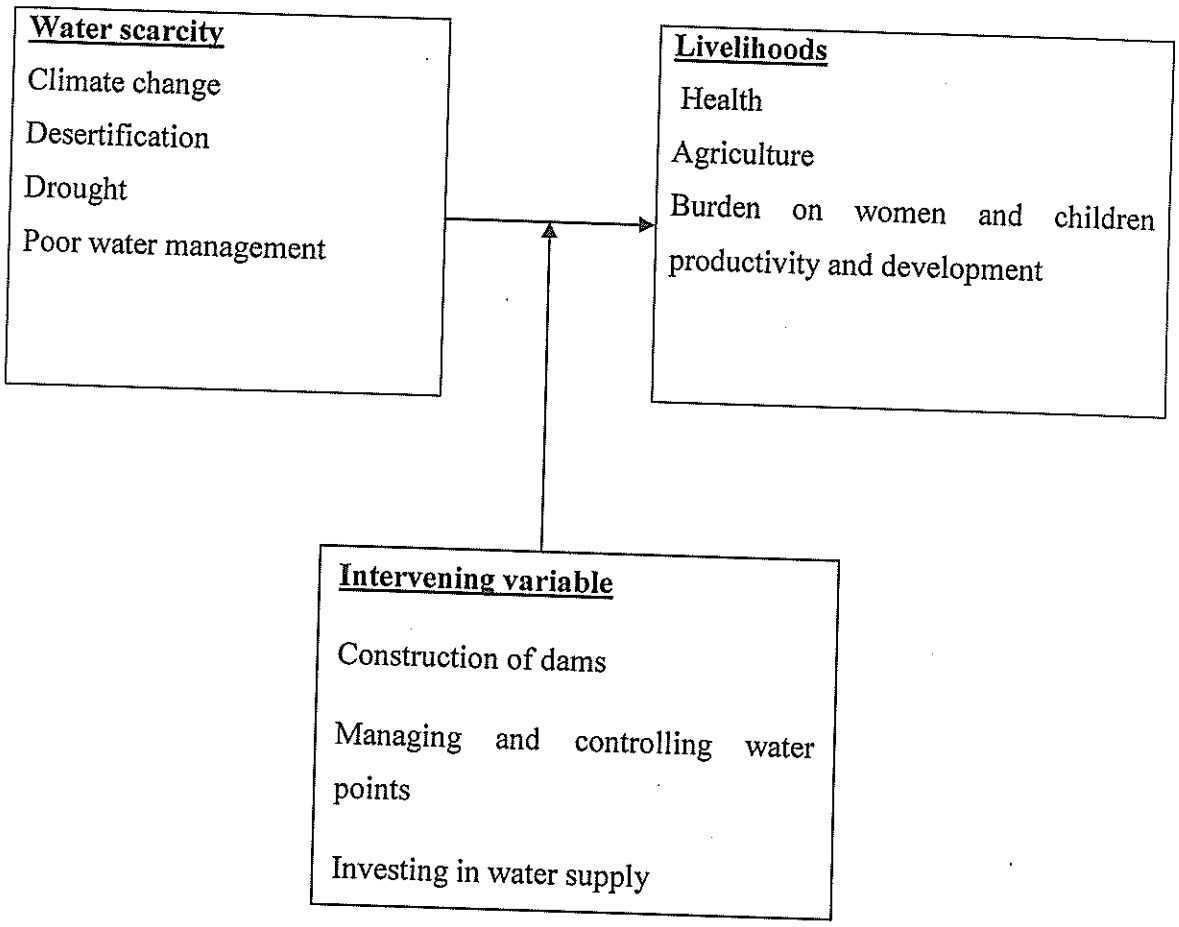
Pastoralists are people whose livelihood depends mainly on the raising of domestic animals including cattle, camels, goats, sheep, and donkeys, which are used for milk, meat, trans-port, and trade (Elliot, 2001).

Nomadic pastoralists are generally defined as people, whose primary dependence is on animal husbandry in arid and semi arid lands, requiring them to find adequate grazing and water (Hunter, 1997).

CHAPTER TWO
LITERATURE REVIEW

2.1 Conceptual Frame work

Independent variable **Dependent variable**



Source: research devised (2014)

Water scarcity (independent variable) is caused by different factors both natural and man-made. Some of them are similar in almost all areas while others may depend on a specific area of development. In Kathile sub-county, some of the factors could be aridity, drought, desertification, climate change and poor water management, water shortage which is man-induced and includes; reduced reservoir capacities, disturbed and reduced land use.

Such factors lead to serious water scarcity and when it is not controlled and managed, it easily impacts on the livelihoods of people most especially that of nomads who depend on rainfall to sustain their agricultural activities cattle keeping, subsistence agriculture, among others. The

livelihoods of the nomadic pastoralist in Kathile sub-county is affected by scarcity in the following; the health, agriculture, burden on women and children, and productivity and development.

Besides all the above effects, there are also some interventions that the nomads have put in place in other arid and semi arid areas as adaptation strategies to counter the problem of water scarcity some of which could be employed in Kathile sub-county and this include; construction of dams, managing and controlling water points, drilling of dams, among others.

2.2 Factors contributing to water scarcity

Water is becoming increasingly scarce worldwide. The anthropogenic and natural factors are the contributing factors to water scarcity and most commonly, among the natural factors, aridity and droughts are the natural causes for scarcity. More recently, man-made desertification and water shortages are aggravating the natural scarcity while population is growing and the demand for water faces an increased competition among water user sectors and regions. Rainfall is not enough abundant in many regions, thus limiting the quantity of water resources available, and unavailable for more stringent requirements for the livelihoods of many people. Pastoralists migrate periodically with their herds to maximally exploit scarce resources (pasture and water) which they need for their animals and themselves and which are dispersed in time and space Zakar (2012) gives some of the factors contributing to water scarcity in most arid areas occupied by nomadic pastoralists as shown below;

Drought.

Drought is a nature produced but temporary imbalance of water availability, consisting of a persistent lower-than-average precipitation, of uncertain frequency, duration and severity, the occurrence of which is difficult to predict, resulting in diminished water resources availability and carrying capacity of the ecosystems. Droughts are hazards because they are natural accidents of almost unpredictable occurrence, and disasters because they consist of the failure of the precipitation regime, causing the disruption of the water supply to the natural and agricultural ecosystems as well as to the human activities (Luis, 2005).

Water scarcity problems are extremely aggravated by droughts, which are quite frequent throughout many regions of the world (Rossi *et al.*, 2003). Several approaches, such as

exploiting global circulation models in relation to the ENSO and the NOA anomalies together with monitoring the relevant weather variables, may produce appropriate drought forecasts/predictions as for the USA (CPC, 2003).

An appealing article posted by Liebhardt (2010), reflects on the harsh conditions Kenyans now face due to the long-lasting drought. The drought, Liebhardt says, has forced people to move from their home, caused violence, posed educational issues and has burdened people with rebuilding their communities. The drought has forced people living in rural areas to move in order to find water because there is an insufficient amount for them and their animals. Migration has forced children out of school, which has negative implications on their education. Moreover, the severe drought in Kenya affects the total living quality of many families, as many can no longer support their daily needs.

Climate change

Climate change is widely recognized as the most serious environmental threat facing our planet today (Mathew, 2007). Climate change has already affected the global hydrological cycle and is likely to have major impacts on regional water resources, affecting both ground and surface water supply for domestic and industrial uses, irrigation, in-stream ecosystems and water-based recreation. Changes in the total amount of precipitation and in its frequency and intensity directly affect the magnitude and timing of runoff and the intensity of droughts (IPCC, 2007).

Climate change is projected to have significant impacts on conditions affecting global agriculture, including temperature and precipitation. Nomadic pastoralism and Agriculture in general in semi arid and arid areas are still directly dependent on climate, since heat, sunlight and water are the main drivers of crop growth and survival of cattle. Climate change has started and will still bring a range of adverse impacts, including reduced water availability and more frequent extreme weather events (Mtour, 2010).

These impacts may put agricultural activities, certainly at the level of individual land managers and farm estates, at significant risk (AEA Energy & Environment 2007).

Some scientists have argued that climate changes are already happening: analyses of precipitation and temperature data in the last century reveal rising summer temperatures and a delay in the rainfall season (Khatib et al. 2007), as well as increasing inland aridity (Kafle, 2009).

Climate change aggravates periodic and chronic shortfalls of water, particularly in the arid and semi-arid areas of the world (Mujumdar, 2008). Climate change could also contribute to decreasing the level of precipitation and increasing the frequency and average length of droughts (Posner, 2010). Such a situation leads to a sharp increase in the demand for irrigation water as well as domestic and industrial water use (IPCC, 2001).Additionally, climate-change-induced high temperatures may degrade water quality as increasing water temperature could alter the rate of operation of bio-chemical processes and lower the dissolved oxygen concentration of water (IPCC, 2001).

Recently, climate models have consistently and robustly predicted that global warming will create water scarcity in semi-arid regions (Kanae, 2009). One of the most obvious hydrological changes due to global warming is the change in natural water supplies from snow cover and glaciers, both of which are projected to decline (Kanae, 2009). The resulting low water flow, combined with higher temperatures, will not only create water shortages but will also pollute fresh water with sediments, nutrients, pesticides, pathogens, and salts (Posner, 2010). Another connected factor could be global-warming-induced sea level rise, which will lead to saline water intrusion into groundwater and thereby reduce the availability of fresh water (Werner, 2009).

Desertification

Desertification is a man-induced permanent imbalance in the availability of water that occurs in arid, semiarid and sub-humid climates, which is combined with damaged soil, inappropriate land use, mining of groundwater, increased flash flooding, loss of riparian ecosystems and a deterioration of the carrying capacity of the ecosystems. Soil erosion and salinity are associated with desertification, which make many definitions to focus on land degradation (Luis, 2005). As desertification takes its toll, water crises are expected to continue raising ethnic and political tensions, death of cattle,and famines in drylands, contributing to conflicts where water resources straddle or delineate country borders. In some countries, desertification has led to massive internal migrations, forcing whole villages to flee their farms for already-overcrowded cities. 50 million people are at risk of displacement in the next 10 years if desertification is not checked (UNU 2007).

Implementing sustainable land and water management policies would help to overcome the challenge of these increasingly extreme situations.

Drought strongly aggravates the process of desertification when increasing the pressure on the diminished surface and groundwater resources. Climate change also contributes to desertification

and constitutes a serious threat to large areas around the world, mainly in semiarid and sub humid climates. There is a general acceptance about the fact that temperature will rise but there is a great uncertainty about how much it will rise and where, and it is also uncertain how precipitation and runoff will change but they will very likely change.

Poor water management

Water resource is being poorly managed and this contributes largely to the scarcity of water in most regions in the world and most especially the arid areas and developed counties. Jiang (2009) points out a case of poor water management in china, where, effective management of the limited available water resources becomes critical as water resources become limited or scarce relative to dramatically growing human needs. Yet, China's water resource management has been poor, which increases the country's vulnerability to increasingly severe water scarcity.

Economically, water resources are a common-pool resource. This means that people have no incentive to save or use water efficiently, so effective management to deal with the externality of water use and market failure is needed. Over the past decades, China's water resource management, unfortunately, has been dominated by engineering projects to satisfy water demands rather than improving water use efficiency. The institutional system of water resource management is fragmented and ineffective. Water policies largely fail to account for the economic nature of water resources in relation to their natural characteristics.

2.3 Challenges nomads face due to water scarcity.

Most people in the world are already experiencing a variety of stresses and shocks on a regular basis due to water scarcity. The greatest part facing is the sub Saharan Africa where nomadic communities have been impacted making their livelihoods much harder as compared to that of other nomads living in areas of water availability.

Hellandu (2012) explains some of the challenges the nomads are facing due to water scarcity and below are some the challenges;

Health related challenges

The most immediately apparent impact of water scarcity in Africa is on the continent's health. With a complete lack of water, humans can only live up to 3 to 5 days on average. This often forces those living in water deprived regions to turn to unsafe water resources, which, according to the World Health Organization (WHO), contributes to the spread of waterborne diseases

including malaria, typhoid fever, cholera, dysentery and diarrhea, and can lead to diseases such as trachoma, plague, and typhus. Additionally, water scarcity causes many people to store water within the household, which increases the risk of household water contamination and incidents of malaria and dengue fever spread by mosquitoes. Globally, 2.2 million people die each year from diarrhea-related disease, and at any given time fifty percent of all hospital beds in the world are occupied by patients suffering from water-related diseases. Infants and children are especially susceptible to these diseases because of their young immune systems, which lends to elevated infant mortality rates in many regions of Africa.

When infected with these waterborne diseases, those living in communities suffering from water scarcity cannot contribute to the community's productivity and development because of a simple lack of strength. Additionally, individual, community, and governmental economic resources are sapped by the cost of medicine to treat waterborne diseases, which takes away from resources that might have potentially been allocated in support of food supply or school fees. Also, in term of governmental funding, the Water Supply and Sanitation Collaborative Council (WSSCC) estimates that in Sub-Saharan Africa, treatment of diarrhea due to water contamination consumes 12% of the country's health budget. With better water conditions, the burden on healthcare would be less substantial, while a healthier workforce would stimulate economic growth and help alleviate the prevalence of poverty. Hellandu (2012)

Agricultural related challenges

The Human Development Report reports (HDR) that human use of water is mainly allocated to irrigation and agriculture. In developing areas, such as those within Africa, agriculture accounts for more than 80% of water consumption. This is due to the fact that it takes about 3,500 liters of water to produce enough food for the daily minimum of 3,000 calories, and food production for a typical family of four takes a daily amount of water equivalent to the amount of water in an olympic-sized swimming pool. Because the majority of Africa remains dependent on an agricultural lifestyle and 80% to 90% of all families in rural Africa rely upon producing their own food, water scarcity translates to a loss of food security. At this point, with less than a third of the contient's potential using irrigation most of rural African communities are not tapping into their irrigation potential and according to the UN Economic Commission for Africa and New Partnership for Africa's Development, "irrigation is key to achieving increased agricultural production that is important for economic development and for attaining food security". The

doubling of Africa's irrigated land is currently high on many political agendas, which can potentially be addressed through markets, commodity selection, ownership, land tenure, reliable water storage, and international agreements.

But for many regions, there is a lack of financial and human resources to support infrastructure and technology required for proper crop irrigation. Because of this, the impact of droughts, floods, and desertification is greater in terms of both African economic loss and human life loss due to crop failure and starvation. Additionally, lack of water causes many Africans to use wastewater for crop growth, causing a large number of people to consume foods that can contain chemicals or disease-causing organisms transferred by the wastewater Thus, for the extremely high number of African areas suffering from water scarcity issues, investing in development means sustainably withdrawing from clean freshwater sources, ensuring food security by expanding irrigation areas, and effectively managing the effects of climate change Hellandu (2012)

Burden on Women and children

African women and men's divergent social positions lead to differences in water responsibilities, rights, and access and so African women are disproportionally burdened by scarcity of clean drinking water. In most African societies, women are seen as the collectors, managers, and guardians of water, especially within the domestic sphere that includes household chores, cooking, washing, and child rearing Because of these traditional gender labor roles, women are forced to spend around sixty percent of each day collecting water, which translates to approximately 200 million collective work hours by women globally per day and a decrease in the amount of time available for education. Water scarcity exacerbates this issue, as indicated by the correlation of decrease in access to water with a decrease in combined primary, secondary, and tertiary enrollment of women.

For African women, their daily role in clean water retrieval often means carrying the typical jerry can that can weigh over 40 pounds when full for an average of six kilometers each day. This has health consequences such as permanent skeletal damage from carrying heavy loads of water over long distances each day, which translates to a physical strain that contributes to increased stress, increased time spent in health recovery, and decreased ability to not only physically attend educational facilities, but also mentally absorb education due to the effect of stress on decision-

making and memory skills. Also in terms of health access to safe and clean drinking water leads to greater protection from water-borne illnesses which increases women's capabilities to attend school.

The detriment water scarcity has on educational attainment for women in turn affects the social and economic capital of women in terms of leadership, earnings, and working opportunities.[9] As a result of this, many women are unable to hold professional employment. The lost number of potential school days and education hinders the next generation of African women from breaking out of the cycle of unequal opportunity for gainful employment, which serves to perpetuate the prevalence of unequal opportunity for African women and adverse effects associated with lacking income from gainful employment. Thus, improved access to water influences women's allocation of time, level of education, and as a result their potential for higher wages associated with recognized and gainful employment.

In addition, the issue of water scarcity in Africa prevents many young children, especially girls, from attending school and receiving an education. They are expected to not only aid their mothers in water retrieval, but to also help with the demands of household chores that are made more time-intensive because of a lack of readily available water. Furthermore, a lack of clean water means the absence of sanitary facilities and latrines in schools, and so once puberty hits, this has a more serious impact on female children. In terms of lost educational opportunity, it is estimated that this would result in 272 million more school attendance days per year if adequate investment were made in drinking water and sanitation.

For parents, an increase in access to reliable water resources reduces vulnerability to shocks, which allows for increased livelihood security and for families to allocate a greater portion of their resources to caring for their children. This means improved nutrition for children, a reduction in school days missed due to health issues, and greater flexibility to spend resources on providing for the direct costs associated with sending children to school. And if families escape forced migration due to water scarcity, children's educational potential is even further improved with better stability and uninterrupted school attendance Hellandu (2012).

Productivity and development

Poverty is directly related to the accessibility of clean drinking water- without it, the chances of breaking out of the poverty trap are extremely slim. This concept of a "water poverty trap" was developed by economists specifically observing sub-Saharan Africa and refers to a cycle of financial poverty, low agricultural production, and increasing environmental degradation In this negative feedback loop, this creates a link between the lack of water resources with the lack of financial resources that effect all societal levels including individual, household, and community] Within this poverty trap, people are subjected to low incomes, high fixed costs of water supply facilities, and lack of credit for water investments, which results in a low level of investment in water and land resources, lack of investment in profit-generating activities, resource degradation, and chronic poverty. Compounding on this, in the slums of developing countries, poor people typically pay five to ten times more per unit of water than do people with access to piped water because of issues - including the lack of infrastructure and government corruption - which is estimated to raise the prices of water services by 10% to 30%

So, the social and economic consequences of a lack of clean water penetrate into realms of education, opportunities for gainful employment, physical strength and health, agricultural and industrial development, and thus the overall productive potential of a community, nation, and/or region. Because of this, the UN estimates that Sub-Saharan Africa alone loses 40 billion potential work hours per year collecting water Hellandu (2012)

2.4 The adaptation strategies the nomadic pastoralists have adopted to counter water scarcity

The effects of water scarcity to nomadic communities have forced nomads to device adoptaion strategies to counter the water scarcity problem. Most strategies are traditional, which are practiced and do not require large inputs of money, equipments or skills from external bodies and suitable to particular nomadic communities according to their changing surroundings.

Stephen (1983), gives some of the traditional strategies which nomads have adopted to overcome the problem of water scarcity and have taken a number of different forms as shown below;

The strategy of investing in water supplies

One strategy, the 'investment strategy', followed when the technical opportunities for it exist, is to construct new water sources in water-deficit areas. In some areas this has been done on a considerable scale and with a high degree of skill. In the arid Haud-Ogaden region of Ethiopia, for example, thousands of dams, hafirs and cisterns have been constructed (Cossins, 1971). In one part of this region, over an area of 33000 km^2, there are an estimated 41000 manmade water sources, that is to say 1.2 per km^2 (Watson, 1973). Traditional open wells in Niger reach a depth of as much as 90 m (Bernus, 1981) or even 100 m or more (Swift, 1979). In some cases the existing major water sources appear to have been constructed with technical skills which have since been lost (Helland, 1980). In a number of cases the technical skills or labour force, or both, were derived from outside the society which commissioned the work, either in the form of slaves or on a contract basis (Bernus, 1981). Although the transportation of water for livestock over long distances by lorry from water source to herd is not as common in Africa as it is in the Middle East (Bahaddy, 1981), it does occur, for example in southeast Ethiopia (Cossins, 1971) and Somalia (Lewis, 1961). But this is not a 'traditional strategy' as defined above. Transport of water over comparatively short distances from water source to camp by donkey or camel for the use of calves or small stock is a common and traditional practice (Swift, 1979); and this form of investment in transport of water, by allowing the location of pastoral camps at a considerable distance from existing water points, can be an important alternative to investing in new water sources as a means of gaining access to grazing in water-deficit areas.

The strategy of adjusting the species, age and sex composition of herds

Another strategy, the 'composition strategy', concerns the appropriate composition of herds. This is a question of composition partly in terms of species, and partly in terms of age and sex. It is commonly agreed that camels, because of their low water requirements, are of the main species of domestic ruminants the best adapted to water-deficit areas, cattle the least well adapted, and that sheep and goats are in between the two. Some societies, for example the Kababish nomads in Sudan (Asad, 1970), believe goats have lower water requirements than sheep, while in other societies the reverse is the case; for example the Berti of the Sudan water their goats in the dry season once in 3 days but their sheep only once in 6 (Holy, 1974).

Livestock owners react to relative water shortages by adjusting the species composition of their herds. In drier areas there tend to be relatively more camels, in wetter areas more cattle. Since different species differ in ways other than their adaptability to water shortage, for example in the frequency, timing and duration of their lactation, and in the amount of labour required to tend them, it is common for pastoralists' holdings to consist of more than one species in order to obtain the best mix of advantages. However, the overall balance between different species will differ between drier, more water-deficit areas and wetter ones. For example in Kenya, under an annual rainfall of 200 mm, camels and cattle each account for about 20% of the total livestock species (in terms of biomass) and sheep and goats together for about 60%; under an annual rainfall of 500 mm cattle account for 65%, sheep and goats for 35% while camels essentially do not exist (Western, 1974Livestock owners not only adjust the species composition of their total livestock holdings but also the composition of individual herds; each species within the total holding may be herded separately so that its water requirements receive appropriate attention. This point will be discussed later.

Livestock owners also adjust the age and sex composition of individual herds within their total holdings in accordance with water requirements and adaptability to water shortage. For example the Jafarabe Fulbe pastoralists of Mali like to have a proportion of elderly intelligent steers in their herds to lead more excitable, less experienced animals away from a known water source at the end of the dry season towards better grazing (Lewis, 1978). The Borana of Ethiopia and Kenya divide their cattle into two groups. The 'dry' or 'fallow' (fora) group of animals is able to walk further and to drink less frequently and thus can exploit more distant pastures. The 'milking' (hawicha) group, because of the higher water requirements of its milking cows and calves, needs to drink more frequently and to walk less far to water (Dahl, 1979). Not only do the 'dry' herds reach better, less overgrazed pastures by travelling further afield, but by doing so they leave more of the nearer pastures for the more sensitive milking herds.

The strategy of positioning livestock and conserving feed and water

Another strategy, the 'positioning and conservation strategy', involves two elements. One of these is the careful adjustment in space and time of the positions of different species and classes of livestock in relation to water supplies. This adjustment depends on the relative water requirements of each class and species, on the availability in space of forage in the quantity and quality appropriate to those livestock, on the location of sources of drinking water for livestock

in the quantity and quality required, and on the means whereby water is extracted from its source and delivered to livestock.

However, a few brief generalizations can be made. Where water is scarce the total livestock composite will be split up into as many herds of relatively homogeneous livestock as the amount of herding labour permits, so that each species of livestock can be managed in the most appropriate way (Swift, 1979). Other things being equal (they seldom are!) milk stock will graze closer to water and dry stock furthest away from the water point, sheep and goats probably the intermediate area and cattle the nearest. However, there are differences between particular situations (Smith, 1978). Where calves must trek to water and are unable to cover too great a distance, most of them occupy the closest ring; but in other situations (Swift, 1979) sheep and goats occupy the nearest ring and cattle the intermediate area because calves which are too young to walk far to a water point can still have water transported to them in a camp further away.

The second element in this strategy is the conservation of the water and grazing at or around the most permanent and reliable water points ('fallback' or 'dry-season' water points). This is done for as long as possible into the dry season until the water or grazing at other less reliable water points is exhausted; coupled with this is the vacation of dry-season fullback points as soon as possible when rainfall reopens other points. The other elements in this and previously mentioned strategies are matters which essentially concern the individual livestock owner and those who collaborate with him in the labour of herding and watering (his 'herding community'). However the conservation of water and grazing at fullback water points in most of the grazing lands of tropical Africa where communal forms of land tenure prevail, is a matter where the benefit which an individual derives is dependent on many other people outside his own herding community pursuing the same strategy; otherwise the grazing around the fullback point will be used up by others before the peak of the dry season while the individual who is trying to pursue a conservation strategy is still exploiting the less reliable water points.

Conservation at fallback water points is a strategy which, according to reports, is widely practised in many arid and semi-arid parts of Africa, although seemingly to a much less extent in other zones. Among regions and societies practicing some kind of fallback conservation are: the Borana of Kenya (Dahl, 1979) and Ethiopia (Helland, 1980); the Somali of southeast Ethiopia

(Cossins, 1971a) and northern Kenya (Chambers, 1969); the Maasai of East Africa (Western, 1973); the Kababish Arabs of Sudan (Asad, 1970); the Berti of Sudan (Holy, 1974); the Fulani of the Mopti region and Niger delta (although this is a much more complex system due to both the rise and fall of flood water and the risk of damage to cultivation) (Lewis, 1978); the Tuareg of Mali in the central Gourma region (Bourgeot, 1981), in the southeast (Smith, 1978), and in the Adrar region in the northeast (Swift, 1979); the Tuareg and Fulani in the northern Sahelian zone of Niger and to a limited extent livestock owners in southeast and eastern Botswana (Roe, 1981).

This list of examples could, no doubt, be greatly extended by a more complete search of the literature. What is noteworthy is the small proportion of the examples in which this conservation strategy is a formal policy of a community with community-imposed rewards and sanctions for compliance. The strategy is seldom imposed by a society's rules, formally agreed on by a community or decreed by a legitimate authority; usually it is discernable mainly in the way in which people actually behave, although that behaviour may be influenced by cultural norms expressed in acceptance or disapproval by public opinion. In part this observation may be caused by the nature of the evidence on which we rely. In most cases this evidence consists of the reports of anthropologists, many of whom may not have been particularly interested in this aspect and may simply have failed to note the mechanisms by which the community enforces its policy. Nevertheless in a number of cases social scientists have looked for rules and found none.

In the Niger Delta (Gallais, 1975) and the central Gourma of Mali (Bourgeot, 1981) rules exist and are focused on the conservation of grazing. Among the Berti of Sudan (Holy, 1974) no one may use the dry-season well before the well-master (agid al-bir) has formally opened it for the season, but there is no evidence that this opening date is determined by the exhaustion of alternative pastures and water sources. Although the Somali of northern Kenya operate a conservation system, they explicitly deny the existence of customary control or sanctions over opening or closing of grazing. In some clans day-by-day communal discipline was exercised over the process of watering but not over the dates at which water or grazing was opened for use. The only grazing controls were ones imposed by the colonial power and these have now effectively lapsed (Chambers, 1969).

In many cases the reason why pastoralists in practice conserve the grazing and water at fall-back water points is simply that these water points, being deep open wells, require a lot of labour to extract the water, and pastoralists are reluctant to supply this until absolutely necessary. Swift (1979) has shown how a herd of 50 camels watered from a deep well needs twice the number of people (that is to say two persons) as the same herd watered from sources where livestock have direct access. In Botswana a variety of water points are used as fallback points in the dry season; in the case of some dams a form of communal control prevents their use except when other sources of water have dried up (Roe, 1981). However in many cases it is the relative reliability, cost and inconvenience of using some kinds of water points which leads to their being used only at the height of the dry season when no alternative source is available (Roe, 1981).

A strategy of conservation of grazing around dry-season fallback points appears also to be practiced by some wildlife populations. In this case the control mechanism which moves the animals away from the fullback point as soon as rain falls elsewhere (such emigration may start within a few hours of rainfall) is not certain but appears likely to be the relatively better quality of grazing (especially in terms of protein content) away from the fallback water points (Western, 1975).

The husbandry strategy

Livestock owners engage in some other management practices - we can call them collectively the 'husbandry strategy' - in order to overcome water shortage. In some cases selection of breeding stock, especially sires, is done in terms of characteristics associated, or thought to be associated, with ability to withstand water stress. One Somali clan in southeast Ethiopia had only white cows:

'They bred their own animals and selected for this colour and type - it was a light animal and reputed to be able to withstand drought conditions and a bad Jilal (dry season) better than coloured cows.' (Cossins, 1970).

Some herdsmen in northern Kenya also believe that animals with light coloured coats are more drought-resistant (Lewis, 1977). Western (1982) notes that the Maasai of East Africa recognize the relationship between the environment, productivity and coat colour, and suggests that they may be actively reinforcing prevailing selection pressures, which appear to be reflected in the

tendency for the incidence of light-coat colours among cattle in Maasailand to be negatively associated with higher altitude.

King (1983) has reviewed the evidence that coat colour affects the inward flow of heat to livestock from a hot environment and, thus, the degree of heat stress suffered when restriction on drinking water leads to dehydration, and has shown that in hot dry conditions light-coloured cattle are better adapted.

Maasai pastoralists also alter the hours and length of daily grazing in accordance with temperature and distance from water (Western, 1973). The Borana of Isiolo district in northern Kenya at the height of a drought trekked their cattle to water at night in order to reduce losses of body water in their livestock (Dahl, 1980). Elsewhere in northern Kenya at a relatively cool time of year cattle are let out by their herdsman to graze very early in the morning and in this way are able to get all the water they need from the dew formed by the condensation of mist; as a consequence the cattle do not need to drink for up to 60 days and thus are able to graze an area that has no water point (Lewis, 1977).

Another management variable is the duration and number of drinking episodes that take place at each visit to a watering point. When the frequency of bringing animals to the water point is restricted to once in every 3 days or more, pastoralists will often organize the routine of watering so as to allow livestock an opportunity to drink more than once at each visit (Field, 1977), although congestion at wells and labor shortage may prevent this. King (1983) cites evidence that livestock that have been severely dehydrated may need more than one drink to replace lost water completely. In this case watering takes place every other day.

The strategy of managing and controlling water points

Even where livestock owners and herders practice all the strategies discussed so far, there may still be a deficit between the amount of water the livestock in an area need and its supply. The final strategy we discuss is one for managing and controlling water points. By management is meant the organization of watering activities and maintenance in such a way that the minimum of time and water is wasted - through slow rates of extraction due to insufficient labour or other forms of energy to draw water, through quarrels and fighting about turns for watering, through fouling of water by animals or through losses from water sources or troughs.

By 'control' is meant the regulation of access to a water source, and restricting this access to the number of people or livestock for which the water and surrounding grazing is adequate.

The rules and systems for managing and controlling water points differ from society to society and, within the same society, between different kinds of water sources, different seasons of the year, and sometimes between the same season in different years. The degree of management and control tends to vary with the scarcity of water, with the difficulty of extracting it, or with the amount of surrounding grass. Where neither water nor grass is scarce management and control are often perfunctory, becoming stricter as the dry season advances (Stephen, 1983). In arid areas where communal systems of land and grazing tenure apply, it is usual for water in ephemeral natural pans to be unmanaged and uncontrolled; anyone within the society that has grazing rights in the area is at liberty to water his livestock at these pans (Asad, 1970). The water in the pans is likely to dry up more quickly, through evaporation and seepage, than animals drinking there can exhaust the water or surrounding grazing, so that the water is not a conservable resource to be kept from the livestock. However, access to reliable and, above all, permanent water, even when this is a 'gift of God', for example a lake or river is more likely to be strictly controlled (Cossins, 1970).

Where human labor or other resources have been invested in the development of a water resource, then, even if water is not scarce, some nominal control of access is likely to prevail, although in practice it is likely to be of a rather perfunctory nature (Swift, 1979). For example, in some areas occupied by the Samburu in Kenya, water can be obtained simply by digging a water hole a few feet deep. The person who digs it can, in theory, refuse permission to any other person to use it; in practice doing this would create considerable bad feeling, except when water and grazing are in short supply (Spencer, 1965).

Particular permanent dry-season wells are usually owned by primary lineage groups (sub-clans), although several primary lineages may each have their own well or wells within a single well-field. These primary lineages will usually allow free access to members of the same clan, or occasionally the same clan family, without payment or grant of specific reciprocal rights. Members of other clans will normally have to pay in cash or kind or by the grant of reciprocal rights on a contract basis. Small hafir dams (harrs) are owned by individuals or by close family, and water may be sold from them. Large hafir dams were, in the past, owned by primary lineage

groups, but there was a trend prior to 1975 to individual ownership or to ownership by syndicates which cut across primary lineage lines. Water is increasingly being sold to those who are not close relatives of the owners. Concrete-lined water cisterns (birkas or berkads) are also owned by individuals and water may be sold from them even to close relatives.

In this example, control of access to water in order to match supply with demand is regulated by a number of administrative devices. At permanent wells, if supply in a particular season falls short of demand, members of other clan families, then of the same clan family, then of other primary lineages within the clan can successively be refused access. At water sources (harrs or berkads) owned by individuals or small groups the price of water to those who are not the owners of a source can be progressively raised until they are discouraged from coming. In the early 1970s in a bad year it cost the price of a whole sheep to water 170 sheep once.

On the basis of: a 30 kg sheep valued at Eth. Birr 30, water in a bad dry season sold at Eth. Birr 5 per 200 liters, sheep (50% of whom are lactating) watered every 3 days drinking the equivalent of 2.3 liters per day, i.e. 7 liters at a single watering (King, 1983). Cossins' assertion (Cossins, 1971) that sheep are only given 4 liters of water every 9 days in the dry season, that is to say 0.44 liters per day, seems implausible.

Control of access to water usually only distinguishes persons with stronger or weaker claims to use a particular water point. It seldom, if ever, imposes a formal limit, by regulation, on how many stocks each person may water in times of scarcity. However, other kinds of constraint may impose less formal limits. Foremost among these is the increased requirement in times of water scarcity for human labour to extract water from the source and to deliver it to livestock. At the height of a bad dry season the appetites of livestock may be relatively low and the loss of water through fasces correspondingly reduced; but this will be counterbalanced by an increased need for water for evaporative cooling necessitated both by high ambient temperatures and long treks to water (King, 1983). Livestock needs for water will, therefore, be high at precisely the time when there will be most difficulty in extracting water from wells. This difficulty arises both from the low static water level in some reliable dry-season wells (as much as 90 m below ground level in some places) and from the low yields of wells during a drought, which means that labour and livestock have to wait around for the well to recharge itself.

At some wells each herd has to produce its own labour to water its own stock. In such cases owners of herds with high stock: family labour ratios will have to make arrangements to borrow, contract, or hire labour in order to water over-large herds at peak times; alternatively they may arrange to entrust or lend their animals to be managed by people whose herds are smaller. Such arrangements can be expensive particularly in the more commercialized pastoral systems. Entrusting or lending livestock deprives the original owner of much of their products; hiring labour is not only expensive in terms of direct payments in cash or kind, but there is also the danger of incompetence or dishonesty on the part of the hired person (Dahl, 1979). Rather than engage in such expense the owners of large herds may prefer to take their animals away from overcrowded water points into another region where water is less scarce and watering less expensive. For example in north Kordofan province in Sudan,

'Many families watering at the deep wells in Hamrat al-Shaikh have their main herds watered at the bore wells in Um-Sunla about 50 miles west. Because although water from the Hamrat wells is free and from the bore well it is not, it is cheaper for exceptionally large herds to be watered at the borewell than it would be if they were watered by hired labour from the deep Hamrat wells. Watering at the bore well is of course quicker and less laborious than watering at the deep Hamrat wells. But there is a risk involved: a mechanical breakdown of the bore well pump may spell disaster, as happened a year before my arrival in the geld.' (Asad, 1970).
But a Tuareg livestock owner interviewed in Niger in 1972 denied that watering camels or sheep at boreholes involved any fewer herdsmen than watering at other sources such as open wells (Marty, 1972), even though the actual raising of the water to the ground surface is by motorised pump in the case of a borehole and by hand power in the case of an open well.

At other wells watering livestock requires the cooperation of several relatively independent herding units. An extreme example occurs among the Borana in southern Ethiopia where some open wells require a chain (team) of up to 23 strong persons to draw water. In such circumstances the owner of a herd who is unable to provide a labor force proportionate to the size of his herd will find it extremely difficult to find other herding units with whom to form a watering unit. He would, therefore, have to distribute his surplus to friends and allies or recruit extra labour through adoption, foster parenthood or through herding contracts.

He will have to spend much time, and in the end many resources, in recruiting support in the well-council (cora ela) to prevent his exclusion from access to the well and a place in the watering roster (schedule of users). In extreme cases the herder of too large a herd will even bribe the well-master (abba hirega). All these arrangements have their costs, and if the herd owner fails to meet them he will be excluded from the well and his livestock will die unless he takes them off elsewhere to less labor intensive water points (Helland, 1980).

CHAPTER THREE

RESEARCH MATERIALS AND METHODS

3.1 Research Design.

The study employed both qualitative and quantitative designs of data collection. Qualitative design was used whereby data was collected from the field through administering questioners and getting the feedback which was recorded and presented in a narrative form.

Quantitative design was applied to show the numerical form of data such as percentages, statistics among others.. This design was used to quantify the size, distribution and association of the variables. The researcher asked specific, narrow questions and collected a sample of numerical data from the respondents.

3.2 Description of the study Area

3.2.1 Location

Kathile sub-county is found in kaabong district and has the origin of its name from the administrative center, Kathile in Kaabong district. It is bordered by south Sudan to the northwest, the Republic of Kenya to the northeast, and the east, Moroto District to the southeast, Kotido District the south and Kitgum District to the west. Kathile sub-county at Kaabong, is located approximately 165 kilometers (98 mil), by road, northwest of Moroto.

Kathile has five parishes which include Nerengepak, Kathile, Nariamaoi and Kamacharikol and Lotim.

Kathile sub-county has a rocky landscape with hills and valleys. The vegetation is primarily bushes and shrubs. The climatic/weather conditions of Kathile sub-county are more diverse with various soil types, vegetation and altitudes. There are some areas that contain savannah vegetation, but most of the district is semi-arid with thorny shrubs. There is only one annual season of cultivation

3.2.2 Population

The financial year 2010 estimated the population of Kathile at approximately 37, 467 and it has an estimation of 100 nomads according to the production department in kaabong district (UBOS 2012).

3.2.3 Economic activities

Animal husbandry was the main economic activity in the sub-county. A great majority of the sub-county population are nomadic pastoralists who roam the landscape looking for grass and water for their animals. There are four main sources of water in Kathile sub-county which include Kangorok valley dam which provides water to over 4781400 cattle of kathile sub-county as well as providing water to the people living around, Lominyit seasonal river, Tulelo seasonal river, and Lodiket seasonal river. But during the dry season these water sources dry out. Agriculture was to a smaller extent practiced in the western part of the sub-county, though its importance has increased in recent years. It is the primary activity in the western belt of the district and in the northeastern corner, especially Kamion.

3.3 Target Population

The population of the study basically consisted of nomadic pastoralists from selected parishes, the LCIs of the different parishes, the pastoral and agro based workers, animal extension workers and the elders in the study area. These participants were selected depending on how long they have been in Kathile sub-county, especially by considering the age and how interested they were in giving out data. This helped to get information about the livelihoods of the nomads in the given time frame.

3.4 Sampling and Sampling Design

3.4.1 Sample Size

The researcher selected about 80 respondents and 16 were randomly selected from each parish. The researcher also consulted the local leaders, cattle keepers, district council, elders, and civil servants, to get more information on the past and the extent at which water was becoming scarce and how it had affected the livelihoods of the nomads.

The sample size of 80 was determined using the sampling guide provided by Krejcie and Morgan (1970). Out of a sample of 80, 16 respondents were selected per parish from which, 2 local

leaders, 8 cattle keepers, 2 from district council, 2 elders, 1 environmental literate and 1 civil servant from each parish as shown from the table below;

Table 1: Sample size.

Category	Sample	Sample per parish
Local leaders	10	2
Cattle keepers	40	8
District council	10	2
Elders	15	3
Civil servants	5	1
Total	80	16

Source; research devised (2014)

3.4.2 Sampling Method

The researcher used probability sampling technique to give each member of the community a known non-zero chance of being selected. The researcher employed random sampling where by the people where numbered from different households and the people with the fifth figure were selected randomly and that gave each member an equal chance to be chosen in the sample group when forming clusters in each division to represent the rest of the population since Kathile sub-county has 5 different parishes that would take much time to visit all areas of concern and respondents there.

Also purposive sampling technique was used by the researcher especially for those respondents who are knowledgeable in this field of study. One Natural resource officer of Kaabong district, one productions officer and 5 environmental literates in Kathile, one from each Sub County were selected. These were among the district council elders that made up part of the sample.

3.5 Sources of Data.

The sources of data of this study were both primary and secondary data.

3.5.1 Primary data

This involved collection of data from respondents in a given area who were living there. This is the first hand data that was organized and compared to secondary data for better reporting of the problem.

3.5.2 Secondary Data.

The secondary data was acquired from reports, which had been compiled by field researchers, magazines and newspapers that concern water scarcity and its effects in Kathile. Secondary data helped me to come up with a better comparison of the past and present situation in Kathile as regards water scarcity and livelihoods.

3.6 Data Collection Methods.

In order to address the objectives of this research, the researcher used the following instruments which assisted in gathering and collection of data.

3.6.1 Questionnaires.

Questionnaires were issued to the selected respondents, made up of open and closed questions. The questionnaires were self-administered amongst the respondents in order to collect all the complete responses within a short time since clarity to questions was needed on the spot.

3.6.2 Consultative Interview.

This was employed on different respondents on why and how they came to live or work in Kathile Sub-County.

The researcher conducted personal interviews with the help of community leaders that were administered to the respondents. Respondents involved leaders themselves, women, men, the elders and the youth to get the different views from a variety of personalities.

3.6.3 Observation.

This method that involved what the researcher personally saw in relation to the problem of study. The researcher was much interested in what was exactly on the ground in terms of sources of water, population, topography, vegetation cover, among other aspects of the problem.

3.7 Validity and Reliability

The research instruments that researcher used are questionnaire and interviews. The researcher carried out a pre-test of the questionnaire before using it in the research. The interview instrument was cross examined for approval by the research expert, to ensure that the information they would generate is appropriate and consistent.

3.8 Ethical Consideration

This involved seeking permission by the researcher from the senior leaders of the study area. Permission was also sought from the relevant authorities like Local Council leaders; with respect

to the respondents' views. This was important for the protection of the researcher from harm or harassment and the confidentiality of the respondents and their superiors' sensitive information.

3.9 Data Analysis and Presentation

Data was analyzed and presented with the use of tables, and percentage scores basically showing Potential themes, categories and patterns were closely examined to see how they actually emerge from the data in relation to the objectives of the study. With the use of SPSS, the information was analyzed quantitatively.

3.10 Limitations in the Study

In the course of carrying out this study, the researcher anticipated several constraints, which one way or the other, limited the findings of the research. They include the following;

Time limitations; scheduling programs most certainly affected the researcher's ability to gather information, since all respondents had responsibilities at their jobs. So it was hard to make appropriate schedules for proper information gathering.

Limited financial resources were also be a challenge in terms of accommodation and food. Some people expected some money before releasing any information required.

CHAPTER FOUR

PRESENTATION OF FINDINGS AND DISCUSSION

4.1 Demographic characteristics of respondents

Table 1: Sex of respondents

SEX	FREQUENCY	PERCENTAGE
Male	35	43.8
Female	45	56.3
Total	80	100

Source: primary data

From table 1 above, 56.3% of the population in Kathile Sub County was female while 43.8 was male, an indication that the most affected group by water scarcity are women. Women are responsible for fetching water and men to graze animals. This leaves the weaker group of women to suffer the burden of moving long distances looking for water.

Table 2: Age of the respondents

AGE	FREQUENCY	PERCENTAGE
11-20 (young)	22	27.5
21-30 (youth)	20	25
31-40 (adults)	30	37.5
41and above (elders)	8	10
Total	80	100

Source: primary data

Table 2 presents 37.5% of the people were 31-40, 27.5% were 11-20, 10% are elders and 25% are aged 21-30, an indication that the youth suffer a lot moving long distances to fetch water for the rest of the population since they are considered strong and responsible for that.

Table 3: Marital status of respondents

STATUS	FREQUENCY	PERCENTAGE
Single	24	30
Married	48	60
Widowed	5	6.3
Divorced	3	3.7
Total	80	100

Source: primary data

About 60% were married, 30% single, 6.3% widowed and 3.7% divorced which shows that the married people get more challenges of water scarcity than the rest. The married have more

responsibilities like taking care of the little children, looking for food and also providing labour in water to other households in order to earn a living and that limits them from moving flexibly to the water sources for their own.

4.2. Factors that contribute to water scarcity

Table 4: factors that contribute to water scarcity

Factors	FREQUENCY	PERCENTAGE
Drought	30	37.5
Desertification	5	6.3
Climate change	35	43.7
Poor water management	10	12.5
Total	80	100

Source: primary data

According to the above table, 43.7% of the respondents argued that it was climate change that contributes greatly to the problem of water scarcity in Kathile sub-county. As Mathew, (2007) put it forward; Water scarcity problems are extremely aggravated by climate change, which are quite frequent in Kathile. Climate change has affected the hydrological cycle and has caused major impacts on water resources, affecting both ground and surface water supply for domestic, crop irrigation and for animals.

Respondents reported that drought (37.5%) had a great impact on reducing the available little water in Kathile. Like Rossi *et al.*, (2003) drought is widely recognized as the most serious environmental threat facing our planet today; it is the same factor leading to water scarcity.

Drought in Kathile Sub County has also increased the loss of the soil moisture from the poor sandy soils even after dew had formed in early morning hours during the cool periods.
Only 12.5% and 6.3% of the respondents claimed that water scarcity is due to poor water management and desertification respectively.

However, from my own observation, I realized that other factors like overgrazing, soil type and deforestation have contributed to water scarcity in Kathile. Nomadic pastoralists graze their animals on pastures to the extent of leaving the soil bear especially during the dry season. This leads to soil erosion because the plants which would reduce the speed of water and even retain it for immediate use are overgrazed.

Kathile has sandy soils which are more porous and their water retention capacity is very low. This facilitates faster infiltration of water to the underground leaving soils at the top very dry and without water ready for fetching.

Deforestation is a big hindrance to water availability in Kathile Sub County because it affects the hydrological cycle leading to drought. The area is not developed and people only use fire wood as a source of fuel for cooking, and heating. The people also use the wood from trees for building their houses and 'Manyatas'. This has claimed many trees as they are also needed for construction and charcoal burning for sale.

4.3. Challenges faced due to water scarcity

Table 5: challenges faced due to water scarcity

Challenge	Frequency	Percentage
Health	8	10
Development and production	10	12.5
Burden on women and children	24	30
Agriculture	38	50
Total	80	100

Source: fro field by researcher

From my observations, water scarcity has affected the education level of people in Kathile Sub County. Most nomads especially during the dry season move away from school with their animals to look for areas where pastures and water are still available. In that case, the attendance of the students is irregular because they miss more times than attending. This affects their performance and when they reach candidate classes to seat for national examinations they fail and cannot continue with school any more. Some of them even miss exams just because they are far away struggling for their animals to get water and pastures.

From table 5 above some respondents said that agriculture (50%) is the most activity affected by water scarcity. Like in Turkan Northwest Kenya, water scarcity has led to serious losses of livestock due to climate change in the vulnerable semi arid area of Kathile Sub county combined with long droughts which has caused. The impacts of water stress are not limited to the agricultural sector alone: the livestock sector has also been affected negatively by the shortage of fodder and water for drinking. Sometimes especially during the dry season, it becomes worse and

many animals die because of lack of pastures and water. Conflicts also arise over water resources and nomads kill each other not leaving animals also.

The respondents in Kathile Sub County in their majority revealed that the shortage of fodder and vegetation renders livestock physically weak and unproductive and they are compelled to sell stock at throw away prices or slaughter them. In addition, we learnt that 2003, the livestock population decreased by about 50%. Sharing a personal experience of drought, a local farmer from Saht said that the drought in 2001 so affected the prices of animals so badly that people sold their animals at unbelievably low prices.

Lots of crop failure and death of the domestic animals the nomads own, since the nomads have to move from areas of pastures to more far areas of water points, the animals lose weight and keep dying especially the calves which reduces on the production rate of the animals, and in a long run a large number of livestock is lost.

About 30% said that there is a serious burden on women since they are the ones responsible for fetching water. Women move long distances to fetch water, pregnant women suffer more and sometimes they get miscourages. Sometimes they are employed to fetch water for irrigation and brick laying which they must to because they are poor.

Development and production (12.5%) is affected while only 10% of the respondents argued that it is health that is affected in that the water related diseases like foot and mouth diseases which attacks humans from sharing the same source of water with the animals and other people like children often get diarrhea from drinking the dirty water which animals have even put their wastes. Water scarcity affects the economic activities and therefore increases poverty among the people. This affects the education and health of the people of the people in Kathile.

4.4. Adaptation strategies adopted to counter water scarcity

Table 6: Adaptation strategies adopted to counter water scarcity

Adaptation strategies	FREQUENCY	PERCENTAGE
Digging sand wells	18	22.5
Managing and controlling water resources	10	12.5
Investing in water supply	14	17.5
Positioning animals and conserve water resource	12	15
Practicing husbandry	9	11.2
Construction of solar energy powered tanks	4	5
Construction of valley tanks	6	7.5
A forestation	7	8.8
Total	80	100

Source: primary data

This particular study presents digging of sand wells (22.5%) as shown in table 7 as the most adoptive measure used in Kathile to avail water for animals and domestic use. These sand wells according to Lokong Matthew, a kraal leader in Teregu parish, are dug deep to about 5 feet in a seasonal river of Teregu, and ladders are use for getting in to draw water which is the passed by four people each after the other to the top where the water containers are filled with water for domestic use and animals are also watered in the same way.

About 17.5% also agreed that investing in water supply was another adoptive strategy that was adopted. And according to the LCI of kathile, investment was in terms of human labor whereby they could carry jerry cans of water from the sand wells and a few boreholes to their specific households and this was mostly done by women and teenage girls. Others also avail water by hiring some poor women and children to collect water and they get paid with some little money at end. Donkeys and bicycles are also used to transport water to the households and to water the vegetables and calves. As Swift (1979) puts it forward in Ethiopia, transportation of water over comparatively short distances from water source to households in Kathile is by donkeys.

Also to get connected to the tap water which was constructed by the Water and Sanitation Department in Kaabong district to Kathile sub-county, the people had to pay at least some

amount of money but only few individuals are connected and other see tap water as expensive since they do not have even businesses to earn money from.

According to the table above, positioning of animals and conserving water resources (15%) stands out to be part of the adoptive measures the nomads have practiced to counter the problem of water scarcity since it is even a traditional practice but adoptive even for harsh climates and the practice was passed from one generation to another and it is part of the discipline the herders should practice to show respect to clans.

As swift (1979) gives about positioning of animals, in Kathile, the nomads position animals in the classes for example the female cattle and lactating cows are being position to where there is at least enough water and also pasture in order to make sure that they are able to produce milk for calves and for the nomads too. The bulls which have fewer products are positioned even to areas which have less water and because they can move for longer distances, it is possible that whichever water found on the way can be availed to them as the nomads search for pasture. For other animal species like goats and sheep, the nomads have always preferred keeping cattle because they can take some good time without drinking water and the nomads decisively move with them to farther areas in search of water and pasture and live the nearby water points for the weaker animals like cows and calves and also for domestic use.

Conservation of water and grazing around the most permanent water points is also practiced among the nomads in Kathile sub county and in whereby the cattle, goats, sheep, and donkeys are grazed around the permanent water sources like sand wells in then seasonal rivers in the dry season and when the rains are reliable, the nomads then migrate to the other water sources like valley dams and boreholes which are nearer to the homesteads and farms.

People also reported that managing and controlling (12.5%) of water sources was an adoptive strategy used in Kathile counter the problem of water scarcity. Though management and control of water sources in Kathile is not taken seriously since the nomads believe that the water sources especially sand wells from seasonal rivers are "gifts from god", some management and control of water resource was practiced in other sources like valley dams and boreholes. According to Siloi Philips, the kraal leader of Narengpark parish, water resources are being managed in a way that the water drawn from sand wells are got at a slow rate by the and the same is to the boreholes because water may keep reducing if drawn faster. Also the rate of usage of water is controlled in

a way that the animals which need a lot of water are taken to the borehole, while the bulls, donkey, and sheep are watered from the valley dams and sand wells.

According to the above table, 11.3% said that husbandry was practiced. Like Lewis (1977) puts it for Kenya, the nomads in Kathile also graze their animals in the morning during the cool days of the year so that the animals are able to get enough water from the dew and the animals with light colours are preferred to other colours since they can reflect heart hence reducing on the rate of evaporation thus less water is required.

Aforestation (8.8%) is also one of the adaptive measures being practiced by the people of Kathile. The government through the district environment officer and the Minister of Karamoja has tried to give out the tree seedlings which would help in modification of climate through influencing the hydrological cycle. However, the people reported that due to the current water scarcity and climate problems, a few trees survive to the next level of growth.

Construction of valley tanks (7.5%) is being undertaken and implemented by the government of Uganda and other nongovernmental organizations. Valley tanks that are already in place include Kaamatar, in Narengpak parish and, Lominyit in Lotim parish but people said that they are not maintained well.

Construction of solar energy powered tanks (5%) is also being implemented like the one at Kathle primary school. The government together with the nongovernmental organizations and individuals has tried so much to help in curbing down the problem of water scarcity.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

Generally, water scarcity has been one of the major constraints facing Kathile sub-county. Kathile consists of a large number of nomadic pastoralists where the animals and the people all compete for the scarce and limited water resources.

Climate change exacerbates the problem of water scarcity in Kathile sub-county. Climate change reduces precipitation and increases the mean annual temperature and this increases the vulnerability of socio-ecological systems. Climate change has been a challenge to the nomads who do not have the knowledge of the phenomena and besides, with the increase in annual temperatures and reduction in precipitation, their livelihoods are seriously impacted since nomadic pastoralists mostly depend on the rains.

Drought has been another factor that contributes to water scarcity in Kathile sub-county since it has led to the rapid evaporation of soil moisture and from a few available surface ground water. It has also been exacerbated due to climate change and due to the aridity of Karamoja as a region. Drought is considered for long as the main cause of water scarcity for crop production, animal production and also domestic use.

Among others are desertification which is showing gradually in Kathile sub-county and poor water management as the least factor since it specifically takes place in a few water resources like valley dams and sand wells were animals are drinking water and urinate in the same points as well as humans bathing in the same water sources when they feel like cooling and cleaning themselves. Corruption is also one of the contributing factors to poor water management making water scarce for the nomads nearer to the sand wells and valley dams because money for maintenance and motivation of nomads gives responsibility to remove the silts, fence the water source are being put in pockets.

Water scarcity has impacted on the livelihoods of the nomads in Kathile Sub County and has attacked the most sensitive part of the survival of nomads; agriculture that comprises crop production and animal keeping. Although agriculture has been identified to be affected, women and children have not been left out untouched by the problem of water scarcity which in the

same way, has hindered production and development of the poor nomads. Nomads are not able to yield any sum of money from the activities they do since the conditions and the situation of water do not favour at all. The health of both nomads and their animals is also affected due to sharing of open water sources and contamination by animal wastes like dung and urine.

Although water scarcity has constrained the livelihoods of the nomadic pastoralists, the nomads have not left the problem to keep bothering. They have tried to practice some adaptation strategies by their means to curb down the effects of water scarcity in Kathile Sub County. The adaptation strategies the nomads have adopted are the traditional and local strategies and are: digging of sand wells in seasonal rivers to provide some water for domestic use and for animals, valley dams which they manually dig by themselves on the ground surface to collect the rain water from sloppy areas, the nomads have also invested on water supply but in a very local and in efficient way.

Use of donkeys which are also few to transport water means a few individuals will get water and others have to manually carry water from very far and for long distances yet time is wasted as there are other productive activities the nomads would rather do to earn a living. Positioning of animals and conservation of water resources are done though it does not increase on the availability of water to everyone. Animals are the only ones which would benefit by drinking the water but the people who fetch water from the sand wells and valley dams may get less water, at times will have to wait for the animals to finish using the water sources and delay becomes obvious to the people. The strategy is all that not effective even at the side of management of the water sources because it is difficult to stop animals from pushing sand into the well or valley and also excreting the waste into the water.

While management and control of water resources seems to be a proper strategy, there is corruption, lack of; skills, capital and human labour hampers the performance, and effectiveness of the strategy and the little attention made on the monitoring of the water resources worsens the situation of the water resources. Husbandry which the nomads practiced can not address the need for water since it is not necessary that cool periods will always occur and that animals will have their thirst quenched but that can do well only in morning hours and that is the ends. Dew does not also sustain the crops which just end up wilting when the scorching sun heats the ground and of course cause evapotranspiration. Irrigation would help but

there is no such technology and the weak nomads cannot afford the labour, also it has not been initiated by government or NGOs in Kathile.

5.2 Recommendations

What is now urgently needed is a rapid assessment of impacts of water scarcity on the livelihoods of the nomadic pastoralists of Kathile Sub County so that the total cumulative impacts can be kept to a minimum. The way water issues are addressed, impacts upon the successful achievement of most Millennium Development Goals for example goal 1 among the eight; access to water for domestic and productive uses has a direct impact on poverty, food and insecurity. Consequently, it is recommended that a mission on the impacts of water scarcity on the livelihoods of the nomads of Kathile Sub County be considered a priority.

The government of Uganda should recognize the problems of this area and invest in harvesting of ground water by construction of bore holes. The government should also invest in more research to come up with a full book containing better adaptation strategies practiced successfully elsewhere like exploitation and use of solar energy for water drawing from the bore holes would save women drudgery. More sustainable water management methods need to be developed, financed and implemented by the government since these nomads are very poor citizens. Such methods should include construction of water reservoirs that are cemented and closed. This helps to reduce loss of the little available water through infiltration and transpiration respectively.

Furthermore, and on governmental level, improving large-scale water harvesting techniques and enhancing dams' capacities through the removal of seasonal sedimentation would be beneficial especially in the unexpectedly good rainy periods. Identification of policy options and sustainable water supply harvesting and storage strategies to reduce the cumulative water scarcity impacts on livelihoods of nomads in the whole Sub County to a minimum. There is need to build capacity and skills of people to harvest and store rain water and surface run off. In addition, a water shade management in Kathile Sub County is urgently needed to save the pasture lands for animals and crop production.

Diversification in the sources of livelihoods like crop production and business to reduce total dependency on livestock. Women empowerment through engagement in productive and income oriented activities such as small animal production, apiary, vegetable growing, handcraft, and

agro forestry. Action plans including project/program briefs, which could be submitted to donors as stand-alone interventions, other recommendations and/or proposals as considered appropriate.

Also, digging of sand wells should be cited as the major means of countering the problem of water scarcity and to ensure a continuous supply of water in the sand wells, communities should participate to the extent of offering voluntary labour for digging more sand wells, tree planting during the rainy season and management and maintenance activities in the valley dams and boreholes since most of them may not demand payment for their effort because the problem of water scarcity affects them hardly and they want it solved. Committees should be formed to help in management of the little water such that it is not wasted. Availability of participatory water management and supply monitoring activities in water scarce affected areas are some of the responsibilities that should be influenced by the committees formed. Community associations in rural areas could play a pivotal role in encouraging and funding such community committees. The need to restore and empower tradition leaders and strengthen linkages between different clans and pastoral groups is paramount for sustainable management of water resources.

The social and economic choices made by nomads have the potential to increase the vulnerability to climate change risks. In order to understand appropriate responses to current and future water scarcity it is necessary to understand the vulnerability of the systems, sectors, populations, that are at risk climate change and those specific activities that influence climate change. To respond to these vulnerabilities, measures like a forestation and reforestation need to be initiated since trees play a very vital role in the hydrological cycle. In that case, deforestation must be stopped and wood fuel replaced by renewable energy resources cheaply available in the area like wind energy, biogas and solar power.

Sensitization and encouragement of the nomads to be flexible to in order to live a sustainable life by practicing other activities like crop growing instead of being nomads only. Nomads should also be well taught and encouraged to carry out some business to generate income in a dry season than losing many animals. This includes selling of animals especially the bulls and those without calves so that they can leave enough pastures and water for the needed animals. Sensitization should also include teaching them pasture preservation method like use of hey and silage which are prepared during a rainy season when there is enough water to influence the growth of pastures. Hey and silage help as feeds for the animals in a dry season.

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APPENDIX I

QUESTIONNAIRE

Dear respondent, my name is **Maraika Amabile**; I am a student from Kampala International University (main campus), School of Engineering and Applied Sciences. I am conducting a research about the **"Effects of water scarcity on the livelihoods of nomadic pastoralist in Kathile sub-county".** So please help me answer these few questions I am going to ask you.

Questionnaire number.....

Tick or write answers in full where applicable.

SECTION A: Background information

1. Gender

a) Male ☐ b) Female ☐

2. Marital status:

a) Single ☐ b) Married ☐ c) Widowed ☐ d) Divorced ☐

3. Age bracket (yrs)

a) 11-20 ☐ b) 21-30 ☐ c) 31-40 ☐

d) 41 and above ☐

4. Highest level of education attained

a) None ☐ primary b) secondary ☐

d) University

5.is there a problem of water scarcity in kathile sub-county?

a)Yes ☐ b) No ☐

If yes, which problems most?

A) Crop failure b) death of livestock c) burden on women d) diseases

6. Do you access water easily?

a) Yes ☐ b) No ☐

I f yes which water sources most?

a) Bore holes ☐ b) wells ☐ c) seasonal rivers ☐ d) valley dams ☐

7. Which people are most affect by water scarcity in Kathile sub-county?

a) Nomads ☐ b) Farmers ☐ c) students and pupils ☐ d) others ☐

Specify?.....

8. What are the causes of water scarcity in Kathile sub-county?

a) drought ☐ b) desertification ☐ c) climate change ☐

d) poorwater management ☐

9. What is the most sources of livelihoods in Kathile sub-county?

a) Subsistence farming b) commercial farming c) petty farming d) family support

On a scale of 1-5, tick in the appropriate box on how you strongly agree or disagree with the statements given.

Scale	1	2	3	4	5
	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree

SECTION B: Factors that contribute to water scarcity

Statement	1	2	3	4	5
Drought has been the main cause of water scarcity					
Climate change leads to reduction of water resources and affects livelihoods					
The number of years water scarcity has been caused by poor water management					
Desertification brings about the problem of water scarcity in kathile					

SECTION C: the challenges faced due to water scarcity

Statement	1	2	3	4	5
Water scarcity has impacted on the health of people in kathile.					
For a long time, Kathile has failed to develop and is poor in production due to water scarcity.					
Women and children are burdened in Kathile mainly by the problem of water scarcity.					
Agriculture in many parishes in Kathile, is failing due to water scarcity.					

SECTION D: adaptation strategies adopted to counter water scarcity

Statement	1	2	3	4	5
The nomads in Kathile dig sand wells in the seasonal rivers to provide water for domestic use and to water animals.					
Managing and controlling of water sources is used as a strategy by the nomadic pastoralists to avail water in Kathile sub-county.					
The nomadic pastoralists in Kathile sub-county invest in water supply to counter the problem of water scarcity					
The nomadic pastoralists position animals and conserve water in Kathile sub-county.					
Husbandry is practiced by the nomadic pastoralists in Kathile sub-county to counter water scarcity problem.					
Construction of solar energy powered tanks					
Construction of valley tanks					
Afforestation					

Thank you for the co-operation...