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Trees and Livelihoods in Karamoja, Uganda



Anthony Egeru, Clement Okia and
Jan de Leeuw

December 2014



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Trees forming bushlands that provide hunting grounds for young people and trees shielding a water pan in Nadunget Moroto district.





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Executive Summary

This report presents results of a rapid desk review of academic and grey literature on the evidence relating to trees and livelihoods in Karamoja a region in north eastern Uganda. The review identified the range of problems in the Karamoja sub-region; benefits of trees to people and communities living in Karamoja; the role of trees in resilience building; role of trees in agricultural production, traditional knowledge of trees in Karamoja; threats to trees, drivers of development in Karamoja; tree-based initiatives in the sub-region; and opportunities for action research in Karamoja. Using their experiences in the Karamoja sub-region and other similar ecosystems in Africa, the authors provide insights of the contribution of trees to livelihoods in Karamoja.

Karamoja sub-region is a semi-humid to semi-arid sub-region in north eastern Uganda covering approximately 27,200 km². It has a complex range of problems including: historical injustices, misconceptions of the sub-region and its people, poor infrastructure climate variability and change, existence of several agricultural risks, weather based vagaries, low agricultural productivity, a declining pastoral production system, increasing environmental degradation orchestrated by a number of mal-adaptations, and poor performance of the region with respect to development indicators as compared to other parts of Uganda.

The climate in Karamoja sub-region is generally harsh with high rainfall variability and high evapotranspiration. The sub-region's rainfall regime ranges between 350-1000 mm per annum. This precipitation is usually sporadic and falls in one rainy season. The sub-region generally suffers from poor rainfall distribution rather than from low rainfall totals. However, it is the intensity and the variability, particularly the existence of sporadic intense wet periods followed by drought events that has always had debilitating impacts on the sub-region.

There is wide evidence to suggest that trees provide a range of services and benefits to the people and communities living in Karamoja. Following the Millennium Ecosystem Assessment (<http://www.millenniumassessment.org>) analysis, these are categorised into four sub-groups: provisioning, regulating, supporting and cultural services.

This review reveals that the Karamojong¹ derive a wide number of herbs and medicinal products for humans and livestock from trees. Consequently, the Karamojong have high levels of ethnopharmacological and ethnoveterinary knowledge. Firewood, charcoal, building materials, gums, resins and extractives are also harvested from different tree species within the sub-region. Further, trees provide forage and browse to livestock during both dry and rainy seasons. Browse is particularly important during the dry seasons when acacia pods are utilised.

The trees in the sub-region act as wind breaks against the strong winds that emerge from the Turkana plains in Kenya; trees also help to control soil and water erosion. In places where trees have been cleared, soil erosion is strongly evident, developing into gullies.

¹ 'Karamojong' is a generic word used to describe the people of Karamoja sub-region. In its depth however, it refers to the dominant plain dwelling people of Karamoja. The Karamojong comprise five distinct Nilotic peoples (Karimojong-Matheniko, Pian and Bokora, Dodoth, Jie, Labwor and Pokot) in the plains and five small Kuliak groups (Tepeth, Kadam, Ik-Tueso, Nyangia and Mening) found along the mountains whose languages are unique and unintelligible to the broader Karamojong. Despite generally being considered as part of the Karamojong, the Pokot are however distinct. This is because they belong to the Southern Nilotic with a close linkage to the Kalenjin sub-group.



Trees in Karamoja help in soil fertility management as well as being important in early warning through their phenological characteristics. In addition, the literature shows that trees help conserve biodiversity, preserve cultural heritage, and promote peace in the sub-region. These and a range of other benefits are similarly considered as potential components in building the resilience of households and communities in Karamoja sub-region.

This review also notes that trees in Karamoja are under pressure. Threats include; expansion of export-oriented charcoal and firewood from the sub-region; expansion of cropland (especially encroaching into bushland/woody vegetation) to increase production; and the breakdown in traditional institutions that supported conservation. These threats and other challenges in the sub-region have driven development actors, including government, civil society and humanitarian agencies, to undertake tree restoration interventions in the Karamoja sub-region. These interventions have focused on tree planting, establishing tree nurseries, distribution of seedlings, formation of community-based organisations, and awareness campaigns on the dangers of environmental degradation. Interventions have generally been driven by the understanding that trees are central to human survival in Karamoja and that loss of tree cover in a semi-arid area like Karamoja will expose it to desertification. Some interventions have also focused on protecting and/or regenerating existing trees in the sub-region (e.g. use of farmer managed natural regeneration) given that tree planting frequently results in low survival rates of seedlings due to harsh conditions.

The review identified opportunities for action in the sub-region geared towards strengthening natural resource management for income generation and livestock production among others. With regard to opportunities for research, it is recommended that attention should focus on: agricultural risks analysis, understanding tree-crop interactions and appropriate combinations for the sub-region, developing tree-food security ecosystems and a community resilience framework, exploring the utilisation of nutrient and fertility islands for tree-based systems, understanding indigenous tree management systems, and exploring eco-hydrological connections, complexities and tree systems in the sub-region. Other areas of research include: valuating the role of trees in soil fertility management (fertilizer trees), and selection and cultivation of indigenous fodder species.

The review recommends that opportunities for action to include among others; rehabilitation of degraded rangelands using enclosures to enable native regeneration; promotion of conservation agriculture with trees; undertake community-based forestry management and management of trees in communal lands (Parklands); and promote sustainable harvesting of valuable indigenous tree products in Karamoja with a particular focus on gum arabica, shea butter, khat, desert date and sandalwood. Value chains for these tree products should be developed with emphasis to local processing by women groups and market linkages to provide income as well as enhance biodiversity conservation. Establishment of improved fruit orchards for mangoes, oranges and other suitable fruits should be explored. Furthermore, the use of hydrogels to enhance tree survival and establishment should be integrated into on-going tree planting initiatives.

Whereas this was not a comprehensive study of trees and their influence on livelihoods of people living in Karamoja sub-region, the review reveals that trees have a vital role in Karamoja. Because the Karamojong generally have a close relation to their environment, they have a wealth of knowledge of trees and their uses. In their bid to circumvent the challenges imposed by the intermittent drought and other associated effects, the strategies adopted by individuals and communities threaten the existence of trees and the general health of the rangeland upon which they so much depend on.

SECTION 1

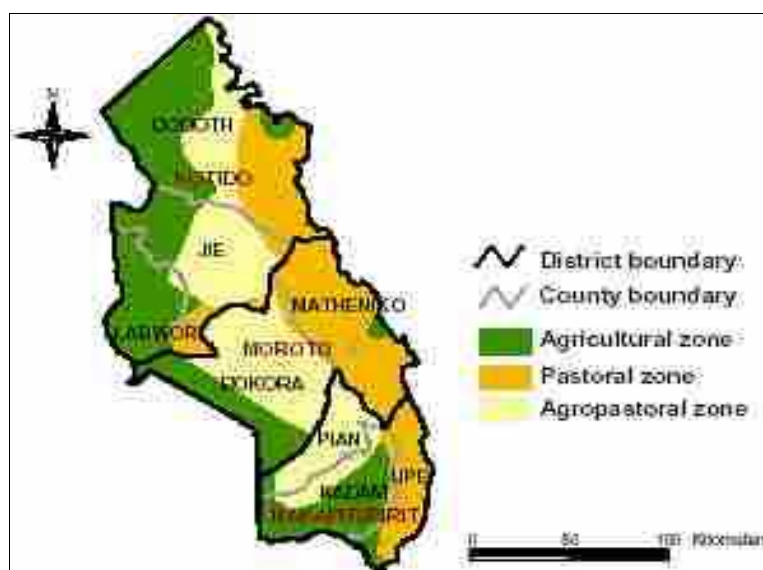
Introduction

1.1 Background

Livelihoods in Karamoja are changing, gradually moving away from primarily relying on pastoralism to relying on more diversified livelihoods, whether by default, impulse and/or orchestrated by an outside force. This diversification can be seen in the rapid adoption of crop-based agriculture (Egeru et al., 2014a), the proliferation of artisanal mining of gold, marble and stones (Houdet et al., 2014), and the adoption of charcoal trade and brick making (Burns et al., 2013). The option of greater access to livestock markets, which could be pivotal for livelihoods, is impeded by trade prohibitions imposed due to frequent disease outbreaks (Institute for International Cooperation and Development, 2010).

Karamoja is sub-divided into three livelihood zones (Figure 1); (i) the Sub-humid Wet-Agricultural Zone, (ii) the semi-arid Agro-Pastoral Zone, and (iii) the Arid-Pastoral Zone. Each of these livelihood zones has defining attributes. The wet agricultural zone runs down the western part of the sub-region and receives the highest rainfall total in the region – on average 800 to 1200 mm per annum. The agro-pastoral zone represents the crop-livestock mixed farming system and runs through much of central to northern Karamoja with annual rainfall averaged at 500 to 800 mm, which is often poorly distributed. The arid-pastoral zone occurs in the eastern part of the sub-region, covering parts of Kotido, eastern Moroto and Amudat. This zone is characterised by variable, poorly distributed and low rainfall not exceeding 700 mm per annum (GoU, 2009). Unlike the rest of the country, with two rainy seasons and two planting seasons, Karamoja has only one rainy season and one planting season (OPM, 2009). Karamoja is also characterised by high spatial-temporal variability in rainfall with a lack of a smooth transition from one extreme event to the other (Egeru et al., 2014b).

Figure 1 Karamoja's three livelihood zones






For a considerable period of time, the perception of Karamoja within government and among development partners was that the population is i) extremely poor, ii) has livelihoods that are very vulnerable to frequent droughts and iii) follows pastoral livelihoods that are not viable in the long term (Levine, 2010). Further, the sub-region has been considered as a development challenge. Karamoja is also represented as an exceptional situation, disconnected from 'the rest of Uganda' in cultural and economic terms and desperately needing to 'catch up' with the rest of Uganda (Kratli, 2010). These perceptions have echoed through over the decades from the colonial times to the present. During the colonial period, for example, the British administration erected a sign-post at its headquarters in Moroto informing visitors that they had reached the 'heart of Africa' (Akabwai and Ateyo, 2007). In the 1954 movie by Krogger Babb, the Karamojong were portrayed as the 'most primitive' people ever filmed (Friedman, 1990). The British protectorate also introduced a forceful land acquisition and transfer programme, followed by intensified exploitation apparently to control environmental degradation caused by 'overgrazing'. Consequently, within six years of the introduction of the Karamoja Cattle Scheme in 1948; almost 60,000 cattle had been purchased out of Karamoja (Mamdani, 1982). This represents part of the historical injustices and marginalisation that the Karamojong have had to contend with since colonial times as well as in post-Independence Uganda.

The population of Karamoja has been growing since the early 20th century. The Karamojong constituted a small proportion of the 1,038,000 people of the northern region during the 1948 East African census (Martin, 1949). In the 1959 census, Karamoja's population was estimated at 171,945 people rising to 370,423 (1991 census), 723,538 (2002 census) and 988,429 in the 2014 census (UBOS, 2006; UBOS, 2014). Livestock remains a key livelihood source in Karamoja augmented by subsistence crop cultivation. In the last Livestock Census, Karamoja was reported to have up to 2.3 million cattle representing 19.8% of the national cattle herd (MAAIF-UBOS, 2009). The sub-region has the highest density of cattle, sheep, goats, donkeys and camels in Uganda (MAAIF-UBOS, 2009).

The Karamojong's focus on livestock is often associated with poverty and backwardness. Yet it has been shown that households in Karamoja that have livestock assets have better food security than those that do not. According to Akabwai and Ateyo (2007) in a food security assessment of the sub-region in 2007, approximately 70% of households in the "food secure" category were those that owned livestock or poultry. Crop farming has been on the rise in the last decade with a tenfold increase in subsistence farmlands (Egeru et al., 2014a). This is despite strong evidence that livestock provides more food security than growing crops in the semi-arid areas; the food crisis in these regions is actually a livestock crisis (Kratli et al., 2013).

Multiple initiatives have been undertaken in Karamoja to improve food security, bring peace and security, and build resilience of communities to climatic change and variability shocks. The Government of Uganda (GoU) for example has undertaken a range of multi-million dollar projects through initiatives and agencies such as: the Peace, Recovery and Development Plan for Northern Uganda (PRDP), Karamoja Development Agency (KDA), Northern Uganda Social Action Fund (NUSAF), Karamoja Action Plan for Food Security (KAPFS), Karamoja Livelihoods Improvement Programme (KALIP), Agricultural Livelihoods Rehabilitation Programme (ALREP), Karamoja Integrated Disarmament and Development Programme (KIDDP) and the operationalisation of a fully-fledged Ministry for Karamoja Affairs. Like in most of the pastoral regions in the Greater Horn of Africa, resilience building is currently the major focus of both government and development and humanitarian actors in the sub-region. However, a recent study by UNDP showed that there was a mismatch between what is considered by the community as resilience contributing activities and the funding and interventions provided by the actors (UNDP, 2014). Consequently, as other actors seek to make a contribution towards resilience building using tree-integrated options,



it is imperative to undertake a rapid assessment of the role of trees in the livelihoods of people in Karamoja sub-region. It is within this perspective that this rapid review was commissioned to provide background information and evidence relating to trees and livelihoods in Karamoja.

1.2 Approach used in the review

This review is based on on-line searches and the research and field experiences of the authors in the region and other similar agro-ecologies in drylands of Africa.

1.3 Limitations of this review

This review is a rapid desk assessment seeking to identify the evidence relating to trees and livelihoods in Karamoja sub-region. It does not purport to provide a comprehensive and rigorous analysis of the livelihood status of Karamoja sub-region. Owing to the limitations of the literature on trees and livelihoods in Karamoja sub-region, the authors utilised their own research and field experiences and observations in Karamoja and other dryland and agro-pastoral areas of Africa to provide a better picture of the role of trees in Karamoja sub-region. The authors also utilised grey literature from NGO reports and from on-line web portals to further bridge the limited literature on trees and livelihoods in Karamoja.


1.4 Understanding Karamoja as complex problem terrain

The Karamoja sub-region represents a complex problem terrain as a range of issues interact to make a one-off fit for all problems unattainable. As earlier observed, the sub-region has had a long history of exclusion from the rest of Uganda and has experienced about three and half decades of civil unrest orchestrated by a proliferation of small arms and armies, a civil and administrative vacuum, crippled traditional institutions and intermittent extreme climatic events which have pushed the community's coping and adaptation strategies to the limits. The challenges facing the sub-region include but are not limited to the following:

Covariant risks of drought include meso-shocks that often affect specific groups of households in the sub-region, particularly those without livestock holdings. Macro-shocks tend to affect the entire sub-region, particularly when there is a prolonged drought affecting the entire region as was the case in the 1980 and 1984 drought events. Furthermore, idiosyncratic shocks, also known as micro-shocks, often affect specific individuals and/or households. In Karamoja, the elderly and the children are often hard hit by such shocks (e.g. during the 1980 famine an estimated 20,000 to 50,000 deaths were reported, most of whom were children). Irregular rainfall further explains the high (up to 70%) incidence of crop failure and the associated disruption of water and pasture supplies (UNOCHA, 2008; Umana-Aponte, 2011; Egeru et al., 2014b).

Karamoja sub-region is faced with agricultural risks - both farm-level risks and constraints and supply chain risks. For example, the presence of the covariant risks of drought relating to climate and weather variability leads to lower yields, crop-failures and loss of productive assets such as livestock. Biological risks relating to pests and diseases also lead to yield losses and income and food insecurity. Price risks often escalate the costs of other goods and services in the sub-region. Poor infrastructure and limited connectivity particularly during the wet seasons are part and partial of agricultural risks afflicting Karamoja (Anderson and Robinson, 2009; Institute for International Cooperation and Development, 2010; Robinson and Zappacosta, 2014).

High livestock disease burden in the region including the presence of *peste de petits ruminants* (goat plague), and *contagious bovine pleuropneumonia* (CBPP), Brucellosis, and



ticks and other tick borne diseases. The pattern of disease outbreaks often leads to considerable livestock deaths with quarantines being imposed. This affects household incomes and often escalates the food insecurity situation in the Karamoja sub-region (Institute for International Cooperation and Development, 2010; Robinson and Zappacosta, 2014).

There is a high dependence on vulnerable livelihood options including among others: crop cultivation, unskilled wage labour, brewing, petty trade and livestock herding dominate the sub-region.

The region and her people are faced with several historical misconceptions about their culture and livelihoods. For example, pastoralism in Karamoja has been portrayed as backward, a flawed way of life, Such skewed representations have played a silent yet pervasive role in undermining pastoral livelihood by reproducing wrong policies, pre-empting service provision and turning positive programmes into ‘white elephants’ (Kratli, 2001). According Levine (2010), there is evidence that, contrary to a widespread misconception, crop farming in the agricultural belt is less secure as a livelihood than pastoralism in the dry belt, even for the poor.

Long history of neglect and exclusion from the wider Uganda. The sub-region has had to contend with a systemic protracted marginalisation since colonial times. This became ingrained among the wider Ugandan populace in the decision making cycles with the infamous derogatory phrase “*we shall not wait for Karamoja to develop*” whenever anyone was either delaying any process or decision making. This demeaning phrase, believed to have first been made in 1963, further represents the isolation the Karamojong continued to endure (lyodu, 2010; Salonen, 2012). The marginalisation in Karamoja also reveals two issues: the inability of the people to participate adequately in decision making processes and the inability to profit from national benefits to the same degree as other Ugandans (Mamdani, 1982; Kagan et al., 2009).

Insecurity and ‘perceived insecurity’, ‘restrictions on movement’ though there is growing peace and security following the ‘successful’ disarmament programme in the sub-region. It is important to note that the guns have relatively silent in Karamoja but the security situation still relies on the heavy deployment of the Uganda Peoples Defence Forces (UPDF); indicating a precarious position. The situation is partly precarious because of the mass of youth who surrendered their guns and practically have little productive engagement for most of the year; secondly, those who surrendered their guns became impoverished as their ability to reconstitute and protect their herds was removed, the most affected being the Bokora (Knighton, 2003; Ng, 2012).

A rising shift towards charcoal production and firewood trade within the urban centres in the sub-region and outside is also occurring (Egeru et al., 2014a; IUCN, 2014).

Unguided and uncoordinated development interventions; several actors and independent implementation agendas. Of particular concern have been uncoordinated development interventions that have in one way or the other perpetuated poverty and food insecurity, imposed unrealistic technologies and practices that have even had worse off negative impacts in Karamoja (Kratli, 2010; Flintan, 2013). In addition, Karamoja suffers from a range of emergency programmes that have been initiated from time to time with rather seemingly common goals but highly scattered in implementation, small in size with short-term funding, high staff turnover and territorial divisions by authorities. Consequently, a longer term and coherent view of development for the region has been hard to come by (Anderson and Robinson, 2009).



SECTION 2

Tree benefits, role in resilience and threats in Karamoja

2.1 Introduction

Trees play a significant role in the lives of the people of Karamoja on a daily basis. In a round trip and consultative meeting² in Karamoja sub-region, FAO's Ben Chikamai observed that the sub-region was sitting on a goldmine; he was referring to the luxuriant gum arabica and amarula trees in Karamoja. The ecosystem services accruing from trees to the people of Karamoja can be grouped as: provisioning that describe products obtained from ecosystems; regulating services that refers to the benefits obtained from the regulation of ecosystem processes; supporting, and cultural services that describes the non-material benefits people obtain from ecosystems. Each of these ecosystem services has been described in the following sub-regions.


2.1.1 Provisioning services

Trees in Karamoja **provide herbs, medicines, pesticides and extractives** (*Acacia gerradi*, *A. mellifera*, *A. nilotica*, *A. oerfota*, *A. abyssinica*, *Albizia anthelmintica*) (Obua et al., 2006; Grade, 2008). The medicinal value of acacia trees species in the sub-region has been documented by Grade (2008). For example, *A. seyal* treats diarrhoea, *A. Senegal* is believed to treat rinder pest, trypanosomiasis, and childbirth pains, and *A. nilotica* believed to cure pneumonia. Several introduced tree species (long term - *Azadirachta Indica*) and recently introduced -- *Moringa oleifera*) are utilised in Karamoja for medicinal purposes (Grade et al., 2009). In addition, on Mt. Kadam, Khat (miraa) is harvested and traded in Moroto, Nakapiripirit, Namalu and Mbale towns.

Trees in Karamoja **provide firewood and charcoal for both domestic and sale**; particular tree species are important firewood providers; locally preferred trees for firewood in Karamoja include Ekoromwai (*A. xanthophloea*), Ekapelimen (*A. nilotica*), and Eseperwai (*Ormocarpum trichocarpum*) and for charcoal include: Eperu (*Tamarindus indica*), Ekorete (*Balanite aegypticus*), Ekoromai (*A. seyal*) (Obua et al., 2006).

Building materials are principally provided by trees and grasses given that a majority of semi-permanent homesteads (manyattas) have walls and roofs made of wood structures. The Karamojong also invest highly on security by building a one meter thick perimeter ring fence around the homestead, this fence is made of wood. Trees preferred for this purpose include: Ekodokodoi (*A. senegal*), Ekorete (*Balanite aegypticus*), Ekale (*Ziziphus mauritana*), Ekoromwai (*A. xanthoplea*), and Esilang (*Ziziphus abyssinica*) among others (Obua et al., 2006; Egeru per. Observation).

² Ben Chikamai from the Food and Agricultural organisation (FAO) coordinating network for gums and resins was in Karamoja sub-region studying the viability of gum Arabica. As part of his activities, he met with President Yoweri Kaguta Museveni at Soroti State Lodge on September 22, where they discussed various possibilities of harnessing resins in Karamoja as well as establishing an Aloe Vera boiling plant in the region.



Trees **provide gums, resins and extractives** for the Karamojong. Ekodokodoi (*A. Senegal*) is traded in small volumes; other gum producing acacias include *A. gerrardii*, *A. seyal*, *A. sieberiana*, *A. tortilis*, and *A. nilotica*. These gums are used for purposes such as trapping birds and rodents and mosquito repellents (Egadu et al., 2006). Lothiru (*Orthosiphon* sp.) is a herb species with a pungent scent that is often used as a mosquito repellent (Egeru, 2014).

Trees **provide important forage and browse for livestock** particularly goats, sheep and camels. Cattle may browse on trees during periods of herbaceous forage deficits. There are over 110 browse forage species in Karamoja, most of which are acacia species. *A. camplacantha* and *A. nilotica* are important because they provide both leaves and pods. Others include; *A. Senegal*, *A. seyal*, *A. drepanolobium*, *A. tortilis*, and *Indigofera erecta* among others (Egeru, 2014).

Trees **provide food options, most importantly during periods of drought**. The Karamojong have up to 126 plant-based hunger food sources. *B. aegyptica* (Ekorete) finds all three of its parts edible in times of hunger; the leaves may be cooked as a vegetable, the edible fruit mesocarp is sucked as candy and the hard, woody endocarp seed coat may be cracked open and the inner kernel (Abalit) pounded, soaked, cooked and used as oil-rich seed 'famine food' (Grade, 2012). Leaves, tubers, roots and nuts are often harvested for consumption, for example, leaves (*ngoizat* leaves in Tepes), roots and tubers (*regnat/reggen*, bitter roots of *opat* tree) (Weatherby, 2012). The Karamojong also benefit from a range of fruits and extractive juices obtained from trees for example *tamarind indica* fruits and marula tree fruits (Etengu, 2006). Other wild edible plants foraged by humans in Karamoja particularly during the dry seasons include *ebisinai*, *edwol*, *esoboliat*, *ebabui* plus fruits like *ngimongo*, *ngakalio*, *ngiru*, *ngacok*, and *adilat* among others (Ayoo et al., 2013).


Support for honey production, wild honey harvesting is undertaken especially during the dry seasons. Recently, domesticated production using improved bee hives is on the rise. Bee hives have been observed in Nadunget near Moroto airstrip, other beehives have been observed at the Agro pastoral farmer field schools (APFS) in Nabilatuk, Nakapiripirit district. The honey and wax coming from Karamoja is noted to be of high quality because it comes from the acacia and aloe flowers all of which have medicinal value. The Ik community in Kaabong district that also depend on honey and some sub-counties in Amudat are already involved in processing honey for income generation (Ayoo et al., 2013).

2.1.2 Regulating services

Trees in Karamoja are important wind breaks for the strong winds and sunshine/heat (Grade et al., 2010). The sub-region generally lies to the west of Turkana thus intercepting strong winds that emerge from the Turkana plains particular during the dry season. The regeneration and planting of trees to protect the overly open water dams from strong winds to reduce evaporation losses has been recommended for the Karamoja sub-region (Elokaokich, 2001; Chow, 2010). This is very important in an area like Karamoja where the rate of evaporation exceeds precipitation.

Trees are culturally known to protect the soil from run-off and making the soil fertile. In some locations such as in Kotido some soils are known as 'cool soils' because they are under the *A. camplyacantha* and *A. nilotica* trees along the Dopeth river banks; these soils are associated with high productivity. When the soils are exhausted, trees are left to cover the land through natural regeneration; often such landscapes get colonised by *A. mellifera* particularly in Kotido district (Egeru 2014, Egeru et al., 2014a).

Meanwhile, **dams are shielded from siltation by trees, shrubs and other vegetative matter**. During periods of drought, potential water locations are identified by the existence of particular tree species such as *Ficus exasperata* and *Kigelia africana*; thus, trees are



important traditional ‘geo-reference points’ for water locations in the Karamoja as trees traditionally follow water courses with deciduous woodlands marking areas with higher rainfall and water (Dyson-Hudson, 1962).

Trees are important early warning systems among the pastoral and agro-pastoral communities. The phenology and change patterns in liaison with the behavioural characteristics of animals are utilised for early warning. For example; the presence of large game near communities precedes a drought and *Tamarind* trees bearing unusual amounts of fruits are an indicator of a bad year ahead (Powell, 2010).

2.1.3 Supporting services


Trees are important biodiversity centres in Karamoja sub-region by providing a range of leaves, tubers and roots that are important food sources and supporting a range plant species that provide herbs and medicines. Further, several trees support wildlife and birds in the region; these also provide key food sources by supporting the hunting expeditions of the Karachunas (youth). Wildlife such as *dik-diks*, *antelopes*, *duikers*, *warthogs* and *rodents* (locally referred to as ‘black bananas’) are hunted in the rangelands in Karamoja (Egeru per. observation, 2013). In Matheniko game reserve around Kobebe valley dam, swarms of different bird species such as egrets, Abdim’s Stork, Yellow billed stork and Sacred Ibis have been observed (The Naturalists, 2013).

Besides biodiversity conservation, **trees in Karamoja enhance soil fertility, conserve soil moisture and act as wind breaks**. It is common to observe crop-cultivators in Karamoja, especially in Nakapiripirit and Napak leaving some trees standing in their gardens to break reduce wind speed that would potentially destroy sorghum. *Euphorbia trucalli* is also planted around most of the gardens near manyattas particularly in Kotido to tame winds, erosion and livestock (Egeru per. observations, 2013). In a country study on indigenous fruit trees (IFTs) in East Africa, Okia et al. (2008) have shown that IFTs are retained on the farm because they are believed to enhance soil fertility due to their nitrogen fixing ability, water retention and soil erosion control. Further, some of the tree species such as *Albizia coriaria* (Ecaillait) have been documented with the potential to increase soil nitrogen (e.g. Nsubuga et al., 1984) and have also been documented as used for treating rinderpest and barren cows (Grade, 2008).

2.1.4 Cultural services

Traditional and cultural heritage; trees provide a history of a clan, a community and tradition. They are important land marks for boundaries between parishes, districts, tribal groupings, and land demarcations between families and clans (*Euphorbia tirucalli* are commonly used for land demarcations). Specific tree species are used for discharge of justice and instilling discipline, e.g. a tree locally referred to as *akali* is used for caning wrong doers within the community in Nakapelimoru sub-county, Kotido district (Egeru per interviews with elders, 2013).

Cultural responsibility passed on from generation to generation among the Ngiyepan clan. The *Ngiyepan* clan is said to have existed and exists among the Pian tribal grouping; this clan is believed to be responsible for tree protection and shrine management with women being at the forefront. During the periods when they were active, the shrines were believed to have bigger trees and plenty of rain. Their role and presence has however been observed to have dramatically declined; indicative of a cultural erosion in the sub-region. Among the Ik people living in north eastern part of the Karamoja region around the Zulia Mountains, it is traditionally held that God gave the Ik “nakut” (the digging stick) but gave the Turkana and Dodos cattle. As such the Ik treasure trees as the major source livelihood as



they provide wild fruits and honey and to the Ik trees represent their cultural heritage (Turnbull, 1987).

Trees are important arbiters for peace, security management and demonstration of spiritual powers in the sub-region. Peace is often made under trees and shrines. Testimonies have been shared of how traditional healers' lives were spared by warriors of opposing tribal communities because of the herbal concoctions they provided to save livestock from those communities. In addition, the memories of buried spears and hoes were discussed under the trees by elders, during peace-making ceremonies (Mirzeler and Young, 2000). The politico-religious leaders (*ekeworan*) may from time to time demonstrate their spiritual powers by making fire from the wet branches of *esegese* tree (Mirzeler and Young, 2000).

2.1.5 Role of Trees Portrait in Karamoja



An agro-pastoral community in Lomejan village in Kotido district planting while nurturing *Acacia siamea* trees (above). Two years later, the acacia trees had grown (below).

A fruiting acacia with pods at CARITAS Kotido offices (above). A goat feeds on the acacia pods (below). These pods are essential for sustaining browsers during the dry seasons.



A temporary shelter for harvesting of *Catha edulis* (Khat) on top of Mt. Kadam (Gerald Eilu, 2014)



Processing Aloe tweedieae at Lorengendwat (Francis Gachathi, 2014)



Nuts of shea butter tree. The shea nut belt in Karamoja occurs in western Karamoja running from Abim, Napak to Nakapiripirit districts (Francis Gachathi, 2014)



Quality Acacia resin taken from Kapedo (Francis Gachathi, 2014).

Trees are felled for multiple purposes, for firewood ferried by women & young girls (top), for manyatta construction (middle) and for charcoal (bottom).



Trees shield dams from sedimentation and evapotranspiration. Lomogol dam in Kotido.



Trees offer opportunity for art and crafts at Lobel, Kotido district.



A kid being treated by administering herbal concoctions.



Trees shield the ground from soil erosion and are important wind breaks for the homesteads and croplands. If not present erosion is increased.



A child eating the fruit of *Balanites aegyptiaca* (Ekorete) to wade off hunger.



2.2 Role of trees in resilience in Karamoja

In this sub-section, the role of trees in resilience building is provided. The sub-section also provides a classification of how trees are utilised in the resilience development process in Karamoja.

2.2.1 Contribution to resilience building

Trees provide a range of benefits both direct and indirect to people in Karamoja however, as indicated in section 1.4, Karamoja sub-region faces a number of challenges and these influence the resilience development process as they have an effect on the livelihood assets (natural, social, financial, human, and physical capital) in the region. Further, they also influence people's visions, hopes and fears as well as the manner in which they recognise and utilise trees for resilience building either directly or indirectly.


Karamoja's trees and tree-based systems are easy to identify. Firstly, the agricultural-cropping system is a tree-based system that is rapidly rising in the sub-region particularly in the last decade alone (Egeru et al., 2014a). It is a common sight to observe isolated trees interspersed within sorghum gardens in parts of Abim, some tree-based crops such as Nyapena (*Cajanus cajan*) mixed with other crops also grown in Abim and in Karenga in Kotido district. Secondly, are the grassland/thickets and shrubland systems that make the pastoral rangeland. This system is particularly wide spread in the sub-region with the dominance of grasslands, thickets/shrublands and rising gradient of bushlands (Egeru et al., 2014a). Third, is a rather conspicuous forest/woodland system which observers often tend to disapprove of their existence but these are mainly found on top of mountains and also act as the water towers of the region. For example; Mt. Kadam central forest reserve, Mt. Moroto, Mt. Labwor, Mt. Iriiri and Mt. Zulia (Mt. Zulia is a key a hunting ground for the Ik indigenous community). There are also several other forest reserves in the region including: Akur, Alerek, Ating, Kaabong, Kano, Lomej, Lopeichubei, Lotim-Putu, Lwala, Morongole, Nangolibwel, Napono, Nyangea-Napore, and Timu among others. These forest reserves occupy an estimated area of 322, 210 hectares (Rugadya et al., 2010).

Trees and tree-based systems contribute to resilience building at different levels along the resilience development process. The resilience building process can be categorised into three levels i.e. *coping, adaptation and transformation*; these levels, actions and processes have operated in rather fuzzy continuum in Karamoja sub-region as we describe in the sub sections that follow.

Coping

A growing concern in the Karamoja cluster is whether the pastoral and agro-pastoral communities are adapting or simply coping to inherent shocks in the areas they occupy (Wasonga et al., 2012). The classification of actions within the coping range that have been identified (e.g. Levine, 2010; Browne and Glaeser, 2010; IUCN, 2014; Egeru et al., 2014a) in Karamoja including among others; charcoal production and firewood trade, provision of casual labour in urban centres, harvesting of wild fruits, roots and tubers, relying on humanitarian assistance, commercialised raids³, brewing local beers, and movement and

³ Livestock raiding was traditionally used as a herd reconstitution and retaliation strategy in Karamoja. However, raiding in the region took different trends with upsurge of guns from the late 1970s (small fire arms mainly AK47 rifles). During the early 2000s, livestock raids adopted a third dimension of commercial interest. These raids operated outside of the informal governance system of the elders, and was necessitated by short-term livelihood needs for some, and driven by profiteering for others. Raiding was organised at different levels either in large groups, or small groups of youths, and may be managed by racketeers, or richer cattle owners who loaned out weapons (Agade, 2010).



settling in wetter areas reveals a community that is coping. The prevalence and successive occurrence of shocks have particularly made these forms of coping mechanisms more pronounced in the sub-region (Browne and Glaeser, 2010). Trees and tree-based systems in Karamoja play a vital role at this level for example through the provision of browse and pasture which sustains livestock during recurrent droughts. This is because pasture and browse (the last to be affected by a drought) are not affected in the same way as planted crops such as sorghum (Levine, 2010). Whenever, a dry spell has affected Karamoja, livestock has provided a secure fall-back position for livestock owning households thereby buffering them against food insecurity compared to the non-livestock owning households (Akabwai and Ateyo, 2007; Levine, 2010).


Coping represents the first and precarious stage in the resilience building process. This is because it allows for the survival of the human population past the shock. However, as it can be noted, some of the coping strategies relating to intensified natural resource extraction such as cutting of trees for charcoal and fire wood sale, and poaching have a potential of negative consequences particularly environmental and land degradation. Thus, this will threaten the viability of livestock production, thereby increasing the region's vulnerability and the potential for conflict over control, access and use. It is this that introduces the bigger challenge into the resilience building agenda for Karamoja sub-region.

Adaptation

When taken from its literal meaning, adaptation (adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts) is both a process of adapting and to the condition of being adapted (Smit et al., 2000). This occurs through different types which are differentiated according to numerous attributes (Bryant et al., 2000). Commonly used distinctions are purposefulness and timing (Smit and Pilifosova, 2003). Autonomous or spontaneous adaptations are considered to be those that take place-invariably in reactive response to climatic stimuli as a matter of course, without the directed intervention of a public agency (Smit and Pilifosova, 2003). On the other hand, planned adaptations can either be reactive or anticipatory (undertaken before impacts are apparent). In addition, adaptations can be short or long term, localised or widespread, and they can serve various functions and take numerous forms (Smit and Pilifosova, 2003).

It is evident that some of the actions and options observed in Karamoja mirror adaptation in action and in progress and trees play a role in one way or another. In this regard, the realisation, strengthening and transition from simply relying on the extractive enthanoveterinary knowledge to agroforestry of medicinal plants (Grade et al., 2008) in the sub-region represents an action towards anticipatory adaptation with trees at the centre stage. It is also worth noting that a range of institutions particularly non-governmental organisations (NGOs) and humanitarian agencies (e.g. FAO, WFP, Mercy Corps, ACTED, Welthugerhilfe, and CARITAS) are supporting tree-based livelihoods and have supported some of the initial steps. Some tree species, e.g. acacia have been planted in Karamoja and other wild landraces domesticated (Grade, 2008; Ferreri et al., 2011). However, it is important to note that most of these efforts are fairly recent in the sub-region and thus most participants in the projects are yet to experience the full benefits on these initiatives. Few cases have reported success particularly where beekeeping was integrated as part of the broader environment and rangeland management under the FAO farmer field schools in Napak and Nakapiripirit districts and parts of Rupa (Okoth et al., 2013; Houdet et al., 2014).

Relying on trees and tree-based systems for production of alternative goods and services also represents a means by which the communities in Karamoja are beginning to diversify their livelihood sources by increasing their participation in a wide range of welfare improving activities. This indicates a process of slowly moving the community from highly extractive activities that were enumerated under the coping with a potential to escalate household



and/or community vulnerability. Further, the pastoral households in the region are introducing and increasing camel production with a view of taking advantage of the abundant browse forage in the sub-region but also exploit their biological and physiological adaptation to harsh environmental conditions. The camels will be able to browse the upper part of trees which are out of reach for goats, sheep and cows. The shift in preference from cattle to camels in the face of increased climate variability has also been reported among the Borana of Kenya (Kagunyu and Wanjohi, 2014). From the 2008 Livestock Census results, the camel population in Karamoja was estimated to have reached 32,030 animals representing 97.4% of the national camel herd (MAAIF-UBOS, 2009). This has been viewed as positive development since camels are more adapted to dry conditions, produce more nutritious milk and generally their sale fetches more money compared to cows.


Transformation

Transformation is a higher order level action in the resilience building process/agenda. This is because transformation requires crossing thresholds to new development trajectories. As such, transformational change at smaller scales enables resilience at larger scales and the capacity to transform at smaller scales draws on resilience from multiple scales whilst making use of crises as windows of opportunity for novelty and innovation, and recombining sources of experience and knowledge to navigate social–ecological transitions (Folke et al., 2010). The transformation can either be deliberate or forced; both of these transformations are occurring in Karamoja. Due to the number of pastoral drop-outs arising from livestock raids that pitched in the sub-region in the early 2000s and the subsequent disarmament that curtailed the ability to reconstitute herds through raids, adoption of crop cultivation increased tremendously in the region over the last decade (Egeru et al., 2014b). The pastoral drop-outs became an easy target for crop production promotional efforts; while on one hand it was a deliberate transformation, on the other hand it was a forced transformation arising from the provided option.

Another transformation occurring in Karamoja is that propagated through the FAO agro-pastoral farmer field schools (APFS) in various districts within the sub-region. In these APFS, participants are taught how to tend to gardens, prepare tree seed beds, raise nurseries, manage bee hives, kitchen gardening and tree market orientation. In addition, as the traditional institutions are weakening, communities are realising the need to have coordination and action towards environmental management and conservation for posterity thus, community based organisations and non-governmental organisations are being formed to champion such interests. For example, four organisations have been formed at community level with a focus on ethnoveterinary application. These include: Bokora Traditional Livestock Healers Association (BTLHA), Pian Traditional Livestock Healers Association (PTLHA), Karamoja Ethnoveterinary Information Network (KEVIN) and Karamoja Christian Ethnoveterinary Programme (KACHEP); this represents a transformation process in the resilience building process with trees having a central role. Out of these organisations, more than 70 healer communities are involved in conservation of medicinal plants mainly in Pian and Bokora (Grade, 2008).

2.2.2 Role of trees in agricultural production in Karamoja

The role of trees in agricultural production has in one way or the other been highlighted in previous sub-sections particularly relating to the regulating, provisioning and supporting services. Where trees have been maintained in Karamoja they have been reported to minimise degradation (the reduction in productive potential of the resource base for agriculture at landscape level through control of soil erosion and conservation of soil moisture). Although not undertaken within Karamoja, a study in the neighbouring Soroti district showed that *Borassus aethiopum* contributes to the improvement of organic matter and soil moisture, increased growth and grain yield of finger millet (Ajotu, 2013). *Borassus*



aethiopum has been observed in some parts of Karamoja sub-region particularly around Lorengchora in Napak district and between the Labwor ranges and Abim district town in Abim district (Egeru per. Observation). Trees contribute to agricultural production primarily through; provision of a productive and profitable component in the system through supply of forage and herbs, reducing the amount and intensity of processes and events that cause land degradation, and modifying the microclimate.

2.2.3 Traditional knowledge of trees in Karamoja

The Karamojong live with trees on a daily basis, if it is not for human consumption, their livestock will be feeding on, and/or they will be singing and praising their livestock in relation to where they have grazed and what they have grazed on and the anticipated benefits on animal body condition, milk yield and reproductive potential. In addition, they may simply be relaxing under trees or utilising trees to treat water and/or make fire. Such is the intricate relationship between the Karamojong and trees. Owing to this interconnected relationship, the Karamojong have vast traditional ecological knowledge on trees and their uses. This knowledge also extends to the tree growth forms, growth periods (wet vs. dry season), locations, livestock as well as preferences by humans. Grade (2008) undertook an ethnoveterinary study that documented trees of medicinal value in Karamoja. Further, Egeru (2014) has shown extensive detail of the local ecological knowledge of up to 110 browse forage species in Karamoja sub-region.


Other trees and plants of medicinal value in Karamoja sub-region; in addition to the ones listed in the section on the benefits of trees include: *A. spirocarpa* (Etirir) believed to treat abscess, *Acacia* sp. (Ewalongor) for treating goat pox, *Acacia* sp. (Eminit) administered in the event of rinderpest, *Albizia amara* (Ekwakwa) for abscess, and *Albizia anthelminitica* (Ekapangiteng) for treating bloat and cough in livestock (Grade, 2008). In addition to all the acacia species noted above, other browse forage species utilised in Karamoja sub-region include: *Triumfetta anua* (Ekwangayaro), *A. oerfota* (Epet), *Caparis tormentosa* (Erogorogoite), *Leucas martinicensis* (Ekwangpen), *Grewia mollis* (Ekalie), and *Cissus quadrangularis* (Egigith) (Egeru, 2014).

2.3 Threats to trees in Karamoja

Hunger is a common issue when working with local communities in Karamoja. It represents the different experiences and realities of the poverty, desperation and a need that requires immediate, moderate to long-term solutions. At the immediate level, the need to leverage on the natural resources to survive past the biting pangs of hunger is creating a nexus of threats to trees in Karamoja. In general, the threats to trees in Karamoja include but are not limited to:

Expanding charcoal and firewood supply belt eastward from adjacent Teso and Lango sub-regions to Karamoja particularly to the districts of Abim, Napak and Nakapiripirit. Coupled with a destitute situation prevailing in the sub-region, the Karamojong have become easy bait from the profiteering businessmen/women based in the Mbale, Soroti and Lira towns as well as from growing business acumen from within the region. A bag of charcoal is purchased from the Karamoja at approximately UGX 15,000 (USD 6) and is retailed in Mbale or Kampala at approximately UGX 50,000 (USD 20). Therefore, the on-slot on trees in the region is fast, indiscriminate and competitive despite the presence of rules banning the production of charcoal.

Indiscriminate expansion of croplands in the sub-region with horizontal incremental land production rather than increased production per unit area is causing rapid disappearance of considerable tree cover in Karamoja (Egeru et al., 2014a). In the last



decade (2000-2013) croplands in the Karamoja sub-region were found to have increased by tenfold mainly affecting the grasslands and woodlands. Farming as practiced in Karamoja is mainly through slash and burn (IUCN, 2014) which is unsustainable as farmers open new land upon decline on productivity of the current farmlands.

The sub-region is also faced with **unregulated harvesting of trees and tree resources**. In Mt. Moroto and Mt. Kadam for example, there is wide scale unregulated harvesting of Khat/miraa (*Catha edulis*), in addition, there is unsustainable debarking of the *Podocarpus* (podo) trees for both local and commercial purposes. This despite the fact that this tree (Podocarpus) is red listed by IUCN, indicating that the species requires targeted actions to be protected. The *Podocarpus* tree on Mt. Moroto is cut for various purposes including: timber, making beehives, and during land clearance for cultivation (Eilu, 2014).




Slash and burn garden preparation in Lopotuk in Karamoja (IUCN, 2014)

Bushland encroachment is also affecting the existence of trees in Karamoja. The explosion of some tree species such as *A. mellifera*, *A. oerfota* and the current entry of *Prosopis juliflora* will further affect the native tree species in the sub-region. As noted earlier, the increase in bushlands in Karamoja relates to the absence of grazing in those locations which was caused by limited access to such grazing sites as a result of insecurity.

Pests, particularly increased termite activity in the region in the recent past, have been observed. However, overwhelming levels have not yet been reached except where termites have devastated maize and sorghum plants. Historical accounts show that caterpillars attacks have often occurred in Karamoja (Weatherby, 2012) with the most recent caterpillar attack reported in Karita, Losidok, Lokales, Katabok, Loburin, Loro, Achorichor, and Abiliep in Amudat district destroying edible tree leaves and crops (UNDP, 2014).

Breakdown in traditional institutions; the Karamojong traditionally had a strong elders' council and elders' roles were defined in guiding the community. However, the advent of the gun changed the balance of power, the gun dictated who had power and control; as such young men became unruly leading to a shift from the traditional systems (Mirzeler and Young, 2000). Even in the post disarmament period, the elders have never regained their position in the Karamojong society; this has meant that the guidance, rules and caveats that were always placed by the elders in conservation of natural resources are now little respected. It is this divide and weakening of traditional institutions that is making the drive for charcoal burning easily acceptable and exercised among the youthful population. This is also indicative of the a silent increase in individual interests as opposed to the traditional communal interests that guided the pastoral way of life in the sub-region.



Low survival of planted trees; tree planting initiatives have recorded low survival of trees planted. Part of the problem has been planting tree species, which are not ecologically adapted to the ecology of Karamoja. Low survival rates apply to other tree seedlings of species such as Teak (*Tectona grandis*), *Grevillea robusta*, *Eucalyptus grandis*, and *Markhamia lutea* that have been planted under the auspice of Welthungerhilfe (Lokoru and Ullerich, 2014). Additionally, timing of planting and source of planting materials are other reasons for the low survival. Little attention has been paid to indigenous trees naturally growing in Karamoja and other similar environments, yet some of these are already playing a demonstrated role in supporting livelihoods through provisioning and service functions. An example is *Balanites aegyptiaca* (Desert date), whose fruits and leaves are a reliable source of food for both humans and livestock in Karamoja and neighbouring Teso sub-regions for 4 - 5 months during the dry season (Okia, 2010). Low survival rates also apply to other tree seedlings such as Teak (*Tectona grandis*), *Grevillea robusta*, *Eucalyptus grandis*, and *Markhamia lutea* that have been planted under the auspice of Welthungerhilfe (Lokoru and Ullerich, 2014).

SECTION 3

Tree based initiatives in Karamoja

3.1 Introduction

Tree-based initiatives have been presented as one of the most reliable and sustainable livelihood diversification options for semi-arid regions with meaningful returns to labour and investments (Tougiani et al., 2009; Prasad et al., 2014). This section presents a list of tree-based initiatives and actors in Karamoja sub-region.

3.2 Tree-based initiatives in Karamoja

As pastoralists and agro-pastoralists, the Karamojong have traditionally retained and managed selected trees on their landscape. Tree growing efforts are becoming an important aspect in the Karamoja sub-region as several actors (Table 1) strive to build the community resilience in this sub-region.

Name of Organisation	Beneficiary communities	Tree based	Reference
CARITAS	Kotido district Moroto district Napak district	<ul style="list-style-type: none"> community managed and CARITAS Kotido managed tree nurseries 10000 trees planted (e.g. <i>Acacia Senegal</i>, <i>Azadiracta indica</i> (neem), <i>Tamnalia cattapa</i>, Pondo, Teak, <i>Grevillia</i>, grafted mangoes and citrus) over 500 households supported Planting of fruit trees Planting of trees with timber production potential Supports apiary production for the youth 	Grange (2010) Egeru Anthony (per. Observation)
WFP	Moroto/Napak districts Kotido district	<ul style="list-style-type: none"> Environmental conservation intervention undertaken under the SAFE project awareness campaign on the dangers of environmental degradation 140880 trees planted in Moroto district 10,938 trees planted in Kotido district 1.5 million seedlings gum <i>Arabica</i> were to be distributed by the end of 2012 in Karamoja sub-region support to schools for raise 	Bizzarri and Barbelet (2011)



Name of Organisation	Beneficiary communities	Tree based	Reference
		kitchen gardens and tree planting in Kotido, Nakapiripirit and Kaabong districts	
FAO	Nakapiripirit/Moroto/Napak/Kotido/Kaabong districts	<ul style="list-style-type: none"> community managed tree nurseries Apiary production all activities largely managed through agro-pastoral farmer field schools (APFS) 	Okoth et al. (2013)
Dan Church Aid	Amudat, Moroto, Nakapiripirit, Napak districts	<ul style="list-style-type: none"> fruit tree cultivation school based tree action planning community wide natural resource management sensitisation 	Korugyendo and Akureje (2012)
Nabuin ZARDI	Nakapiripirit district	<ul style="list-style-type: none"> Government of Uganda zonal research institute focusing on semi-arid research field demonstrations for various fruit, and fodder trees 	Egeru Anthony (per. Observations)
MADEFO	Nakapiripirit district and Moroto district	<ul style="list-style-type: none"> Focus on land degradation awareness campaigns advocates and supports adoption of live fences promotes tree planting through food for work scheme 	Grange (2010)
GTZ	Napak, Moroto districts	<ul style="list-style-type: none"> Irrigated agriculture in Nakicumet fruit trees trees of commercial value pond fisheries 	Egeru Anthony (per. Observations)
SVI	Napak, Moroto, Nakapiripirit districts	<ul style="list-style-type: none"> supported documentation of Kadam and Napak forest values and threat analysis supported capacity building in fruits, honey, vegetables, medicinal herbs, glue and gum arabica skills development established training and demonstration facilities in Namalu in Nakapiripirit and Iriir in Napak district supports environmental conservation efforts in Moroto and Nakapiripirit districts 	http://www.kampala.cooperazione.esteri.it/utlkampala/EN/partner/ONG/svi.html
ADRA	Lorenchora in Napak district	<ul style="list-style-type: none"> Training farmers on tree planting and nursery bed management for environmental awareness and protection 	ADRA Newsletter, 2011
BTLHA, PTLHA, KEVIN and KACHEP	Napak/Moroto/Nakapiripirit districts among the Pian and Bokora communities	<ul style="list-style-type: none"> focus on enthanoveterinary conservation of trees strengthened domestication and conservation medicinal 	Grade (2008)



Name of Organisation	Beneficiary communities	Tree based	Reference
Welthungerhilfe	Nakapiripirit, Moroto districts	plants <ul style="list-style-type: none"> • tree seedling nursery preparation • planting of teak, Grevillia robusta, eucalyptus, neem, cassia 	Lokoru and Ullerich (2014)
Several community based organisations (CBOs) in the region including among others: Omina's Damon Tree Planting Group (Moroto district), Namukur Women's Group- Nacheele (Kaabong district), Lokopo Women's Development Group and Lotome Women Empowerment Group (Napak district), Looborio Tree Nursery (Nakapiripirit district)		<ul style="list-style-type: none"> • tree planting • cereal banking • environmental conservation in general 	Indigenous information Network http://indigenous-info-kenya.net/wp-content/uploads/2011

Table 1 List of tree-based initiatives and actors in Karamoja sub-region



SECTION 4

Options for research and action in Karamoja

4.1 Opportunities for research

This review focused on identifying evidence relating to trees and livelihoods in Karamoja sub-region, Uganda. In light of the complex development terrain, the problems and potential opportunities facing the sub-region, the role of trees in the livelihood of the communities, and the range of actors involved in food security and resilience building in Karamoja, the following are worthy noting as potential thematic research areas:

Agricultural risks analysis

While the risks faced by farmers and pastoralists in Karamoja are perceivably known; it is vital to understand the nature of these risks at the local level. This is particularly important for the case of Karamoja so as to avoid the risk of initiating tree-based interventions that will have a similar orientation that is too focused on ‘technical’ targets, defined in abstract terms with little connection to the production systems and the societies of producers in Karamoja. In undertaking this analysis, farm-level risks and constraints, supply chain risks, and agricultural risk management as exercised in the region and how they may impact tree growing need to be critically explored.


Tree-crop interactions studies

Since there is increased crop cultivation in the sub-region, there is need to undertake long-term analysis of benefits relating to retaining/planting and managing trees on farms to rehabilitate land, control soil erosion, conserve soil moisture and manage watersheds/catchments. The focus should be to understand what trade-offs have to be made against the impact of tree competition with subsistence crops (which provide immediate benefits to the community and is the focus of many actors since it offers immediate success stories yet it does not provide a long-term success storyline), potential commercial crops, and the potential of tree-based systems to increase livestock productivity in Karamoja. The underlying assumption will be that the incentive to adopt tree-based systems would be higher if tree competition can be offset by economic returns gained from the tree products and by the beneficial effects which trees confer on crop yields, livestock and resource sustainability.

Reconciling the hydro-ecological differentials on tree introductions in Karamoja; the thinking behind this is that trees will co-exist with crops and livestock, it therefore becomes imperative to analyse the implications of the potential increase of water use on the medium and longer-term water budgets. This research would then address issues pertaining to the source of water used by trees, the rate of water depletion below the crop rooting zone and the prospects for deep recharge within the Karamoja agro-ecologies. Seeking to understand this dimension of facts will help provide direction to the adoption of tree-based options.

Developing a framework for trees-food security-ecosystems and community resilience

During the review process it was observed that there was a lack of integrated framework for analysing the beneficial effects of trees at community level. It is therefore suggested that a framework of methodological innovations in collaborative actions to integrate tree-based



options in wider community development interventions and linkage to policy processes is developed as a tool kit for dryland farming systems.

Utilising nutrient and fertility islands in Karamoja

The practice of moving livestock between different grazing lands according to seasons with resting grounds at the central kraals for protection and maintenance of a milking herd at the homesteads (manyattas) creates localised nutrient rich deposits which become islands of fertility. There is no information regarding the productive potential of these fertility islands and gradients. Most of the fertility islands are abandoned when homesteads are moved; how these nutrients can either be directly utilised and/or recovered to support farming needs to be studied. Further, how these fertility islands influence the agro-ecology of the areas also needs to be investigated.

Evidencing indigenous tree management systems

It is evident that a mixed form of agroforestry is exercised in the Karamoja sub-region; first, there is the use of the traditional agroforestry practices through managing scattered trees deliberately left in the gardens and/or near homesteads, secondly through conserving the multi-purpose wild trees in rangeland locations in Karamoja, and thirdly through adopting new tree introductions into the sub-region. There is limited information available on the traditional indigenous agroforestry systems and practices available in Karamoja that could perhaps be adopted and utilised as an effective entry for catalysing appropriate agroforestry practices. Further, in the review of different projects implemented, there was emphasis on exotic fruit tree varieties but there is no justification as to whether these varieties were adapted to ecological conditions of Karamoja sub-region. There are no indications as to why there is limited preference for locally adapted dryland trees; these issues are worthy an investigation.

Eco-hydrologic connectivity and complexities


In the foregoing review, it was observed that Karamoja is experiencing a series of complex changes including rapid agriculturalisation with reductions in grasslands, changes in fire regimes, woody encroachment, deforestation, soil erosion, and creation of multiple dam structures among others. These changes are slowly but gradually transforming the ecosystem processes in the semi-arid area. In this particular theme focus could be geared towards understanding how the transformative landscape change occurring in the region is impacting on evapotranspiration and catchment discharge, analyse of how exogenous forces are weakening/have weakened the stabilising feedbacks and how such state changes can be reversed, seek to explain the self-organising water-limited ecohydrological systems in Karamoja, and explain the ecohydrological connectivity existing in Karamoja so as to better understand and predict how landscapes and ecosystems in Karamoja respond to environmental change among others.

Tree-based systems characterisation and suitability analysis

Considering that different forms of tree-based systems are identifiable in Karamoja; there is need to identify, classify and characterise the tree based systems in the sub-region. Thereafter, determine the areas where the most promising tree-based systems can be introduced. Further, there is need to undertake projections of how these areas are likely to change in the medium and longer terms.

Viability of conservation agriculture with trees in Karamoja

Conservation agriculture with trees has been demonstrated to be effective in tripling cereal yields in semi-arid areas of Southern Africa. It is therefore important to determine the viable of such a low cost option in agro-pastoral zone of Karamoja. In addition, most of these are nitrogen fixing (fertilizer) trees which are already common in Karamoja (e.g. *Faidherbia albida*). The study will also explore how some of these trees can be part of valuable livestock



feed particularly for the milking herds. Earlier reports urged USAID/Food for Peace implementers in Karamoja to join ICRAF's efforts in re-greening/conservation agriculture.

Options for enhancing tree survival and reducing termite damage

Research into the use of hydrogels to enhance tree survival and establishment in semi-arid environment should be pursued. In addition, effectiveness of indigenous and other methods for controlling termite damage on planted trees deserve to be explored and integrated into on-going tree planting initiatives. The Forestry Resources Research Institute (NaFORRI) in Uganda is already in advanced stages in refining these technologies.

4.2 Options for Action

Capacity and institutional building for collaborative Community-Based Forestry Management

Given the rich traditional ecological knowledge of the trees and tree systems in Karamoja, it is imperative for DFID/ICRAF to support capacity building initiatives to enhance and institutionalise community based management of forest reserves and parkland trees in the region through supporting management transfer and user rights of common property resources to the communities. The elders who are slowly regaining their authority following disarmament need to be supported to play a leading role in this regard.

Support innovative financing for tree growing and conservation

In seeking to meet their basic needs, communities in Karamoja rely on the extractive benefits of trees that are often destructive to tree existence in the sub-region. In order to shift from this front, it is suggested that development actors in Karamoja should explore the establishment of community environment fund as a tool to catalyse social, economic and ecological resilience in the sub-region. This innovative financing can be an extension of the current village and savings loan's associations (VSLAs) which have some operational existence in region. Learning experiences can be shared with the IUCN experiences from a similar arrangement in Lango sub-region Uganda.

Rehabilitation of degraded rangelands and woodlands


The review observed that the region is faced with multiple forms of degradation. It is recommended immediate focus be undertaken to rehabilitate degraded areas using enclosures. An alternative approach is the use of Farmer Managed Natural Regeneration (FMNR). Pastoralists have traditionally used enclosure management for considerable periods of time based on landscape heterogeneity approach. Revitalising this management approach will help to reduce degradation. This is because there are success stories coming from parts of Tanzania and Ethiopia's Tigray region in using a similar approach. ICRAF and World Vision are already piloting FMNR in Nakapelmoru sub-county.

Promote sustainable harvesting, processing and marketing of indigenous tree products

The review revealed that Karamoja has a wide range of valuable trees (e.g. Acacias, desert date, sandalwood, shea butter, tamarind, Borassus palm, and marula) but these are under-utilised. Yet others are unsustainably harvested (e.g. Khat). It is therefore recommended sustainable harvesting, production and utilisation of these trees is championed. Further, it will be essential to create meaningful value chains for sustainably integrating these trees and attendant products as part of the valuable economic foothold in the livelihood systems in the region.

Support integrated household tree-based production systems

It was observed that the Karamojong generally are not used to growing and planting trees but at the same time, there is a growing and valuable honey production in the sub-region. It



is therefore recommended that an integrated household tree based production system is championed in which trees with near term economic value including among others *Jatropha curcas* and Casta oil trees as well as bee keeping can be initialised for early production action while integrating trees with longer term maturity periods but with sustainable economic value such as dryland orchards of mangoes and *Acacia senegal*, *Acacia seyal* for gums and resins.

Improved fruit orchards

Establishment of improved fruit orchards for mangoes, oranges and other suitable fruits should be explored. This has potential to contribute towards nutrition and income security, especially in the semi-humid areas of Karamoja.

Innovative learning platforms

It is evident from the review that there is scarcity in success stories of how trees have contributed to livelihoods and livelihood transformation in Karamoja. It is recommended that development actors in Karamoja explore and prioritise supporting innovation learning platforms for pastoralists and agro-pastoralists in the sub-region. This could be executed through the operationalisation of community to community exchanges with farmers and pastoral communities within East Africa where such successes stories can be bench marked. This learning approach will also be part and partial of learning for change, which can open up and build networks for sustainability.

Support fertilizer trees for soil and water management

Karamoja is noted as exercising both pastoral and agro-pastoral production systems. As such water, soil and forage are important production resources in the region. It is recommended that DFID and ICRAF support the process of evaluating fertilizer trees utilisation in soil and water management as well as explore how some of the same trees can be part of valuable livestock feed particularly for the milking herds. Earlier reports showed that Mercy Corps urged USAID/Food for Peace Implementers in the region to join ICRAF's efforts in re-greening/conservation agriculture and further build the capacity of the technical staff to this effect. In doing this, focal farmers need to be identified, targeted and supported to test, adapt and take to scale the locally appropriate agro-forestry re-greening and conservation agriculture practices.

Selected Annotated Bibliography

Reference	Type literature and research type	Summary
Anderson, I. M and Robinson, W.I. (2009). Uganda. 10 th EDF Karamoja Livelihoods Programme (KALIP). Technical Reference guide. Kampala, Uganda	Grey literature from a systematic review	This technical guide is a document providing a framework for the implementation of Karamoja Livelihoods Programme (KALIP) considering the signed financing agreement between the Government of Uganda and the European Commission. The document is intended as a Reference Guide to the Project Management Unit (PMU) and implementation team in establishing the interventions to be considered in the field and to facilitate the detailing of the annual and overall work plans for KALIP.
Ayoo, S., Opio, R., & Kakisa, O.L. (2013). Karamoja situational analysis. CARE International in Uganda, Kampala Uganda.	Grey literature from a systematic review	This supplementary situation analysis report documents socio-economic and conflict dynamics and how it has impacted the vulnerable groups especially women and girls in the Karamoja sub-region. The review was commissioned by CARE International in Uganda.
Browne, S and Glaeser, L. (2010). Karamoja region food security assessment: Uganda. A special report by FEWS NET	Grey literature from primary and empirical interviews	This assessment report focused on the evolution and status of food insecurity in Karamoja, through the collection and analysis of information on coping strategies, local capacity to withstand shocks, and the use and importance of external assistance, especially food aid. The assessment sought to answer two primary questions; (i) how are people sustaining themselves in the face of consecutive shocks? and ii) how significant is relief assistance, particularly food aid, in supporting people's livelihoods? The report was prepared by the Famine Early Warning System Network (FEWS NET).
Chow, J.T. (2010). Karamoja Productive Asset Program (KPAP). Small Earth Dam Technical Assessment Report. ACF International, Kampala Uganda	Grey literature based on a primary and empirical analysis	This report presents the outcome of a technical evaluation of small earth dams in Karamoja Productive Assets Programme (KPAP) was conducted in 2010. It notes that very few dams were built with much forethought to the fundamental technical and siting criteria essential for a properly functioning earth dam.
Institute for International Cooperation and Development, C&D. (2010). Livestock disease surveillance in Karamoja. The importance of early detection of diseases and epidemics for livestock dependent communities. Kampala, Uganda	Grey literature from secondary research, theoretical and conceptual, primary and empirical	This report documents several experiences of actors involved in livestock disease surveillance in Karamoja in close collaboration with Institute for International Co-operation and Development (C&D). C & D is a non-profit organisation operating in Karamoja since 1979.
Knighton, B. (2003). The State as Raider among the	Academic coming from	This paper provides an analytical perspective new world order. It



Reference	Type literature and research type	Summary
Karamojong: 'Where there are no Guns, they use the Threat of Guns'. <i>Africa</i> , 73(03), 427-455.	analytical research, primary interviews and observations	specifically expositions the atrocities committed during the disarmament exercise and illustrates some of the challenges arising from expected instant shift from one cultural dispensation to another that is less understood and appreciated.
Egadu, S. P., Mucunguzi, P., & Obua, J. (2007). The population of Acacia tree species producing gum arabica in the Karamoja region, Uganda. <i>African Journal of Ecology</i> , 45(3), 236-241.	Academic Arising from primary and empirical data collection and analysis	This study provides and understanding of the population status of the different Acacia tree species producing gum arabica in the undisturbed, grazed and cultivated habitats in the Karamoja region, Uganda. The study observed the existence of poor regeneration rates of acacia species in the region.
Egeru, A., Wasonga, O., Kyagulanyi, J., Majaliwa, M.G.J., MacOpiyo, L., and Mburu, J., (2014a). Spatio-temporal dynamics of forage and land cover changes in Karamoja sub-region, Uganda. <i>Pastoralism: Research, Policy and Practice Journal</i> , 2014, 4:6.	Academic based on primary and empirical analysis	This study presents spatio-temporal dynamics of pastoral grazing resources in Karamoja. It identified herbaceous and woody forage species in different grazing land cover types, quantified forage in different grazing land covers, analysed long-term land use/cover change (from 1986 to 2013) and determined the relationship between Normalized Difference Vegetation Index (NDVI) and herbaceous biomass.
Egeru, A., Osaliya, R., MacOpiyo, L., Mburu, J., Wasonga, O., Barasa, B., Said, M., Aleper, D., and Majaliwa, MGJ. (2014b). Assessing the spatio-temporal climate variability in semi-Arid Karamoja sub-region in north eastern Uganda. <i>International Journal of Environmental Studies</i> , 71(4), 490-509.	Academic based on primary and empirical analysis	This study analyses climate variability in Karamoja and finds that Rainfall exhibited a non-significant long-term trend. The climate of the area is variable (coefficient of variation-CV >35.0%) with spatio-temporal oddities in rainfall and temperature. A rise in minimum (0.9 °C), maximum (1.6 °C) and mean (1.3 °C) temperature occurred between 1979 and 2009.
Flintan, F. (2013). Summary brief: Opportunities to promote integrated planning in the drylands of Kenya, Ethiopia and Uganda. REGLAP, Nairobi Kenya	Grey literature based on systematic review	This article is an edited extract of the report ' <i>Plotting Progress: Integrated Planning in the Drylands of Kenya, Ethiopia and Uganda</i> ', which responds to the many issues and challenges of integrated development planning. The extensive report draws together and reviews current and recent experience in planning processes in the drylands of Ethiopia, Kenya and Uganda
Salonen, R. (2012). The light of the future. <i>Godparents News</i> . Vol. 14. No.9.	Grey literature based on experiential learning	This article presents experiences of socio-cultural and political dynamics in Karamoja. It addresses issues relating to social/ethnic exclusion, popular democracy, and participation challenges in Karamoja sub-region.
Grade, J., Tabuti, J., & Van Damme, P. (2010) The IK Bridge to Innovation through Endogenous Development. http://www.tropicallab.ugent.be/jeanpos2.pdf	Grey literature from primary and empirical research	This study uses participatory methods to document EVK, and to create local infrastructure to endogenously develop ways to preserve, promote and protect local EVK. The study provided information that was essential in increasing sharing, conservation and protection of natural resources, particularly medicinal plants; and to increase interest in EVK among both the Karamojong and external parties.



Reference	Type literature and research type	Summary
Houdet J., Muloopa H., Ochieng C., Kutegeka S. and Nakangu B. (2014). Cost Benefit Analysis of the Mining Sector in Karamoja, Uganda. Kampala, Uganda: IUCN Uganda Country Office	Grey literature from primary and empirical analysis	This study conducted an economic, social and environmental cost-benefit analysis (CBA) of Large Scale Mining and Artisanal and Small-scale Mining in the region, with a view to help inform policy makers, civil society, mining companies, and development agencies on best bet policy, legal, regulatory, investment and environmental frameworks for responsible and equitable mining
IUCN. (2014). A rangeland's management framework for Karamoja, 2014-2018: A handbook for local governments and partners. IUCN, Kampala Uganda	Grey literature from primary assessment and analysis	This hand book presents a rangelands management framework for Karamoja for the period 2014-2018 under the initiative of IUCN. The provides an explanation of threats to the rangeland health in Karamoja and the operationalisation framework for rangeland management.
Kagan, S., Pedersen, L., Ollech, S., & Knaute, D. (2009, February). The Karamoja Syndrome: Transdisciplinary systems research informing policy and advocacy. In 1st World Conference of Humanitarian Studies, Groningen.	Grey literature, theoretical and conceptual	This study presents a systematic, transdisciplinary diagnosis of the contemporary development situation among the pastoralist communities of Karamoja. The study uncovers local and global structures of unsustainable developments, identifying functional patterns (or clinical pictures) of interaction between humans and nature. It further draws together different perspectives from ecological, demographic, economic, political, cultural, technological gender and other perspectives.
Kagunyu, A. W., & Wanjohi, J. (2014). Camel rearing replacing cattle production among the Borana community in Isiolo County of Northern Kenya, as climate variability bites. Pastoralism, 4(1), 1-5.	Academic from primary and empirical analysis	This study focused at understanding whether a pastoral community of the Borana community would let go their cattle culture and embrace camel production. The study finds that the Borana have changed their preference from cattle to camel rearing. The study identified the constraints in camel production in the region to include: diseases, raiding and competition from other livestock. There is need to employ animal health workers to bail out the pastoralists from threats of livestock diseases, and to promote peace in the region.
Kratli, S. (2001). Educating nomadic herders out of poverty? Culture, education and pastoral livelihood in Turkana and Karamoja. Institute of Development Studies, University of Sussex, UK.	Grey literature based on primary and empirical analysis	This study focused on understanding the relationship between culture and poverty, and particularly how attention to aspects of culture can help reduce poverty and improve the well-being of the poor. The study identifies three major issues to include: (i) Mainstream society in Kenya and Uganda represents pastoralism as a fundamentally flawed way of life; (ii) There is a wide gap between pastoral livelihood and its representation within the culture of mainstream society; and (iii) The general cultural attitude towards pastoralism, based on this misrepresentation, plays a silent but pervasive role in undermining pastoral livelihood by reproducing wrong policies, pre-empting service provision, turning positive programmes into useless or negative outcomes and preventing



Reference	Type literature and research type	Summary
<p>Ferreri, J., Frei, B., Ross, B., & Stoker, C. (2011). Pastoralists, peace and livelihoods: Economic interventions to build peace in Karamoja, Uganda. The Elliot School of International Affairs, pp. 61.</p>	<p>Grey literature based on systematic review</p>	<p>communication and good circulation of knowledge. This report reports on pastoralists, peace and livelihoods based on the economic interventions to build peace in Karamoja undertaken by Mercy Corps. It recommends that Mercy Corps programming in Karamoja be based in four key development areas: village and community-level investments, value-chain development, natural resource management and development, and local capacity building. Specific interventions within these areas are identified, and are based on the theory of change that links economic security with broader issues of security and peace.</p>
<p>Mirzeler, M., and Young, C. (2000). Pastoral politics in the northeast periphery in Uganda: AK-47 as a change agent. The Journal of Modern African Studies 38, 3: 407-429.</p>	<p>Academic based on analytical discourse</p>	<p>This study presents a discourse on the effects of firearms on the relationship between the state and pastoral communities in contemporary northeast Uganda. It argues that the transformation of local modes of conflict by large-scale infusion of the AK-47 has had far-reaching effects both on relationships with the Ugandan state and its local representatives, and within Karamoja societies. The younger men who possess these weapons elude the authority of the elders, and entertain ambiguous relations with the state authorities, whom they may serve as auxiliaries or resist.</p>
<p>Gachathi, F. (2014). The promise of drylands. Miti, Issue No. 22, pp8-11</p>	<p>Grey literature based on primary evidence, and analytical discourse</p>	<p>This study focuses on the promise existing in the drylands based on the potential of plant resources in Karamoja to generate wealth and uplift the people's living standards. It provides the usefulness on several plant tree species existing in the sub-region.</p>
<p>Eilu, G. (2014). The forgotten mountains of Uganda. Miti, Issue No. 22, pp14-16</p>	<p>Grey literature based on primary evidence, and analytical discourse</p>	<p>This study potential of two mountain ranges (Mt. Moroto and Mt. Kadam) in Karamoja to realise economic benefits. It also identifies the range of challenges existing on the extractive nature and utilisation of resources on these mountains.</p>
<p>Lokoru, A. and Ullerich, D. (2014). Planting trees in the 'land of thorns'. Miti, Issue No. 22, pp21-23.</p>	<p>Grey literature based on primary evidence, and experiential learning</p>	<p>This article presents experiences of an NGO in establishing tree plantations in central Karamoja.</p>
<p>Ng. J. (2012). The pastoralist as outlaw: exclusion and violence in Karamoja, Uganda. pp. 54</p>	<p>Academic, thesis based on an analytical discourse</p>	<p>This study explores the discourse of Karamoja, a historically marginal and conflict affected pastoralist region in Uganda, from a critical theoretical framework. It draws on Hayden White's critique of historical discourse that deconstructs tropic devices and Giorgio, gamben's paradigm of the state of exception as theoretical tools for its own critique of narratives depicting the problems in Karamoja.</p>




Reference	Type literature and research type	Summary
Obua, J., Agea, J. G., Namirembe, S., Egadu, S. P., & Mucunguzi, P. (2006). The potential of <i>Acacia senegal</i> for dryland agroforestry and gum Arabic production in Uganda. <i>Journal of the Drylands</i> , 1(2), 186-193.	Academic based on primary and empirical analysis	This study provides an account of studies undertaken to determine the agroforestry and gum arabic production potential of <i>Acacia senegal</i> in the drylands of Luwero, Nakasongola and Karamoja districts of Uganda. It shows that the density of <i>A. senegal</i> varied in Karamoja and was highest in Jie county.
Okia, C.A., Opolot, V.I., Sekatuba, J., Katumba, B.M., & Esegu, J.F. (2008). Use and conservation of indigenous fruit tree diversity for improved livelihoods in Eastern Africa. National Forestry Resources Research Institute (NaFORRI), Kampala, Uganda.	Grey literature based on primary and empirical analysis	This report presents the experience and results of the project "Use and Conservation of Indigenous Tree Diversity for Improved Livelihoods in Eastern Africa" that was aimed at improving livelihoods and increase incomes of rural farmers through growing, processing and marketing products from indigenous fruit trees.
Umana-Aponte, M. (2011). Long-term effects of a nutritional shock: the 1980 famine of Karamoja, Uganda. Center for Market and Public Organisation. Working Paper No. 11/258	Grey literature based on primary and empirical analysis	This paper uses the 1980 famine in Karamoja, Uganda, as a natural experiment to evaluate its possible long-lasting cognitive and health effects. Results indicate a strong negative impact on the educational attainment of adults exposed to the famine in utero or infancy.



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