Indian Journal of Traditional Knowledge
Vol. 11 (2), April 2012, pp. 217-224

Role of Indigenous Knowledge in Climate Change Adaptation: A case study of the Teso Sub-Region, Eastern Uganda

Anthony Egeru
School of Forestry, Environment and Geographical Sciences,
Department of Environmental Management, Makerere University, PO Box 7062 Kampala, Uganda
Emails: egeru81@educ.mak.ac.ug/eanthony@muienr.mak.ac.ug

Received 20.10.2011, revised 21.12.2011

This study examined the role of indigenous knowledge in climate change adaptation in Uganda with specific focus on the Teso sub-region. Specifically, the study identified indigenous knowledge practices used in climate change adaptation, documented indigenous knowledge in climate observation, and identified constraints to indigenous knowledge use for climate change adaptation. Data was collected using semi-structured questionnaires, individual interviews, focused group discussions and observation of local traditional rites. Local observations confirmed altered climate patterns noticeable from the changes in the planting, weeding and harvesting periods in agriculture, in tree growth, and in wind directions. Farmers still observe the intensity of East-West blowing winds, colour of the clouds in the East, and plant traits for rainfall prediction. In addition, they also rely on the meteorological information disseminated through the local radio stations. Low mastery of indigenous knowledge practices by younger community members and persistently changing weather patterns have challenged community reliance on indigenous knowledge for climate change adaptation. There is need to strengthen dissemination of indigenous knowledge and to integrate modern approaches that strengthen indigenous knowledge in climate change adaptation and resilience.

Keywords: Adaptation, Climate change, Indigenous knowledge, Teso Uganda
IPC Int. Cl.[8]: E04H 9/16, A62B, G08, A47G 19/26, A47J 39/02

Like any other indigenous populations of the world who have lived in balance and/or quasi harmony with nature, the Iteso people of the Teso Sub-region of Eastern Uganda have been unequivocally good custodians of their environment. Over long periods of time, these people, who are agro-pastoralists in a drylands area, have acquired detailed knowledge about the functioning of their immediate environment, including observations and insights on a wide array of issues. Indigenous knowledge is that knowledge accumulated over generations of living in a particular environment[1] has been vital in responding to environmental challenges including floods, droughts, disease and pest infestations, and their attendant effects. Droughts in particularly are not a new phenomenon to Iteso, and over time they have developed particular indigenous knowledge to cope with water shortages. The transfer of this knowledge and associated practices has been embedded in the culture through various rites of passage such as birth, initiation into adulthood, marriage, death, twin dancing and social gatherings that include beer parties. Such knowledge thus existed within their belief systems and in the formation of their moral values.

Phenological knowledge held in the indigenous communities has a high value[2,3,4]. Many traditional societies have built up knowledge over long periods about environmental change and have developed elaborate strategies to recognize and cope with these changes. Worldwide, however, applications of traditional knowledge systems in mitigation and adaptation to climate change have long been neglected in developing and implementing climate change policy and have only recently become part of the climate change discourse. Traditional and indigenous peoples have valuable lessons to offer about successful and unsuccessful adaptations to change, lessons which could be vital in the context of global climate change[5]. In the Sahel, for example, the local populations, through their indigenous knowledge systems, have developed and implemented extensive mitigation and adaptation strategies that have enabled them reduce their vulnerability to past climate variability and change[6]. This study provides another case example of a people's adaptation to climate change and evaluates the relevance and effectiveness of their knowledge and practices.

Methodology

The Teso sub-region of Uganda consists of eight districts: Ngora, Kumi, Bukedea, Serere, Soroti, Kaberamaido, Amuria and Katakwi. The area experiences a humid and hot climate, receiving bimodal rainfall with an annual average between 1000 to 1350 mm, much of which is received between March to May. There are decreasing to light showers between June and August and heavier rains again between Septembers to November. The dry season begins in December and lasts in February. The climate of the sub-region is modified by the large swamp wetland area that surrounds it. Minimum and maximum temperatures are about 18ºC and 31.3ºC respectively. However, extremes usually occur in February, when the temperature can exceed 35°C. The highest ever recorded temperature was 40°C, in February 1949[7]. Teso slopes from east to west. Thus, it receives discharges from the Karamoja highlands and Sebei uplands, this occasionally creates flooding. The sub-region is known for ox-traction with an economy based on subsistence agriculture and livestock rearing. Farmers grow a diversity of crops, especially legumes and cereals. Typical crops include millet (a staple), sorghum, beans, rice, maize, cassava and cotton now grown by few farmers. Livestock reared include pigs, goats, sheep, cattle and poultry, such as chicken and turkeys. Fishing is also conducted in the freshwater lakes – Lake Kyoga (a major lake in the area), and its satellite lakes: Opeta and Bisina, Kiondo, Namasajeri, Naragaga, Pachoto, Kadiko, Kowidi and Kojweri – as well as in the permanent and seasonal wetlands including Omunyal, Apujan, Opteacharo, Akwangakera, Kirig, Acomia and Awoja, and the massive Lake Bisina and Lake Opeta wetlands.

The study was conducted in five parishes across four spatially representative districts of the Teso sub-region: Kalengo parish (Ngora district), Osuguro parish (Serere district), Katine and Gweri parishes (Soroti district), and Opot parish (Amuria district). Under the local government administrative structure, a parish is the lowest development structure in the district, each having its own development committee. Households were randomly selected; in total 52 households were included in the study. These included: 10 households in Ngora, 12 in Osuguro, 13 in Opot, 8 in Gweri and 9 in Katine. Data was collected by way of focus group discussions (3 in total) in Osuguro, Kalengo and Katine parishes, semi-structured interviews and informal observations were also conducted. Data was coded and analysed in the Statistical Package for Social Scientists (SPSS), and descriptive statistics were generated.

Findings

Respondent's socio-economic and demographic characteristics

Fifty eight per cent (58%) of the respondents were male while 42% were female. Of these, ninety-five per cent (95%) married, with 66% having attained primary level of education. Eighty-nine per cent (89%) engaged in crop production at a subsistence scale level. Of those involved in crop production, 61% of owned at least one type of livestock (i.e. a goat, pig, cow, and/or chickens). There were diversified sources of livelihood with 20% obtaining income from non-farm activities such as teaching, local government and district service jobs and petty trade, 5.5% receiving remittances, 13% engaged in charcoal burning (Table 1) and 9% involved in fishing. Close to 84% of the households owned land on a customary basis with user rights while 7% were renting land for production. About 84% of the respondents confirmed to that they had heard about global climate change.

Indigenous knowledge in climate observations

Local observations have confirmed the existence of climate change (*ejulujuleta nu ikwamin)* in the area, with a general consensus that a number of weather

Table 1—Respondents' socio-economic and demographic characteristics (N = 52)

Variable name	Percent
Number of female respondents	42
Number of male respondents	58
Marital status	
Married	95
Widowed	4
Single	1
Education level	
Primary	66
Secondary	16
Never	9
Other	9
Livelihood sources	
Crop production	89
Livestock	61
Remittance	5.5
Off-farm activities	20
Formal employment	4
Fishing	9
Charcoal burning	13
Provision of casual labour	13

patterns have changed over time. These changes have had attendant effects on people's activity patterns. In Ngora district, respondents noted that winds that bring rainfall used to blow from East to West but this has totally changed. There is no specific direction from which rainfall bearing winds blow now; instead there is coolness/hotness any time (*ekadakada*). Wind intensity has also generally increased, but with a short time span of blowing. In this area, winds blowing from the Southeast and Western parts to the Northeast also bring rainfall. This is because the Southeastern and Western parts of the sub-region are covered by the massive papyrus Kyoga basin wetlands. These changes were attributed to a Godly being and could be traced to around the mid 1980s. Cloud thickness (darkish coloring) has been observed to have been reduced. Respondents also noted that in the past, when clouds turned reddish in the East, such rainclouds brought hailstones. Today, however, hailstones fall without forewarning. One respondent remarked, "*It takes us unaware and devastates our crops.*" The moon cycle also was relied on for predicting rainfall patterns. Particular shapes, coloring and location of the moon in the sky would be interpreted to predict either the onset of rains, cessation of rains and/or rainfall intensity.

Vegetation growth patterns have also changed. Plants are no longer reliable predicators for the onset and cessation of rains. Respondents noted that the trees *Milicia excels* (elua) and *Erythrina abyssinica* (engosorot) have changed their shading patterns. Traditionally, trees dropping off leaves occurred in the months of November (*osuban*), December (*Opo*) and January (*orara*). In January and February trees would then begin to grow new leaves, and this growth was used for detecting the proximity of rainfall onset. It was during these periods that people prepared gardens and some people sowed millet in the soil, awaiting imminent onset of a wet season in March (*okwang*). Respondents lamented that these activity patterns (Table 2) can no longer immensely be followed.

Indigenous knowledge in drought detection and rain-making

Respondents noted that hand rims (depressions and protrusions of one's fist) were an important tool for reading months of the year and the elders were the specialists; this skill was passed onto the young around the fireplace. In case a drought persisted, then elders hypothesized that one of the village residents may have killed an Abyssinian hornbill (esukusuk-*Bucorvus abyssinicus*). In the event that one had killed an Abyssinian hornbill, the offender would be 'buried' in the wetland's mud in a ritual ceremony. The offender would then be required to slaughter two male goats that would be roasted to appease the ancestors; the accused would neither touch nor taste of this meat. In other instances, the absence of rain was associated with the growth and exposure of a table-like mushroom within the village. The herdsmen were required to keep searching for this mushroom as they grazed cattle. Respondents in Ngora noted that exposure of shiny rock surfaces around Awoja-Aganya (Soroti), Okiba (Ngora) and Apujan (Ngora) was associated with persistent drought. One of the respondents noted that "*when Europeans saw that these rocks were of value and useful to us, they dug them up and took them away*".

In the event of a drought, a *diviner* would be anointed by calling of the ancestors; he/she would be the one to mobilize the people of a particular village to organize a rain-making ceremony (*elelekeja*). The diviner would advise on the food items to be cooked according to the revelations she/he has obtained from the ancestors. These items usually included: cucumber fruit (*akobokobo*), cowpeas (*imare*) and intestines (*offals - these would first be read/interpreted by the diviner before they would be cooked*) of goats, sheep and cows. The rain-making ceremony included construction of an entrance near a big tree closer to the wetlands. Food and local brew (*ajon*) would be served, dancing and singing and mud smearing would be performed on the locals. During dancing and singing, participants would chant "Rain! rain! rain! (*Akiru! akiru!).* This was an act of invoking the ancestors to grant them rain. A child with a particular hand orientation (left or right), male or female, a twin or not, would be selected by a diviner to serve food during the rain-making ceremony. This was believed to bring good luck because it was obedience to the dictates of the ancestors. After the ceremony only men were allowed back to the ceremonial grounds until rain fell.

Indigenous knowledge and climate change events

Major climate events experienced from 1960-2011 were reconstructed using memories of elders (Table 3). During our discussions, controversy arose as to whether the disasters (i.e. droughts and floods) being experienced were due to climate change or were a punishment from God/ancestors for the rebelliousness and selfishness that some Iteso people

Table 2—Indigenous activity calendar of the Iteso

Months	Months in local language based on Ateso from Ngora-Bukedea-Serere	Activity
December	Opo	Garden preparation and social events including marriage ceremonies, sun drying potatoes and cassava.
January-February	Orara-Omuk	Waiting for the rains and social events including hunting and fishing in seasonal swamps
March	Okwang 'dusty'	Gardening and planting, children are often hungry in this period and dusty (hence the name)
April-May	Opedelei-Odungei	Weeding, white ants harvesting. April (Opedelei) the stomachs are flat due to insufficient food. May (Odungei) cooking fires extinguish faster for two reasons: limited cooking was done during this time; and rains were intense, thus firewood is quite often wet
June-July	Omaruk-Omodokokingol	Harvesting and early garden preparation for second rains. Plenty of food thus giving hence the name Omodokokingol for the month of July because the mingling stick is surrounded by remainders of millet flour. Harvesting of mushrooms (ebaale-*Imaruk)*; hence the name Omaruk for the month of June.
August	Oloja	Harvesting and Planting Second rain crops. There is plenty of millet grain fallen off from the millet heads during drying. This is called *iloja*, giving rise to Oloja-August. The first millet brew is tested around this month.
September	Ocoto	Weeding second rain season crops started. This is the month when grass tends to bend towards the ground due to maturity and disturbance by winds. Grass cutting in preparation for house thatching would be carried out.
October-November	Osokosokoma-Osuban	Harvesting, sun drying of sliced sweet potatoes (*amukeke*) begun in November through December. Osokosokoma (October) indicates a period when grass would start drying up while Osuban (November) is a period commonly used time to perform last funeral rites and other rites of passage (*asunban*).

Table 3—Documented accounts of events in Teso (1960-2011)

Period	Indigenously documented events: Overview
1960-1969	Food was abundant, millet was predominant, social inclusion existed. Livestock was an important component of food security. Flooding occurred about 1962-1963. During this time, clouds used to be very dark, moving from East to West; rainfall was predictable and reliable, floods always occurred around April or August but were less intense, flooding mainly in the wetlands.
1970-1979	In the early years food was available but later food insecurity increased especially in the mid-decade; this was mainly due to increasing insecurity of the brutal dictatorship by Idi Amin. Livestock treatment was very simplistic, by killing ticks. A dry spell was experienced but people are not certain of the exact year. It is around this time that rainfall patterns started becoming less predictable.
1980-1989	Cattle rustling by the Karimojong started to intensify with the use of guns; crop production started declining and famine shocks experienced around 1981-1983. Temperatures started rising and an intense dry spell was observed. During this time people survived on food delivered and obtained from Lango by train and by road and footpaths through Orungo and Alito (Amuria district) to Pader.
1990-1999	Food insecurity was acute between 1993-1994 after an earlier dry spell and an outbreak of cassava mosaic and civil insurrections that did not allow a settled life – a spillover effect from the late 1980s. Communities started receiving food relief. New cassava varieties were supplied by trucks labeled IFAD. Market reliance to purchase food started around this period. Flooding, especially around Lake Kyoga, Bisina, Opeta and Awoja, was experienced with some people living on floating islands (*ekido*) disappearing.
2000-2011	Social exclusion has intensified, food scarcity is evident, a variety of crop pests, diseases and weeds especially witch weeds (*Striga hermonthica*) have intensified, new crop varieties failure rates are high, cassava has become a more major food crop than millet, intensification of pesticide use is required if meaningful yield is to be realized. Devastating floods experienced in 2007 and drought in 2008, and cases of hunger in 2008, 2009 and 2010 were experienced (Figure 1, Figure 2, and Figure 3). The return period of floods and droughts is now very short. Delayed rains in 2011 and disjointed raining pattern/coverage occurred. It started raining in other parts, such as Serere while parts of Gweri and Amuria were still dry. It rained in Gweri and then ceased, drying the already planted crops. Likelihood of hunger in late 2011 and 2012 is anticipated.

have tended to adopt. Respondents argued that the Iteso were a peace-loving, generous and socially responsive people. One of the respondents in Amuria remarked, "*We had been used to running for safety when the Karimojong raided cattle and when Kony had attacked us but not just water (a flood); this was the first time I have had to leave my home to water (flooding) in the 72 years of my life*".

Impacts of climate change

Respondents noted that compared to the 1960s, malaria incidence was now higher and the local concoctions (e.g. *asimiri* and *emunoit*) are no longer effective in remedying the situation. Cases of water-borne diseases such as typhoid have become common, as well as diarrheal diseases. Extreme weather events now tend to lead to higher crop losses whenever there is a drought and/or a flood (Fig. 3), damage to infrastructure such as roads (Fig 1), schools and protected water springs as well as occasional displacement in the event a flood (Fig. 2). There is an increase of temperature that affects both human beings and livestock. Notably, the water discharge from spring wells has decreased compared to the past, and the spring water now bears a coloring, unlike in the past when it was crystal clear. Wetlands (1.6%) are also drying up, including areas that used to support sedges (*emugogol*). These were place where the wetlands retained water for a longer period but are now exposed. Over 47 percent (47.9%) of respondents noted prolonged and recurrent drought as the most important indicator of climate change, 18.5% indicated floods, 16.4% noted early cessation of rainfall, 4.7% cited destructive winds and thunderstorms and 10% declining crop yield. On biodiversity; some bird species (e.g. eagles, Abyssinian hornbill, cranes, echeran and esoroget); fish species (e.g. mudfish, lungfish, and catfish); animal species (e.g. ederit**, Ilobai**, Amori**, hyenas, hippopotamus, and rabbits) have disappeared from areas where they used to occur. The rivers no longer bring the migratory fish that formed an engaging activity in December and Januarys. In this list, **indicates species that have become extinct in the area (Table 4).

Indigenous knowledge use and challenges to use

If it did not matter, why are you here? One of the respondents went on the offensive when asked whether indigenous knowledge (IK) was still vital. Eighty-two percent (82%) of the respondents acknowledged using their indigenous knowledge in everyday activities and in a number of ways ranging from production activities to spirituality. Six areas emerged as prime in the usage of Indigenous knowledge. Forty-eight per cent (48%) of the respondents used IK in crop production, and 13% in preparing for the dry season, while 6% used it for traditional rituals (Table 5). They opined that indigenous knowledge was still vital, but elites who enter *'kitchens without smoke'* (laboratories) think IK is backward. Preparing for the dry season involved and involves ensuring adequate food stocks such as sun-dried potatoes, cassava garden reserves, sun-dried cow pea leaves (*eboa*), and livestock.

In the event of intense drought, indigenous knowledge would be used in harvesting wild fruits and vegetables (18%), including lily tubers-*Ikorom* (Fig. 5) and "*Emulukuju"* (wetland vegetables), *Balanites aegyptiaca* (Ecomai), and termites (*Ikok*),





Fig.1 Once a passable road (let's share our burdens!) 2007 floods (Courtsey of Pilgrim)
Fig.2 Is it real? a family fleeing the rising flood waters in 2007 (Courtsey of Pilgrim)
Fig.3 Salvaging rotting groundnuts from a flooded garden in 2007 (Courtsey of Pilgrim)
Fig.4 Locals fishing during 2010 drought at Omunyal wetland using locally made fishing baskets (Ejang) (Photo courtesy of the New Vision)
Fig.5 Ikorom bulbs- Nymphaea lotus (Courtesy of Clement Okia)

Table 4—Endangered species in Teso

Local name	English name	Scientific name	Status of their population
Ederit**	Bushbuck	*Tragelaphus scriptus*	Populations started declining about 40-50 years ago. By 1960s could remnants could be seen in parts of Amuria and Katakwi. They are no longer seen anywhere within Teso.
Elobai**	Jackson's hartebeest	*Alcelahpus buselaphus*	Populations declined rapidly in the 1960s but in the 1970s some animals could be sighted in parts of Agonga and Amotom in Amuria during the dry seasons. They are no longer sighted during the dry seasons.
Amori**	Bush duiker	*Cephalophus monticla*	These existed in small herds in the 1960s. Today it has not been sighted at least in the last 40 years in Obalanga in Amuria district.
Ebu	Hyenas	*Cracutas cracutas*	Numbers declined drastically in early 1980s following the aftermath of cattle raids by the Karamojong. Some remnants occasionally are sighted in parts of Amuria and Katakwi.
Emiria	Hippopotamus	*Hippopotamus amphibius*	Numbers sought to have declined but those that tend to appear on land are now more destructive and violent
Esukusuk	Abyssinian hornbill	*Bucorvus abyssinicus*	Numbers have declined, they are no longer seen in flocks of more than four yet in the past there could be flocks of up to eight
Ipoa	Rabbit	*Oryctolagus cuniculus*	Bush rabbits have greatly declined in number. Remnants though exist.
Ebileng	Mudfish	*Clarias gariepinus*	Flood waters no longer transport mudfish as much as they used too. This phenomenon started around the 1970s. Mudfish is still though harvested in floodplains and marshes but much smaller in size compared to those of the 1960s and 1970s.
Ikole	Lungfish	*Bagrus docmac*	Number drastically declined in the last twenty years. Fish size has increasingly become smaller. Sometimes flood waters recede rapidly leaving them exposed before maturing.

and hunting for bush meat (2%) including antelopes and rabbits (Table 4). Four per cent (4%) of respondents were involved in fishing during a dry season (Fig. 4), and in building houses on raised ground (4%) during a flood, especially on areas formerly occupied by ant hills. This was more pronounced in Gweri. Early planting and planting of fast maturing varieties was undertaken by 43%, and 31% undertook a multiplicity of coping strategies, including saving planting materials (seeds), offering casual labour, begging, trading livestock with other food stuffs, migrating to other places, stopping selling of food stuffs, and bunkering the compound to prevent heavy runoff during floods. Forty-eight (48%) per cent of the respondents applied indigenous knowledge in crop production by way of seed selection, seed storage, weeding patterns and planting mode (broadcast method for finger millet), 12% in livestock treatment, and 13% in monitoring rainfall (Fig. 6).

Respondents noted that adapting IK to the changing circumstances – especially unreliable weather and climate patterns – is a challenge. Among other challenges identified in the use of IK were lack of a reliable source of financial income and a widening inter-generational gap between those who know what IKs exist and the young. The respondents commented that when the young obtain an elite education, they shun cultural practices as backward. The technologies and seed varieties being emphasized are alien and do not last compared to indigenous varieties. Many old people are dying with their knowledge, without being able to document or effectively train the next generation of users.

Table 5—Edible plant species in Teso

Local name	Scientific name	Parts eaten
Ikorom	*Nymphaea lotus*	Rhizomes
Ekoromoti	*Nymphaea caerulea*	Rhizomes
Ecomai	*Balanites aegyptiaca*	Fruits
Etigo (Alilot)	*Corhorus sp.*	Leaves
Ikok	Termites	Whole body

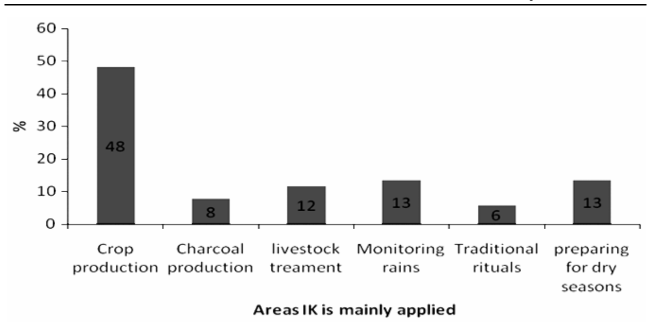

Fig. 6—Major areas where indigenous knowledge is applied based on this research

Discussion

This study examined the role of indigenous knowledge in climate change adaptation in the Teso sub-region, Eastern Uganda. Findings indicate that using indigenous knowledge in coping with and adapting to climate change still occurs. The large number of households using IK in various ways is testimony that IK can still be a formidable and relevant area for adaptation to climate change. Robinson and Herbert (2001)[8] highlighted that incorporating IK into climate change policies can lead to the development of effective adaptation strategies that are cost-effective, participatory and sustainable. Better still, the range of coping and adaptation mechanisms adopted by the households is not surprising, since African peoples are renowned for applying a mix of adaptation mechanisms depending on whether they are pastoralists or agro-pastoralists[9].

The traditional prediction practices of using events, moon characteristics, tree phenology, diviners and particular animal behaviour patterns are still utilised. This is also observed among the Oromo people of Ethiopia[10]. Diviners, however, have particularly lost their central role in community affairs for a number of reasons: (i) rise in Christianization and the East African Christian revival (*imulokolen* as they are known in Teso), which preach against the use and reliance of diviners; (ii) modernity and education in which diviner practices are looked on as archaic; (iii) civil unrest that has broken down cultural institutions; and (iv) a general decline in the wealth conditions of the people in Teso associated with cattle rustling that peaked in the mid 1980s. Thus, the divination component in climate prediction may soon be eliminated altogether. Divination and fortune telling, however, are still relied on for protection against rain in the event of a party or any important celebration. Using plants and animal species for climate prediction is equally on a downward trend, particularly due to biodiversity loss brought on by indiscriminate harvesting of trees for firewood and charcoal, use of wetlands for production of rice ("white gold") and hunting of animals for their skins, hides and bones. This is because the concept of community resource protection has disappeared as individuals now own parcels of land with rights to use them; thus there has been a move away from common access resources to individual resources. This happens despite people's acknowledgement that disappearance of trees and wetlands and burning of bushes are some of the causes of droughts in the area. According to Kelbessa (2007)[10], peasant farmers are well aware of this interconnectedness.

It is evident that the Iteso are confronted with a host of problems emanating from climate change stresses. In turn, the community is drawing on a pool of IK practices to tackle these inter-woven challenges. The Indigenous Knowledge and practices, however, are being challenged by unfamiliar diseases, especially livestock spleen disorder, as well as increased presence of ticks, unreliable seasons, short return period of climate variability events, breakdown in social inclusion systems and a low mastery of IK practices among younger community members. A similar trend was observed by Ifejika *et al.* (2009)[11] among the agro-pastoralists in Makueni District, Kenya. As such, strengthening indigenous knowledge by fusing modern practices to adaptation with the cultural practices and knowledge will offer a greater opportunity for resilience and adaptation to changing conditions and circumstances. In this way, indigenous knowledge will be valued across a wide section of interest groups including the general society, scientists, planners and policy makers.

Conclusion and Recommendation

It is imperative for education institutions, including primary schools, secondary schools and universities, to work with communities to validate and strengthen community practices. Educational institutions should particularly help the younger community members appreciate their cultural heritage and find value in the practices of their forefathers. It is important to integrate indigenous knowledge in the curricula of schools, and to ensure that there is a fusion between communities and educational institutions. People living in the countryside should not be seen as mere '*villagers*' who have nothing to offer. Climate change policy research for adaptation should seek to input communities' knowledge such that technologies developed will be able to deliver more food and better health practices, more efficiently and within the context of community practice. After all, when all the modern project implementers leave, the challenge remains with the resident people to maintain their wellbeing. Recognizing and maintaining local knowledge systems, it is still necessary to integrate modern approaches to climate prediction for the use at the local level in order to fill the gaps being left by declining and unreliable local prediction systems and adaptation. Further, there is a need to develop better communication where climate information (e.g.

forecasts) can be delivered to communities in a timely and simplified manner. Finally, efforts should also be geared towards documentation of indigenous knowledge in the community and demystifying cultural practices and recognizing the importance and validity of traditional values and belief systems in supporting people's ability to withstand and adapt to global climate change.

Acknowledgement

The author is indebted to the respondents who provided valuable information for this study. They spared their time to interface with me during the interviews, some lasting four to five hours. Mr. Samson Odiamo, Mr. John Emoru, Mr. Michael Epedu, Mr. Gideon Ekweu of Katine, Faith Nora Apila, Peter Okello, John Oriokot and Justin E. Egeru of Amuria, Ms Abeja, and Mzee Ekou of Serere were instrumental in corroborating information obtained from other respondents.

References

1 United Nations Environmental Programme-UNEP, Indigenous Knowledge in Disaster Management in Africa, UNEP, Nairobi, Kenya, 2008, 6-10.
2 Lantz TC & Turner NJ, Traditional phenological knowledge of Aboriginal peoples in British Columbia, *Journal of Ethnobiology*, 2003, 23 (2): 263-286.
3 Lefale P, Stormy Weather Today: Traditional Ecological Knowledge of Weather and Climate, The Samoa Experience, Clim Change, 2009, 7-19.
4 Green D & Raygorodetsky G, Indigenous knowledge of a changing climate, *climatic change,* 2010, 100:239-242
5 Macchi M, Indigenous and Traditional Peoples and Climate Change, Issue Paper, IUCN, 2008, 9.
6 Nyong A, Adesina F & Osman E, The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel, *Mitig Adapt Strat Glob Change,* 12 (2007) 787–797.
7 Okori A, Emuria M & Ojuman P, Uganda Participatory Poverty Assessment Process, Soroti District Report, CDRN, MFPED, Uganda, 2002, 21-24.
8 Robinson J & Herbert D, Robinson J, Herbert D (2001) Integrating climate change and sustainable development. *International Journal of Global Environmental Issues*, 2001, 1(2):130-148.
9 Parry ML, Canziani OF, Palutikof JP, Van der Linden PJ &Hanson CE, Eds. Cross-chapter case study, In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK, 2007, 843-868.
10 Kelbessa W, Climate Change Impacts and Indigenous Coping Strategies in Africa: Paper Prepared for the International Conference on Riding on A Moral Storm. The Global Challenge of Climate Change: Science-Economics-Ethics-Politics, Greifswald University, 2007, 4-34.
11 Ifejika SC, Kiteme B, Ambenje P, Wiesmann U & Makali S, Indigenous knowledge related to climate variability and change: insights from droughts in semi-arid areas of former Makueni District, Kenya, *Clim Change*, 2009, 6-15.