WATER AND RANGELAND IN KARAMOJA

Trends, preferences, and status of indigenous and introduced resources and systems

August 2023

Anthony Egeru, Raphael Lotira Arasio, Simon Peter Longoli

Karamoja Resilience Support Unit (KRSU)

Feinstein International Center, Friedman School of Nutrition Science and Policy, Tufts University

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Feinstein International Center, Friedman School of Nutrition Science and Policy at Tufts University
PO Box 6934
Kampala
Uganda
Tel: +256 (0)41 4 691251

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ACRONYMS AND ABBREVIATIONS

DOG	duration of greenness
EGT	end of greenness
FAO	Food and Agriculture Organization of the United Nations
FGD	focus group discussion
GDP	gross domestic product
IGAD	Intergovernmental Authority on Development
KRSU	Karamoja Resilience Support Unit
NDVI	normalized difference vegetation index
NGO	nongovernmental organization
OGT	onset of greenness
UPDF	Uganda People's Defence Force

EXECUTIVE SUMMARY

Water and rangeland resources are the basis for livestock production in pastoralist areas of Africa and therefore have major impacts on pastoral livelihoods. Households with insufficient access to water or productive rangeland experience suboptimal herd growth and production, with associated negative impacts on the income and nutritious foods that livestock provide.

In common with other African pastoralist and agropastoralist areas, Karamoja has experienced various water and rangeland development projects over many years. This review was designed to take stock of experiences with these projects and the extent to which new or introduced facilities or systems take account of indigenous knowledge and preferences, and local institutions. Specifically, the review aimed to:

- Collect and document information on the traditional and newly introduced forms of water and grazing resources management in Karamoja, covering representative livelihoods and ethnic groups;
- Assess the functionality of traditional and newly introduced institutions, structures, and practices for managing pastoral water and grazing resources;
- Assess the extent to which the indigenous and the newly introduced water and grazing resources management systems are integrated;
- Provide recommendations on how sustainable grazing and water resources management can be achieved, drawing evidence from within the region as well as more broadly in East Africa.

The review was qualitative in nature but was supported by long-term analysis of rainfall and vegetation data. Qualitative methods included 28 focus group discussions (FGDs) with 490 participants, 17 key informant interviews, and participatory scoring methods. The review covered 20 villages in Amudat, Kotido, Moroto, and Napak Districts.

GENERAL FINDINGS AND CONCLUSIONS

The general findings from the review are:

- There is still a substantial and unmet demand for reliable, well-sited, and safe water facilities in the four districts of Karamoja visited by the review team;
- The overarching challenge with water development is that although new water facilities are localized in terms of being physically present at community level, they are not well localized in terms of community or joint ownership, or community or comanagement;
- Despite the existence of well-established traditional management systems and rules in place for indigenous water resources, these are not being transferred to introduced water facilities because communities do not have a full sense of ownership or responsibility for these facilities. The net result is the limited functionality of introduced water resources and limited community commitment or capacity to maintain these resources;
- Water development has focused on “hard inputs” such as construction, with less emphasis on “soft inputs” and meaningful participatory processes to ensure community involvement in planning, establishment, and building local capacity for maintenance;
- There is a general preference for water facilities that supply water all year round. Further, a key priority for agropastoral and pastoralist communities is to secure access to rangeland and water during the dry season and droughts. Within this continuum, three important challenges are evident:
  - Access to substantial areas of good quality rangeland is restricted by insecurity; these resources become unused while accessible areas become overgrazed. Conflict management is critical for maximizing the use of the rangelands that are currently available but not accessible.
  - There are several dry season rangeland areas with high potential to provide grazing resources, but these are underused because of limited water availability; in terms of the siting of new facilities to support efficient rangeland access, water development projects are not well aligned with pastoralist’s priorities.
  - Grazing resources over the region are variable but are generally better in the southwestern and western plains of Karamoja. However, there is an overall trend of declining forage resources and declining access to grasslands over the sub-region traceable from around 2017; this is evident from remote sensing data

(Figure 4.3) and is corroborated by indigenous knowledge (e.g., Figure 4.7). The drivers of this trend are declining rainfall, increased and unregulated settlement and farming, and conflict. At the time of the review, access to productive rangeland was further hindered by disarmament strategies that include the forced containment of livestock near military barracks, cessation of livestock mobility, and localized land degradation. Participants in the FGDs had noted that when similar strategies were used in the previous disarmament program, from 2000 to 2009, outcomes included substantial livestock mortality, with associated impacts on human livelihoods and nutrition.

SPECIFIC FINDINGS AND CONCLUSIONS

- Communities have detailed and accurate indigenous knowledge on local water and grazing resources. They describe the temporal and spatial use of these resources, enumerate them, and explain the pros and cons of each type of water resource. The human health benefits of clean water are well known locally. Drawing on their own systems and practices, local people are also very familiar with important concepts such as ownership, management, and payment in relation to water and rangeland resources; in some locations, people contribute to the cost of borehole maintenance. Despite this, there is limited community involvement in selecting appropriate types of water facilities, and the design, siting, and management of new water facilities. Water development is mainly a "top-down" process.
- Although commonalities exist across communities and areas in terms of preferences for introduced water facilities, there is also considerable variation in the use and access of different indigenous resources. This relates to variations in local geography and topography, and the physical presence of some natural water resources in some areas and not others.
- Traditional systems of managing water and rangeland are well established. In the case of water, specific traditional resources can be owned by a community or household, and ownership carries the responsibility for management. The implication for newly introduced facilities is that if communities feel no sense of ownership, they also feel no responsibility for maintenance.
- Community preferences for specific types of introduced water facilities are partly guided by the extent to which a facility is seen to be working. Overall, many water facilities that were intended to supply water during the dry season or drought have limited functionality, e.g., due to management challenges, especially linked to the need for desilting. To illustrate the functionality issue, boreholes were the most common type of water facility introduced in Lokopo sub-county (Napak District), Rikitae sub-county (Kotido District), and Katabok sub-county (Amudat District) (Tables 3.2 to 3.4), but only 15/35, 6/25, and 4/27 boreholes respectively were rated as fully functional at the time of the assessment.
- Communities describe in detail the pros and cons of different introduced water facilities. For example, boreholes are praised for providing safe water and reducing water-borne diseases but are faulted for high maintenance costs, high user fees, and poor management. High maintenance costs and unavailable local skills for repair are associated mainly with boreholes fitted with solar pumps and windmills, and these boreholes provide water only when there is enough sunshine and wind respectively. Despite these issues, there is a strong preference for solar-powered boreholes, especially among women. This is explained by the relatively high functionality of these boreholes and, when fitted with taps, easy extraction of the water.
- Similarly, the benefits of surface water facilities such as valley tanks and earth dams are well recognized locally, but these facilities are prone to siltation and water contamination, and are associated with high desilting costs. Communities are also aware of major problems with the technical design and construction of some water facilities, such as insufficient holding capacity and poor engineering.
- A general model for water and rangeland development has included the introduction of local committees. However, these groups seem only to work effectively when they are strongly but informally reinforced by traditional systems. Despite this, formal integration of indigenous and conventional management systems is negligible, and people are not being empowered to actively engage in management structures and processes.
- Integration has generally been minimal, and there is no clear, deliberate effort between the

developers of conventional water and grazing resources to tap into the indigenous knowledge systems. Most of the observed integrations that have happened appear coincidental in nature.
- Where apparent success in integration has been registered in water resources management, especially in the case of the larger dams, the motives of noncommunity actors have centered on avoidance of conflict and using community members to manage potential escalation of conflict.

RECOMMENDATIONS

This review was conducted at a time when some international aid donors are moving towards localization strategies and when localization is increasingly seen as an essential aspect of climate adaptation. The review recommendations assume that a localization framing has potential to radically shift the current top-down approaches to water and rangeland development in Karamoja towards community-level leadership, ownership, resource control, and management. In practice, this means developing partnerships between technical experts and communities, and co-assessing and co-designing water and rangeland plans and activities. It also means agreeing on long-term roles and responsibilities in terms of the maintenance and management of new facilities or systems. These processes require a mix of indigenous and technical knowledge, as well as hybrid management approaches that combine traditional institutional experience with "formal" approaches. Therefore, the following recommendations are proposed:

- Support forums and dialogue to reach a common understanding among stakeholders of localization principles, and how these principles apply to water and rangeland development in Karamoja while giving opportunity and enabling full participation of communities in the entire process.
- Develop guidelines and tools to enable practitioners to work closely with communities at all stages of a typical project cycle—initial assessment/design/implementation/monitoring/evaluation—and develop indicators and methods to measure localization at each stage. Additionally, draw on experiences with effective localized approaches to land and water planning from other dryland areas of East Africa when developing these guidelines, as well as experiences with participatory methods for the joint analysis of water and range issues.
- Build the capacity of stakeholders in communities, local and international nongovernmental organizations (NGOs), and local government to use these guidelines and tools; support their coordinated use across areas and programs.
- Support flexible programming that enables variations according to local contexts, community priorities, and long-term commitments.

The review highlights the impacts of insecurity on rangeland access in Karamoja and recommends further efforts to build peace in Karamoja to make best use of rangeland that is currently unused. The review recognizes that the recommendations above will be difficult to apply if insecurity persists, because they require prolonged engagement with communities. Integrated approaches to rangeland management are potentially valuable but will be severely constrained by current disarmament strategies that forcibly limit livestock mobility. It follows that an important role for aid organizations is liaison with government actors to enable communities to regain control over livestock management and movement, and thereby limit excessive loss of livestock.

1. INTRODUCTION

1.1. BACKGROUND AND CONTEXT

Livestock are an important aspect of Uganda's national economy and comprises about 3.2% of national gross domestic product (GDP).[1] While this seems a relatively minor contribution, nationally it exceeds the GDP contributions from cash crops or fishing. Furthermore, in certain areas of Uganda, livestock production dominates local economies. As a predominantly agropastoral and pastoral area, Karamoja is a major producer of livestock in Uganda and has been a supplier of live animals to domestic markets and to markets in Kenya and South Sudan. Detailed economic analysis conducted in 2018 to 2019 valued Karamoja's livestock products and services at US$444 million,[2] and estimated that in Uganda, Karamoja accounts for 39% of national cow milk value, 28% of national goat milk value, 37% of national sheep offtake value, and 27% of national cattle offtake value.[3] Critically, this production is derived from the use of mobile livestock systems to access water, and the natural pastures, bushes, and trees on which livestock feed. Although at policy level bodies such as the African Union and the Intergovernmental Authority on Development (IGAD) recognize the economic and ecological rationale for this strategic mobility, within Uganda there is often misunderstanding about pastoralism as a productive system and the role of mobility in underpinning its productive efficiency. In common with other countries in the IGAD region, central policy makers have visions of modernity based on settlement and large-scale, commercialized crop cultivation. In contrast, pastoralists see livestock as central to their livelihoods and identity.[4] Whereas policy has often aimed to replace pastoralism, pastoralists themselves aim to strengthen pastoralism as well as diversify their livelihoods.[5]

Unfortunately, the Karamoja context is further complicated by a long history of violent conflict. Historically, conflict took the form of cattle raiding, with raided communities committing retaliatory raids that led to cycles of violence. This took place in contexts of national or local political instability, increasing access to modern weapons, and various types of conflict with neighboring areas within Uganda as well as with Kenya.[6] As early as 1913, the colonial government executed a systematic forceful disarmament that led to a decline in raiding from 1921 to around the time of independence in 1962. However, even during this period of calm, there was a resurgence of raiding following the great drought of 1943, in which rudimentary spears, bows, and arrows were used as weapons.[7] Rearmament and disarmament patterns have continued in Karamoja during the post-independence period, and in recent history there was a large-scale government-led disarmament program, which peaked between 2006 and 2010.[8] This program included the use of "protected kraals," which were livestock enclosures that were guarded by the Uganda People's Defense Forces (UPDF), who then also controlled access to grazing areas. In response to the protected kraal system, cattle raiders changed their tactics to waylay herders when cattle were being grazed, which in turn led to government and aid interventions around the concept of protected water and grazing areas; the approach was evident in the government-led Karamoja integrated disarmament and development program.

Historical analysis of the water development in Karamoja sub-region shows a dramatic peak in activity during the intensified disarmament between 2006 and 2010.[9] However, both the new water sources and the "protected kraals" disrupted traditional access

1 Behnke and Nakirya, 2009.

2 Behnke and Arasio, 2019.

3 Karamoja Resilience Support Unit, 2020.

4 International Institute for Environment and Development/SOS Sahel, 2009.

5 Krätli et al., 2013.

6 Stites, 2022.

7 Akabwai and Ateyo, 2007.

8 Catley et al., 2021.

9 Egeru, Wasonga et al., 2015.

to pasture and water. Grazing pressure increased significantly around the water sources, especially dams,[10] and these areas became foci for livestock disease outbreaks. The impacts on the livestock population and livelihoods were devastating.[11]

This history is important because after a period of relative peace from 2010 to 2019, conflict and raiding once again started to increase in Karamoja. Although there had been clear development gains up to 2019, the following years saw multiple hazards:

> *2020, 2021 and 2022 were characterized by multiple hazards, occurring within a context of COVID-19 restrictions: African armyworm, drought impacts on crops, crop diseases, desert locusts, human and livestock diseases and, in locations in Nabilatuk and Kaabong, floods and wild animals respectively. These hazards severely affected sorghum and livestock production in Karamoja's agropastoral livelihood zones. Key informants confirmed this analysis, explaining that the negative impacts of multiple hazards were further compounded by volatile food and livestock prices and inflated lean-season food prices, the result of COVID-19 restrictions and the Russia-Ukraine war. Most hazards have been present in Karamoja for decades and partly account for persistently high poverty rates; the Uganda Bureau of Statistics reported multidimensional poverty in the region at around 85% of the total sub-region population.*[12]

Therefore, the recent upsurge in raiding is partly driven by poverty and hunger. However, "commercial raiding" has also become part of the conflict landscape in Karamoja in recent years.[13] This is the organized theft of livestock for direct economic gains, with preorganized buyers and arrangements, from transporting stolen animals to butchers, traders, or others.

As noted above, Karamoja's history includes the introduction of water and rangeland facilities and practices by government and aid programs. New water sources include boreholes and dams, and rangeland activities include area enclosures and "farmer-managed natural resources regeneration." There have also been attempts to change water and rangeland management, and several new institutions have been introduced in the pastoral areas such as Karamoja, including water user committees and farmer/pastoral field schools. However, these initiatives often ignored the social, cultural, and political significance of water and grazing resources management and the critical influence upon pastoral communities' decision making.[14] Without careful design and community involvement, there is a risk that new initiatives will cause environmental degradation, conflicts, and exclusions, and privatization of hitherto communal water and pastures.

Understanding the customary institutions, rules, and other practices for the local management and control of grazing and water resources in Karamoja is crucial for developing policies and programs that provide livelihood benefits across a range of users, and which are effective and locally supported. These are important for the purpose of sustainability of interventions as well as for moving the conversation and engagement of the communities from tokenism to real empowerment and reducing failures often associated with "parachuted" solutions that have become the norm in the drylands and pastoral communities in the region. Taking this careful approach is essential because it is now recognized that some of the interventions introduced by international and national actors have failed to support local livelihoods and have instead contributed to undermining pastoralism along with drought, livestock diseases, cattle rustling, and restricted livestock movement, among other factors.[15]

1.2. OBJECTIVES OF THE REVIEW

The overall purpose of this review was to understand local and traditional as well as newly introduced systems, structures, and practices for grazing and water resources management in Karamoja. Specifically, the assignment sought to:

1. Collect and document information on the traditional and newly-introduced forms of water and grazing resources management in

10 Egeru, Barasa et al., 2015.

11 Catley et al., 2021.

12 Cullis and Arasio, 2022.

13 Arasio and Stites, 2022.

14 Nicol et al., 2022.

15 Akall, 2021.

Karamoja, covering representative livelihoods and ethnic groups;
2. Assess the functionality of traditional and newly introduced institutions, structures, and practices for managing pastoral water and grazing resources;
3. Assess the extent to which the indigenous and the newly introduced water and grazing resources management systems are integrated;
4. Provide recommendations on how sustainable grazing and water resources management can be achieved, drawing evidence from within the region as well as broadly within East Africa.

2. ASSESSMENT DESIGN AND METHODS

2.1. ASSESSMENT AREA

The assessment was conducted in four districts in Karamoja sub-region, viz. Moroto, Napak, Amudat and Kotido (Figure 2.1). The selection of the districts targeted three main livelihood zones: Moroto and Kotido Districts represented the central sorghum and livestock zone; Napak District represented the central sorghum and livestock and the western mixed crop farming zone, generally considered agropastoral; and Amudat District represented the southeastern cattle-maize zone.

Specific sub-counties and villages were selected purposefully using the following criteria: diversity of introduced and traditional water resources; and presence of traditional and introduced grazing resources and systems.

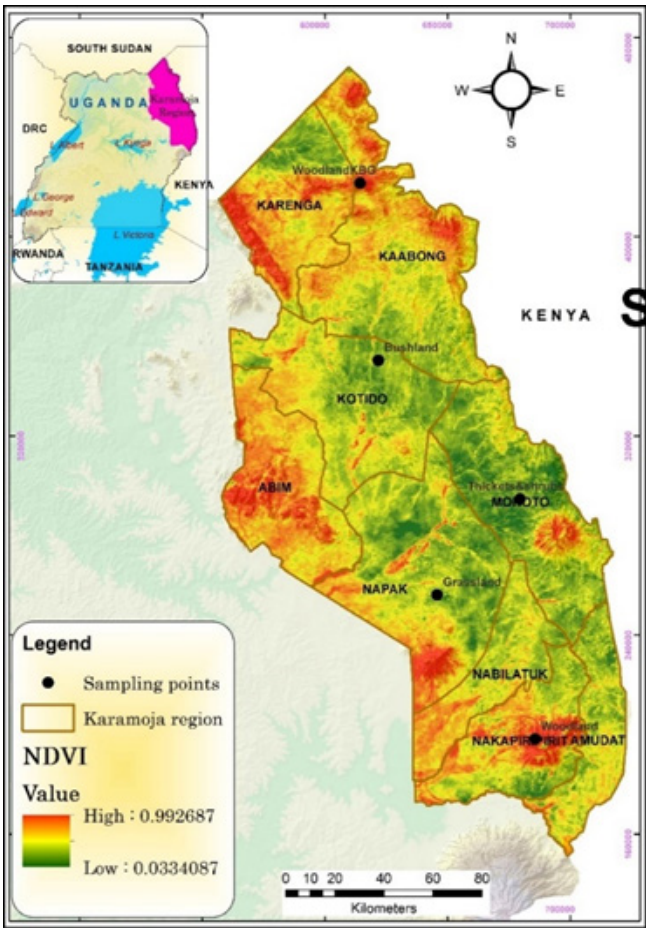

Figure 2.1 Karamoja sub-region with key land cover types.

Field work for the assessment was conducted over a four-week period from late May to mid-June, 2023.

2.2. ASSESSMENT DESIGN

The assessment used a qualitative design that was supported by analysis of long-term quantitative data (conducted by the lead author) and a brief literature review. The field work during the assessment aimed to capture community-level knowledge and perspectives on rangeland and water resources and associated institutions, and therefore used mixes of informal interviews and participatory methods. Further information was gathered using key informant interviews.

Recognizing the value of cultural ecology, all interviews with communities were conducted in Ngakarimojong, with consideration of the local dialects of the Matheniko, Bokora, and Jie. As Pokot communities in Amudat District speak a Nilo-Hamitic Kalengin language, different from Ngikaramojong, a two-phase approach was used to achieve consistency with the other districts. First, interviews were conducted in Loroo, an area occupied by the Kasauria-Pokot,[16] a bilingual community that speaks both Pokot and Ngakarimojong. This activity aimed to identify the correct nomenclature of water and grazing resources in Pokot and aligned to Ngakarimojong. Thereafter, interviews were conducted in other areas of Amudat District. Articulate research assistants familiar with the local language and or dialects, previously trained and engaged by Karamoja Resilience Support Unit (KRSU)/Tufts University, assisted with translation, interviews, and probing during the exercise.

2.3. ASSESSMENT METHODS

2.3.1. Literature review

Literature was reviewed before and during the field work. This literature included peer-reviewed journal

16 Pokot society in Amudat District is subdivided into three clusters: Kasauria occupy the areas of Loroo and Lale; Kacherikua occupy Amudat central areas and Katabok; and Chuuro occupy areas of Kaichom and Karita.

articles, briefing notes, research reports, grey literature, and Government of Uganda policy and program documents.

2.3.2. Focus group discussions and participatory methods

A total of 26 focus group discussions (FGDs) were conducted across four districts (Table 2.1). Female and male participants were selected based on their expected experience and knowledge in water and grazing resources; participants included both elders and youths. Although participant numbers in each FGD were predetermined (10 participants per FGD, disaggregated by gender, age, and experience), new participants sometimes joined a group during the discussion. New arrivals often brought wider experience or perspectives that either validated the information provided by the core participants and/or added further information that strengthened perspectives being provided by the group.

To understand the relative importance of different aspects of water and rangeland resources and management, participatory scoring methods[17] were incorporated into the FGDs (e.g., see Figure 2.2). These methods required participants to assign piles of counters (stones) to illustrate patterns of importance or relevance. To assess long-term changes,[18] four time periods were identified and used. These were: the period of endemic conflict up to 1999; the period of government disarmament from 2000 to 2009; the period of relative peace from 2010 to 2019; and a period from 2019 to the present day, associated with rising conflict. To assess seasonal uses of water and rangeland resources,[19] the wet season, dry season, and intervening transition period from wet to dry season were used; a drought period was also added to these seasons. To assess the functionality of the newly introduced water and grazing resources and the associated management systems, a scale of 0 to 4 was used (0–not functional; 4–fully functional).[20]

2.3.3. Key informant interviews

Key informant interviews were conducted with: civil society leaders and heads of nongovernmental organizations (NGOs) involved in water and grazing resources management; Nabuin Zonal Agricultural Research Development Institute/NARO; Makerere University; CARITAS Kotido; Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ-SCIDA III); Welthungerhilfe (WHH- SRAPLEA); National Water and Sewerage Corporation; District

Figure 2.2 Use of participatory methods.

17 Method: proportional piling.

18 Method: timeline with proportional piling.

19 Method: seasonal calendar.

20 Method: participatory Likert-type scale rating.

Table 2.1 Sampled districts, sub-counties, and villages.

District	Sub-county	Village	Number of participants
Moroto			
1	Lotisan	Lokaal	20
2	Lotisan	Lokaal	25
3	Lotisan	Atedewoi	30
4	Lotisan	Akwapua	15
5	Lotisan	Lokalimon	18
6	Nadunget	Lokeriaut	20
Napak			
7	Matany	Losidongoror	30
8	Matany	Losidongoror	15
9	Lokopo	Namoru-Akwangan	20
10	Lokopo	Namoru-Akwangan	20
Amudat			
11	Kongorok	Naloit	15
12	Katabok	Kanareyon	23
13	Katabok	Kanareyon	10
14	Amudat	Kaaron	11
13	Katabok	Napitira	15
15	Katabok	Napitira	5
16	Losidok	Kaleketyo	16
17	Loroo	Kapuseryon	22
18	Abiliyep	Naklesia	19
Kotido			
19	Kotido	Nayete I	10
20	Kotido	Nayete I	10
21	Kacheri	Lopetae	10
22	Kacheri	Lopetae	10
23	Kacheri	Nasinyon	14
24	Kacheri	Nasinyon	12
25	Nakapelimoru	Lomudit	25
26	Rikitae	Nadome I	14
27	Rengen	Chachaun	15
28	Rengen	Chachaun	21
Total			490

Water Officer Kotido; District Production Officer (Moroto); District Natural Resource Officer (Moroto); Food and Agriculture Organization of the United Nations (FAO); Mercy Corps; Karamoja Agro-pastoral Development Program; District Veterinary Officer (Moroto); Matheniko Development Forum; Karamoja Drought Resilience Project (GFA-BRLI and We Consult); District Agriculture Officer (Moroto); and Karamoja Development Forum.

2.3.4. Quantitative analysis

Quantitative analysis used historical archived data, acquired by the lead author from the Ministry of Water and Environment, and FAO.

The normalized difference vegetation index (NDVI) was used as a proxy indicator of vegetation cover by vegetation type, and the analysis examined NDVI across the sub-region in four years, viz. 2000, 2009, 2019, and 2022, i.e., over a 22-year period. This approach was intended to show temporal and spatial changes in grasslands, woodlands, thicket and shrubs, and bush cover, and hence the availability of natural feed for livestock.

Using data on water resources such as boreholes, dams, and valley tanks in addition to other data on soil, lithology, rainfall, and digital elevation, among others, water resources modeling was performed. The modeling aimed to identify the distribution, and hot-spot and cold-spot water resources, and ground water potential for the sub-region.

2.3.5. Limitations

Information gathering during the assessment was affected by the following issues:

- Security was a major concern. It affected the timing and the length of the FGDs. Some FGDs were not completed because of security concerns.
- Some government officials were reluctant to provide information to the review team, perhaps because of security concerns or because of sensitivities around “elite capture” of water and rangeland resources.
- A time constraint affected the design and scope of the study, and the duration of FGDs.

3. TRADITIONAL AND INTRODUCED WATER RESOURCES

3.1. TYPES AND SEASONALITY OF TRADITIONAL AND INTRODUCED WATER RESOURCES

3.1.1. Traditional water resources in Karamoja

Participants identified 14 traditional water resources and described their relative preferences (Figure 3.1). Although there were notable differences between villages, in general lakes (*anam*), swamps (*ejom*), permanent rivers (*elelea*), and deep wells along a riverbed (*echor/akare*) were the most preferred traditional sources of water.

Preferences depended on the seasonal usefulness of each of the water resources across wet and dry seasons, as well as the interphase-transition period between dry and wet seasons (*nait* in Ngakarimojong) and drought periods. Preferences were also affected by the extent to which a water resource complemented and/or was an alternative to conventional water sources. Overall, traditional water resources are seen as providing water free of charge and are established by God; they are also important in the community's performance of rituals. Area-specific variations in preferences were associated with local variations in water shortages and the relative stability[21] of the water resource in providing the required quantity and quality of water.[22] Detailed notes on each traditional water resource are provided in Table 3.1, and some of the resources are illustrated in Figures 3.2 to 3.4.

3.1.2. Seasonal use of traditional water resources

Due to the critical importance of water seasonality in Karamoja, participants described how each year they plan to use different water sources at different times of year. As water is limited during the dry season

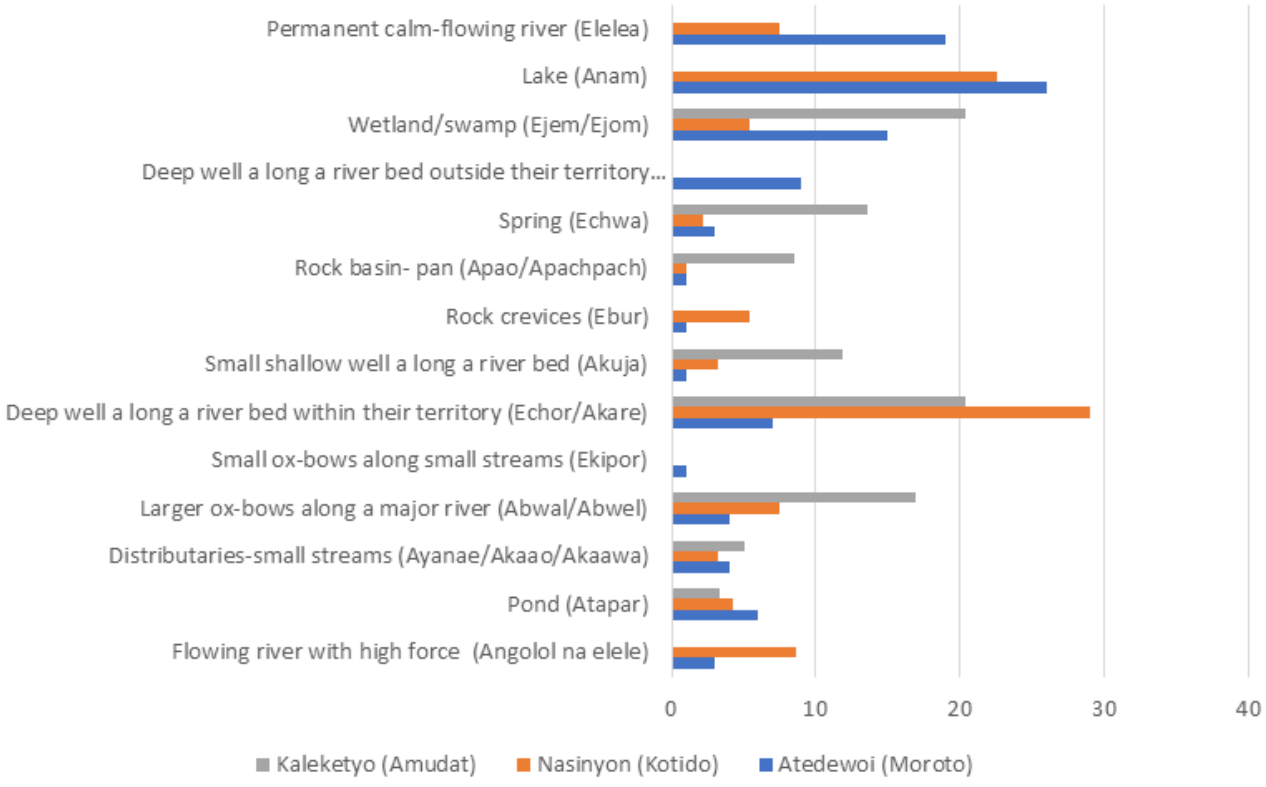

Figure 3.1 Preference scoring of traditional water sources in villages in Amudat, Kotido, and Moroto Districts.

21 "Stability" denotes the reliability of a water resource to provide sufficient amounts and quality of water when the community needs need it.

22 M'Mbogori et al., 2022.

Table 3.1 Traditional water resources in Karamoja sub-region.

Local name in Moroto/Napak/ Kotido	Local name in Pokot (Amudat)	English name	Description
Angolol na elele	*Puserion*	Stream	Flowing river at whatever stage. There are several major rivers and streams in the region, including in Lomaniman, Lokok.
Atapar	*Takar*	Pond	Shallow depressions created by either animals or dug out by people that collect water on a seasonal basis during the wet season
Abwal/abwel	*Ngarpil/akibwor*	Larger ox-bow pool–see Figure 3.3	An ox-bow on the main river. Forms next to a rock or a big tree after a river flow is cut off from a meandering section of the stream. Water remains in the depression.
Ekipor	*Akibwor/na-kasepan*	Smaller ox-bow pool	Ox-bows along the small streams. They form in the same manner as those from the main river except they are smaller in size.
Echor lo alotooma	*Kopopogh*	Deep well on riverbed within their territory	Deep wells in the riverbeds within their territory, created by digging into the riverbed. It gets deeper during the dry season and as the water table further lowers. The depth could keep increasing to the height of approximately two to six people.
Echor lo alokinga	*Kopopogh*	Deep well on riverbed outside their territory	As above, but these wells are outside their territory.
Ayanae/akaao/ akaawa		Tributary and distributary	Small streams that lead to the major river. Often these flow from different sections of the main river and form part of the main river's catchment. As they join the main river, the discharge of the main river increases downslope.
Akuja	*Akwicha*	Pothole–see Figure 3.2	These are shallow wells on the riverbed. They occur during the wet season. They dry up quickly at the approach of the dry season.
Ebur	*Kilit/kelwa*	Rock crevice	A depression or hole in the rock that stores water.
Apao/apachpach	*Kul/kelwa/apawa*	Pit-pan–see Figure 3.4	These are hemispherical hollows developed by standing water in massive or isotropic granitic rocks as observed in parts of Katabok-Kaichom in Amudat District. Two forms of these pit-pans could be observed; the shallow pans with a 1–3-meter diameter, and the slightly deeper 1–2-meter depth and 10-meter diameter pan depressions. The large pit was particularly located at the margins of granite outcrops and received runoff from the adjacent elevated slope while the shallow pans were on top of the granite outcrops.

Table 3.1 Traditional water resources in Karamoja sub-region (continued).

Local name in Moroto/Napak/ Kotido	Local name in Pokot (Amudat)	English name	Description
	Kong popogh ("eyes of water")	Crying rock	This is sub-surface flow passing through the rocks from higher ground through the porous rocks and exiting slowly from the base of the rocks. When the rains are still on, the water is easily found on the surface. As the dry season intensifies, it withdraws closer to the depressions at the base of the rocks. Users may dig the rock base slightly to expose more seepage of the water and to create a slight depression for water to gather in. These are found in the parts of Kaleketyo (Amudat).
Ejem	*Ajam*	Wetland/swamp	This refers to wetlands in the lower plains.
Anam	*Nanam*	Lake	These are found in the western plains of Teso.
Elelea	*Achawa/napaka*	Permanent calm-flowing river	Permanent river flowing throughout the year. If there is no water on the surface, it continues to have base flow through the sand.
Echwa	*Chachaya/koreyon*	Spring	Water released from underground

Figure 3.2 Pothole (*akuja/akwicha*), Nagoliet, Amudat.

and droughts, certain water sources are highly valued because they provide water during these periods. For example, lakes (*anam*) were most useful during drought while permanent rivers (*elelea*) were most important during the dry season; streams (*ayanae/akaao/akaawa*) were most important during the rainy season (*nakiporo*).

Most of the traditional water sources are only available during the wet season, and they hold water for only a short period. These include ponds, flowing rivers, rock basins, small streams, and ox-bows along small streams. There are water sources that are mainly relied upon in the dry season, and these include deep wells in the riverbeds (within and outside their territory), holes in the rock, *elelea*, *echwa*, ox-bows on the river (if deep), shallow wells in the riverbed (if river has a high water table), and swamps. As mentioned above, lakes are important, but these are only found outside their territory in parts of Teso and Lango. Therefore, access

Figure 3.3 Ox-bow pool (*abwal*), Nagoliet, Amudat.

Figure 3.4 Pit-pan (*apao/apachpach*), Kanareyon, Amudat.

to lakes involves migration to these other regions and occasionally results in pastoralist-farmer conflict.

Overall, water sources in Karamoja often dry out between September to April, and this corresponds with relatively high levels of herd mobility in the sub-region in search of water. In essence, seasonal variation in water availability drives mobility. As rainfall and water availability varies spatially and by amount each year, both water sources and mobility patterns are heterogenous each year, both internally within the sub-region[23] as well as across to neighboring communities in Teso, Lango, and Acholi. The Karamojong are always "following their water."[24]

23 Egeru et al., 2020.

24 Akabwai, 2019.

Figures 3.5 to 3.7 below also show marked differences between locations according to local geographical and topographical variations.

Type of water resource	Rainy season	Interphase (*erupe/ atiyath*)	Dry season	Drought
Deep well on the riverbed–within their territory		●●●	●●●●●●● ●●●●●●	●● ●●
Deep well on the riverbed–outside their territory			●●●●●●●● ●●●●●●●	●● ●●●
Pond	●●●●●●●●● ●●●●●●●●●	●●		
Flowing river	●●●●●●●● ●●●●●●●●	●● ●●		
A hole in the rock that stores water		●● ●	●●●●●●●● ●●●●●●●●●	
A rock basin (water collects on top)	●●●●●●●●● ●●●●●●●●●●			
Permanent river			●●●●●●● ●●●●●●●●●	●● ●●
Cry rock/spring		●● ●	●●●●●●●● ●●●●●●●●●	
An ox-bow on the river	●	●● ●	●●●●● ●●●●●●	●● ●●●
Shallow well on the riverbed		●	●●●●●● ●●●●●●●	●●● ●●●
Wetland/swamp			●●●●●●●● ●●●●●●●●●	●● ●
Small stream that leads to a major river	●●●●●●●●● ●●●●●●●●●●●			
Ox-bow along the small streams	●●●●●●●● ●●●●●●●●●	●● ●		
Lake			●● ●●	●●●●●●●● ●●●●●●●●

Figure 3.5 Relative importance of traditional water resources by season, Nasinyon village, Kacheri sub-county, Kotido District.

Note: Figure based on scoring of each water resource and season using up to 20 counters.

Type of water resource	Rainy season (*pengat*)	Interphase (*kitokot*)	Dry season (*komoi*)	Drought (*pekhat*)
Deep well along riverbed (*kopopogh*)			••••••••••	
			••••••••••	
Flowing stream (*puserion*)	•••••••••			
	•••••••••			
Larger ox-bow (*ngarpil*)		••••••••••		
		••••••••••		
Wetland/swamp (*ajam*)		••	•••	••••••
		•	•••	•••••
Distributary–small stream (*nakasepan*)	•••	•••••••		
	•••	•••••••		
Water flowing from a mountain (*napaka/achawa*)		•••	•••••••	
		•••	•••••••	
Pond (*takar*)	••••••••	•••		
	••••••	••		
Shallow well on riverbed (*akwicha*)	••	••	•••	•••••
		•	••	•••••
Rock pan–rock basin (*kul*)	••••	•••••••		
	•••	••••••		
Rock crevices (*kilit*)		•••	•••••••	
		•••	•••••••	
Spring (*chachaya*)		••	•••	••••••
		•	•••	•••••
Lake (*anam*)			••	•••••••••
			•	•••••••
Crying rock–eyes of water (*kongpopogh*)		•••••••••	••	
		••••••••	•	

Figure 3.6 Relative importance of traditional water resources by season, Kaleketyo village, Losidok sub-county, Amudat District.

Note: Figure based on scoring of each water resource and season using up to 20 counters.

Type of water resource	Rainy season	Interphase	Dry season	Drought
Flowing river with high force (*angolol na elele*)	••••••••• •••••••	•• •		
Pond (*atapar*)	•••••••••• ••••••••••			
Distributary–small stream (*Ngipwarin*)	•••••••••• ••••••••••			
Larger ox-bow (*abwal*)	•••••••••• ••••••••••			
A deep well a long a riverbed within their territory (*ecor/akare*)		•••••••• ••••••••	•• ••	
A small shallow well a long a riverbed (*akuja*)	•••••••••• ••••••••••			
Rock crevice (*ebur*)	•••••••• ••••••••	•• ••		
Rock basin–pan (*apao*)	•••••••••• ••••••••••			
Spring (*echwa*)	••••••••• ••••••••	•• •		
A deep well a long a riverbed outside their territory (*ecor/akare*)				•••••••••• ••••••••••
Wetland/swamp (*ejem*)	••••••• ••••••	•• ••	•• •	
Lake (*anam*)				•••••••••• ••••••••••
Permanent river–flowing calmly (*elelea*)			•••••••••• ••••••••••	

Figure 3.7 Relative importance of traditional water resources by season, Atedewoi village, Lotisan sub-county, Moroto District.

Note: Figure based on scoring of each water resource and season using up to 20 counters.

3.1.3. Introduced water resources

The most introduced water resources in the sub-region are boreholes (*achuuma na ngakan*), burrow pits (*abokat/ngipulechio*), ponds (*ngataparin*), and valley tanks (*ngaamaatain/amaata naachi*). However, dams (*adem/amaata napolon*) and solar-powered wells (*ngasola/a-tap*) were the most preferred introduced water resources overall, as illustrated in Figure 3.8. Dams, solar-powered wells, windmills, and boreholes were considered important across the four seasons. Dams in particular were most important during the dry season, followed by windmills.

In general, the use of a water source by a community varies by season and by community. For example, in Kotido, ponds, burrow pits, sand/subsurface dams, rock catchments, and roof catchments are useful mainly in the rainy season. Valley tanks and gravity flow systems serve well in the interphase and dry season. Dams are a reliable source of water in the dry season and during drought. Although the different types of boreholes are more useful in the dry season and during drought (especially high-yielding boreholes), they are rated to be good sources of water throughout the year (Figure 3.10).

The divergence between preference and the level of introduction of conventional water sources in the sub-region could be explained by the different phases and purposes of water resources. When the disarmament intensified between 2000–2010, the Government of Uganda banned the mobile herding camps, and so there was need to increase domestic water sources in the sub-region.[25]

Overall, community preferences for specific types of introduced water facility are partly guided by the extent to which a facility is seen to be working. Unfortunately, many water facilities that were intended to supply water during the dry season or drought have limited functionality, e.g., due to management challenges, especially linked to the need for desilting. To illustrate the functionality issue, boreholes were the most common type of water facility introduced in Lokopo, Rikitae, and Katabok sub-counties (Tables 3.2 to 3.4) but only 15/35, 6/25, and 4/23 boreholes respectively were rated as fully functional at the time of the assessment. In Lokopo sub-county, from a total of 86 introduced water facilities, only 19 (22%) were rated as fully functional (Table 3.2). In Rikitae sub-county, only 6/56 (11%) of introduced water facilities were fully functional (Table 3.3), and in Katabok, 7/60 (12%) were fully functional (Table 3.4).

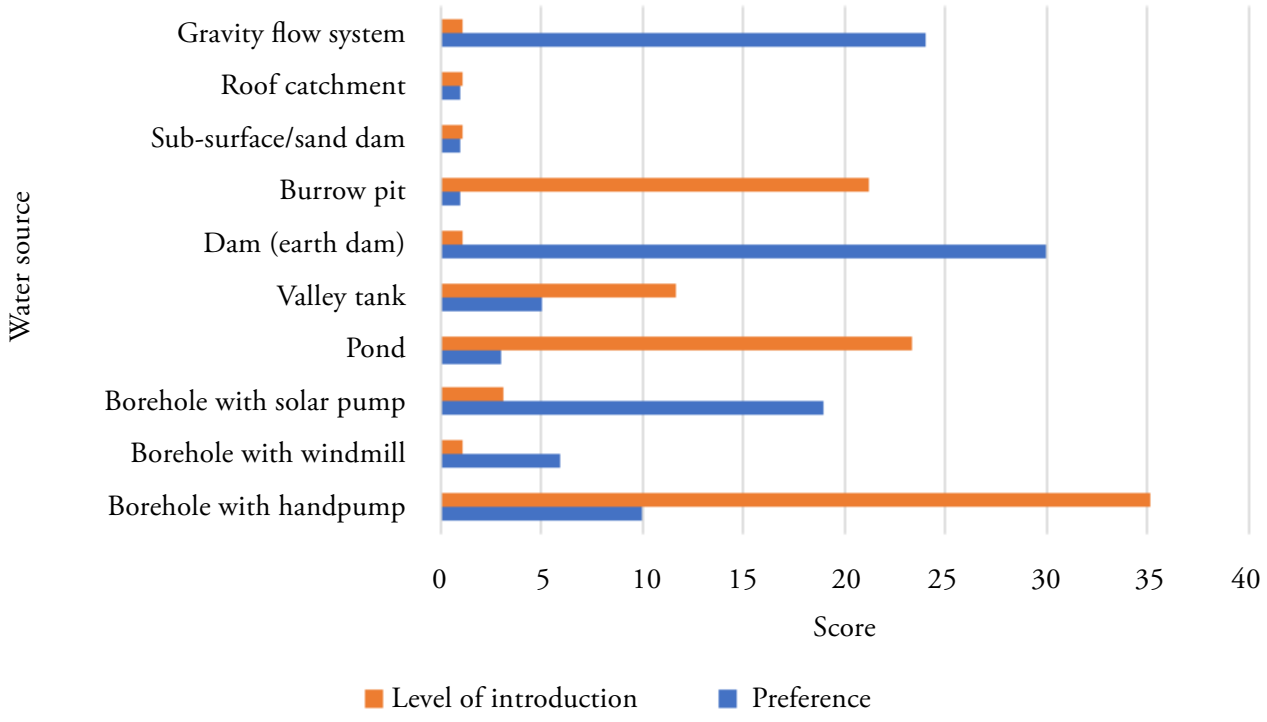

Figure 3.8 Introduced water sources by level of introduction and community preferences in Atedewoi, Moroto.

25 Egeru, Wasonga et al., 2015.

Table 3.2 Participatory Likert-scale rating of water source functionality, Namoru-akwangan village, Lokopo sub-county, Napak District.

Type of water resource	Functionality rating				
	Not functional				Fully functional
	0	1	2	3	4
Borehole with hand pump (n = 24)	9	2	3	0	10
Borehole with windmill (n = 6)	4	1	0	0	1
Borehole with solar pump (n = 5)	1	0	0	0	4
Valley tank (n = 24)	1	7	11	5	0
Earth dam (n = 1)	0	0	0	0	1
Pond (n = 12)	2	6	4	0	0
Burrow pit (n = 10)	4	6	0	0	0
Gravity water flow system (n = 4)	0	1	0	0	3
Total	21	23	18	5	19

Note: Participants considered a scale of 0 to 4, with 0 representing "not functional" and 4 representing "fully functional." They then assigned numbers of facility type to each level of functionality.

Table 3.3 Participatory Likert-scale rating of water source functionality, Nadome 1 village, Rikitae sub-county, Kotido District.

Type of water resource	Functionality rating				
	Not functional				Fully functional
	0	1	2	3	4
Borehole with hand pump (n = 23)	15	1	0	1	6
Borehole with windmill (n = 1)	0	0	1	0	0
Borehole with solar pump (n = 1)	0	0	0	1	0
Valley tank (n = 5)	1	0	4	0	0
Pond (n = 13)	0	7	4	2	0
Burrow pit (n = 5)	3	2	0	0	0
Subsurface/sand dam (n = 1)	0	1	0	0	0
Rock catchment (n = 3)	0	3	0	0	0
Roof catchment (n = 4)	2	2	0	0	0
Total	21	16	9	4	6

Note: Participants considered a scale of 0 to 4, with 0 representing "not functional" and 4 representing "fully functional." They then assigned numbers of facility type to each level of functionality.

Table 3.4 Participatory Likert-scale rating of water source functionality, Napitira village, Katabok sub-county, Amudat District.

Type of water resource	Functionality rating				
	Not functional				Fully functional
	0	1	2	3	4
Borehole with hand pump (n = 23)	6	2	6	5	4
Borehole with windmill (n = 1)	0	0	0	1	0
Borehole with solar pump (n = 3)	0	0	1	1	1
Valley tank (n = 11)	2	1	4	4	0
Earth dam (dam) (n = 1)	0	0	0	0	1
Pond (n = 9)	1	2	3	3	0
Burrow pit (n = 7)	2	2	2	1	0
Subsurface/sand dam (n = 1)	0	0	1	0	0
Rock catchment (n = 1)	0	0	1	0	0
Roof catchment (n = 3)	0	1	0	1	1
Total	11	8	18	16	7

Note: Participants considered a scale of 0 to 4, with 0 representing "not functional" and 4 representing "fully functional." They then assigned numbers of facility type to each level of functionality.

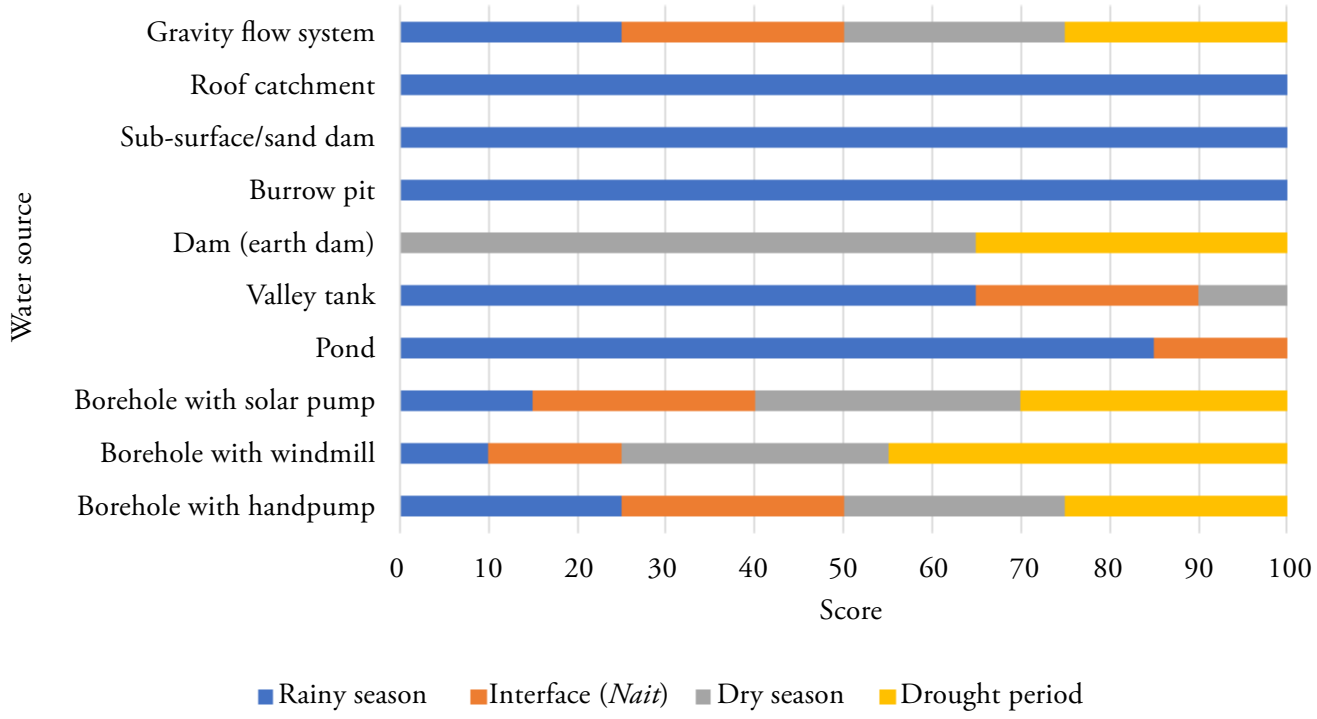

Figure 3.9 Relevance of conventional water resources by season (Atedewoi, Moroto District).

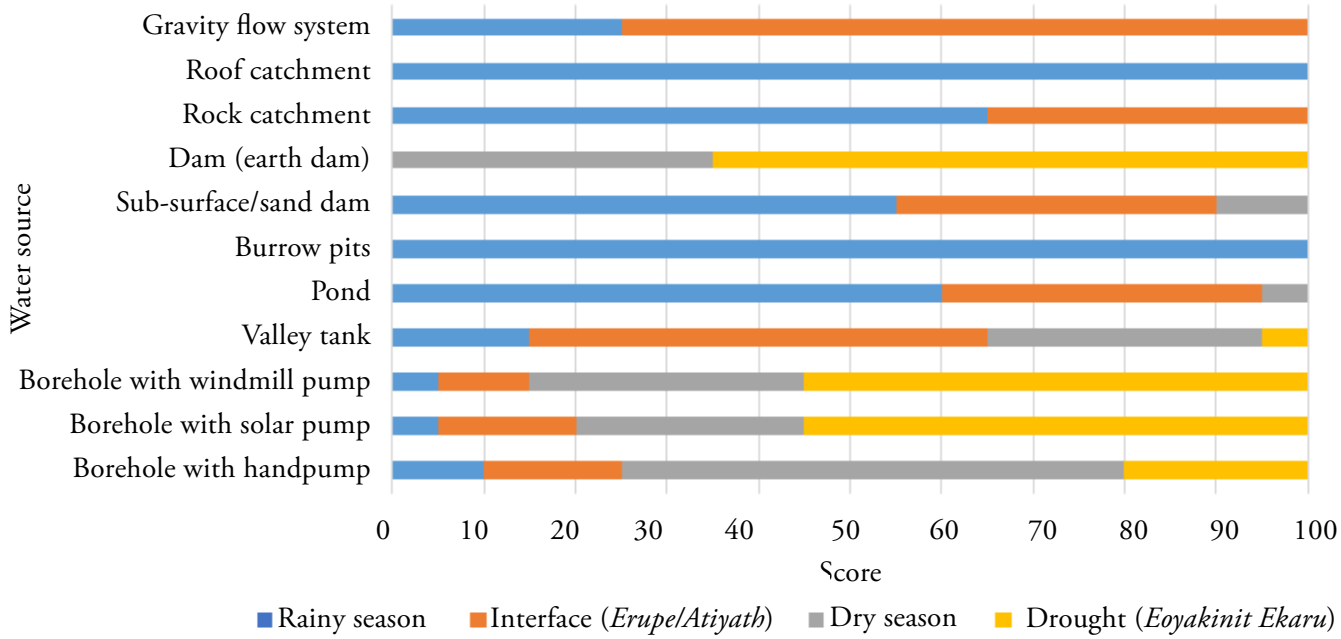

Figure 3.10 Relevance of conventional water resources by season (Nasinyon, Kotido District).

Figure 3.11 Windmill, Mogoth, Moroto.

Figure 3.12 Pond, Kainatuk, Amudat.

Figure 3.13 Valley tank, Napitara, Amudat.

Figure 3.14 Dam, Katabok, Amudat.

Figure 3.15 Rock catchment, Kanareyon, Amudat.

Figure 3.16 Borehole, Lokale, Moroto.

3.1.4. Strengths and weaknesses of introduced water sources

Strengths and weaknesses of introduced water resources are summarized in Table 3.5. In general, these resources provided water during the wet season but were drying up during the interphase period. As the dry season then progressed, water demand was met by fewer available resources. Introduced water sources are recognized for water safety and reduced water-borne diseases, multiple uses, and closeness to settlements. In contrast, they are faulted for high maintenance costs and costs for the use of water and frequent breakdowns; some are constructed in insecure areas, and this limits their accessibility.

3.1.5. Spatial distribution of introduced water resources

An analysis of introduced water resources from archived data shows the diversity of water resources and their distribution. The history of water development in Karamoja started with boreholes, with the first borehole constructed in 1924. The sub-region now has an estimated 2,966 borehole points, and their distribution is shown in Figure 3.17. Boreholes with hand pumps are more common than those with windmills or solar-powered pumps.

In Uganda, > 0.5 m^3/hr is the national acceptable minimum yield for domestic needs for a borehole with a hand pump.[26] In Karamoja, 53% of boreholes have potential yields of 0–1 m^3/hr, 32% have potential yields of 1–3 m^3/hr, 12% have potential yields of 3.1–6 m^3/hr, and 2.7% have potential yields of > 6 m^3/hr. However, in practice most of the boreholes in the sub-region have considerably lower yields, but with a few spots of high yield in Napak, north of the Nakapiripirit border area with Nabilatuk District, central parts of Moroto District, and the northern tips of Kaabong District (Figure 3.18). The distribution of introduced water resources is influenced by the spatial availability of groundwater and the position of established settlements.

26 However, some districts that have lowered this threshold to 300 liters per hour due to extremely low groundwater potential in specific areas. OMO, 2013.

Table 3.5 Strengths and weaknesses of conventionally introduced water resources.

Water facility type	Strengths	Weaknesses
Borehole with a hand pump	• Good source of water for villages and schools. • Free water. • Safe and clean water–reduced water-borne diseases. • Can irrigate vegetables on the sides. • Good source of water in the dry season.	• Hand pump injures children. • Poor management leads to breakdowns and contamination of ground water. • Need to pay for repairs.
Borehole with a solar pump	• Good source of water for villages and schools. • Water piped to homesteads. • Automated water pumping–save the energy used to pump water from hand-pump boreholes. • Even the disabled people can easily use/operate.	• High cost of water–for connection and monthly user fee. • Highly dependent on the sun for water pumping–no sun, no water. • Pumps little water if solar panels are not enough. • Damage to the piping system disconnects water. • Vandalism is common–stealing of solar panels. • Stones thrown by children easily damage solar panels, and this affects water pumping.
Borehole with a windmill pump	• Good source of water for villages and schools. • Automated water pumping–save the energy used to pump water from hand-pump boreholes.	• Rarely found. • Highly dependent on wind to pump water–no wind, no water.
Valley tank	• Located close to homesteads/villages–good resort when pushed back from dry season grazing areas by conflict. • Alternative water source for domestic use in the absence of boreholes. • Animals and children cannot drown. • If large enough, can hold water for a whole year.	• Most of them dry up in the dry season, especially smaller and medium size ones. • Prone to silting when animals drink directly and during rains when water flows in. • If silted, traps animals and doesn't hold enough water. • Water easily contaminated–a source of diseases. • Some are poorly constructed and easily destroyed.
Pond	• Children, herders, and animals cannot drown because it's shallow. • Located close to the village–even sick animals can access. • Its water is good for irrigating trees and vegetables compared to borehole water (can burn).	• Limited use of water, e.g., for bathing and for livestock. • Holds water for a shorter period. • Water easily gets contaminated. • Prone to silting.

Table 3.5 Strengths and weaknesses of conventionally introduced water resources (continued).

Water facility type	Strengths	Weaknesses
Burrow pit	• Close to the road; so good source of water for migrating herds.	• Children drown while swimming. • Holds water for shorter period. • Can spoil the road if too close as water drains into it.
Sub-surface/sand dam	• Controls the flow of water so that it does not destroy the gardens close to the river. • Wells dug around it in the dry season–good source of water. • Increases water retention at the river.	• Some hold water for a shorter period. • Animals and people can get stuck on the sand heaps. • Some concrete barriers/embarkments are weak and washed away by river water. • In some, the water forms another course and leaves the original course.
Dam (earth dam)	• Good source of water in the dry season and during drought. • Fishing done here and it's a source of income. • Water has multiple uses–water for domestic use, livestock, wildlife, fishing, irrigation, among others.	• Prone to silting and might be expensive to desilt. • People and livestock drown. • Concentration of animals around the dam attracts insecurity from raiders. • Crocodiles and other wildlife attack people and animals. • It has evil spirits that are associated with water. • Overgrazing around the dam.
Rock catchment	• Water is clean and mainly for human use. • Most of them are close to settlements, therefore easy to access water.	• Suitable places are rare. • Poor management can lead to water contamination.
Roof catchment	• Traps water for use only in the rainy season. Water only for washing clothes. • Water can be used for irrigating trees and vegetables.	• Benefits only those with iron sheet houses. • Limited use of water–for washing utensils and clothes. • Worms in water if the storage tank is dirty. • Water predisposes you to flu if you drink it. • Water is little and only used for a short time.
Gravity flow system	• Good source of water in the dry season. • Reduces migration to neighboring areas for water. • Can dig wells around it. • This is where elders perform rituals for rain to come.	• Evil spirits are associated with water.

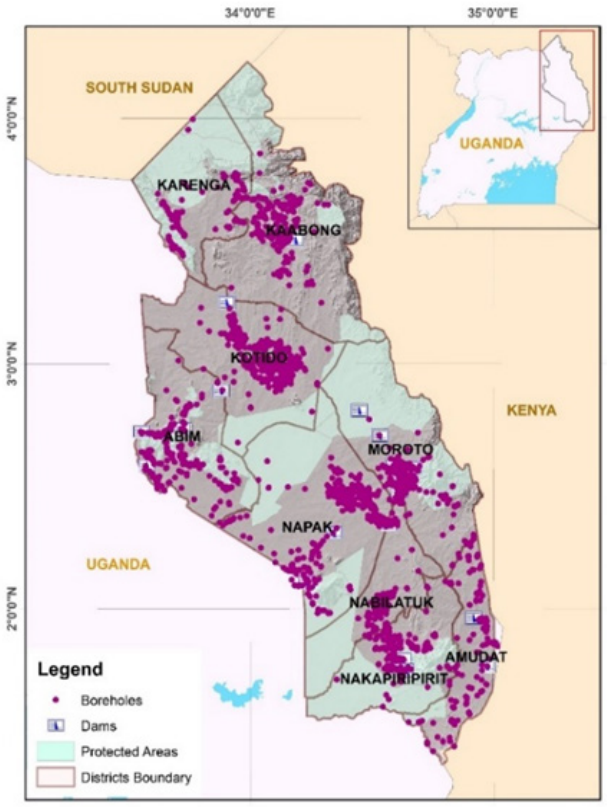

Figure 3.17 Borehole distribution in Karamoja.

Figure 3.18 Borehole distribution by yield and distribution of dams in Karamoja.

Table 3.6 Number of valley tanks and earth dams by district.

District	Valley tank	Earth dam	Total potential water (m^3)
Abim	3	2	1,040,000
Kaabong	1	1	2,020,000
Karenga	4	0	40,000
Kotido	3	4	5,830,000
Nabilatuk	3	1	1,040,000
Nakapiripirit	3	0	30,000
Moroto	6	2	4,352,000
Napak	2	5	5,730,000
Amudat	4	1	1,060,000
Total	29	16	21,142,000

Source: Data synthesized from the assessment report on water for production facilities in Karamoja sub-region undertaken by Ministry of Water and Environment, 2023

Dams were scored favorably during the review (Figure 3.8) because of their capacity to provide water for livestock and domestic needs during the drier periods. Interviews with key informants revealed that there are 16 earth dams in the sub-region, and, when combined with the 29 valley tanks, the potential total holding capacity in these facilities is 21,142,000 m^3 (Table 3.6).

A further seven earth dams are being constructed, with a total holding capacity of 7,285,785 m^3. The Ministry of Agriculture is constructing earth dams

in Sinat (Kotido), Nakonyen (Moroto), Kosike (Amudat), and Usake Valley (Kaabong), and the Ministry of Water and Environment is constructing earth dams in Nangolol Apolon (Kotido) and Lemusui (Nakapiripirit).

3.2. WATER MANAGEMENT

3.2.1. Shifts from traditional to committee-based water resources management

Discussions with the communities revealed that there had been shifts in the management of water resources in the sub-region, with introduced types of water management becoming more prevalent but not necessarily more effective. In general, more modern water facilities are seen as beneficial but only if they are properly designed, located, and managed.

It was explained that traditionally, water was managed through a mechanism called etamam/etem/ekokwa and an institution called akiriket prior to the introduction of new water resources. This mechanism was for accessing resources other than one's own, in effect enabling sharing of the resources and conditions to the same effect. Through this mechanism, water resources were managed based on: defined proximity to the water source; defined history of use and effective control; and defined apparent ownership, especially if the water source was dug out by a particular family, kraal, or group of homes. Traditional water sources are either private or public owned, depending on the water source. For instance, ecor (a deep well in a riverbed) is a private water facility. Traditionally, access to, control, and user rights over a facility as well as its management are defined around clear ownership of the facility, either owned by a family (ekal), mobile camp (awi), or related families or a settlement (ere) or mobile camps (ngawiyei) around the facility. Even traditionally, facilities without clear ownership have issues with user rights, control, and management.

Community members felt strongly that their traditional management systems worked much better than management systems that had been introduced because the former defined their collective rights. In contrast, in newer systems such as committees or user associations, these rights are controlled and defined by another body, namely apukan (government). Similar experiences have been documented in northern Kenya, but largely arising from project-based approaches to introducing new water resources.[27]

The rise in water committees and user groups mirrors the rising trend in construction of new water facilities and a corresponding decrease in the use of, and knowledge about, indigenous water sources. Participants noted that the availability of clean and safe water (throughout the year) has increased, and the sharing of water sources with animals has decreased (Figure 3.19). There is now more automation of water sources (such as boreholes with solar pumps) and less distance to newly introduced water sources. Further, there is a perceived reduction in the incidence of water-borne human diseases such as cholera. However, surface water harvesting technologies were attributed to increased spread of livestock diseases. This could be due to livestock herds congregating at these facilities and more local contamination of water or pasture. While there is increased need for maintenance of water sources, participants also noted that there is general willingness to contribute to the operation and maintenance of water sources. However, the ability to contribute to the operation and maintenance of water sources varies depending on the asset base of households. For example, in some areas, households contribute Ugandan shillings (UGX) 1,000 to 20,000 for borehole maintenance.

3.2.2. Characteristics of effective and noneffective water committees

Generally, communities are familiar with one type of introduced management system: the use of committees. Facilities with management committees include different types of boreholes, ponds, and dams. For example, each borehole has a user committee of nine members. Committee members are elected based on the following criteria: representation from all villages that surround the facility; active; a good mobilizer; listened to and respected; good oratory skills; not quarrelsome; not easily upset; and willingness to volunteer. At least three committee members should be women. Participants noted that valley tanks and burrow pits do not often have management committees. Also, they were undecided on whether sand/subsurface dams and rock catchments have management committees (but these had traditional guards from within the community). Privately owned and managed water facilities such as roof catchments, often in institutions and private homes, are controlled by individuals.

Participants listed several indicators that show that a committee is functional. For example, in the management of a borehole, these included: immediate repairs after breakdown; lobby for repairs; saved money

27 M'Mbogori et al., 2022.

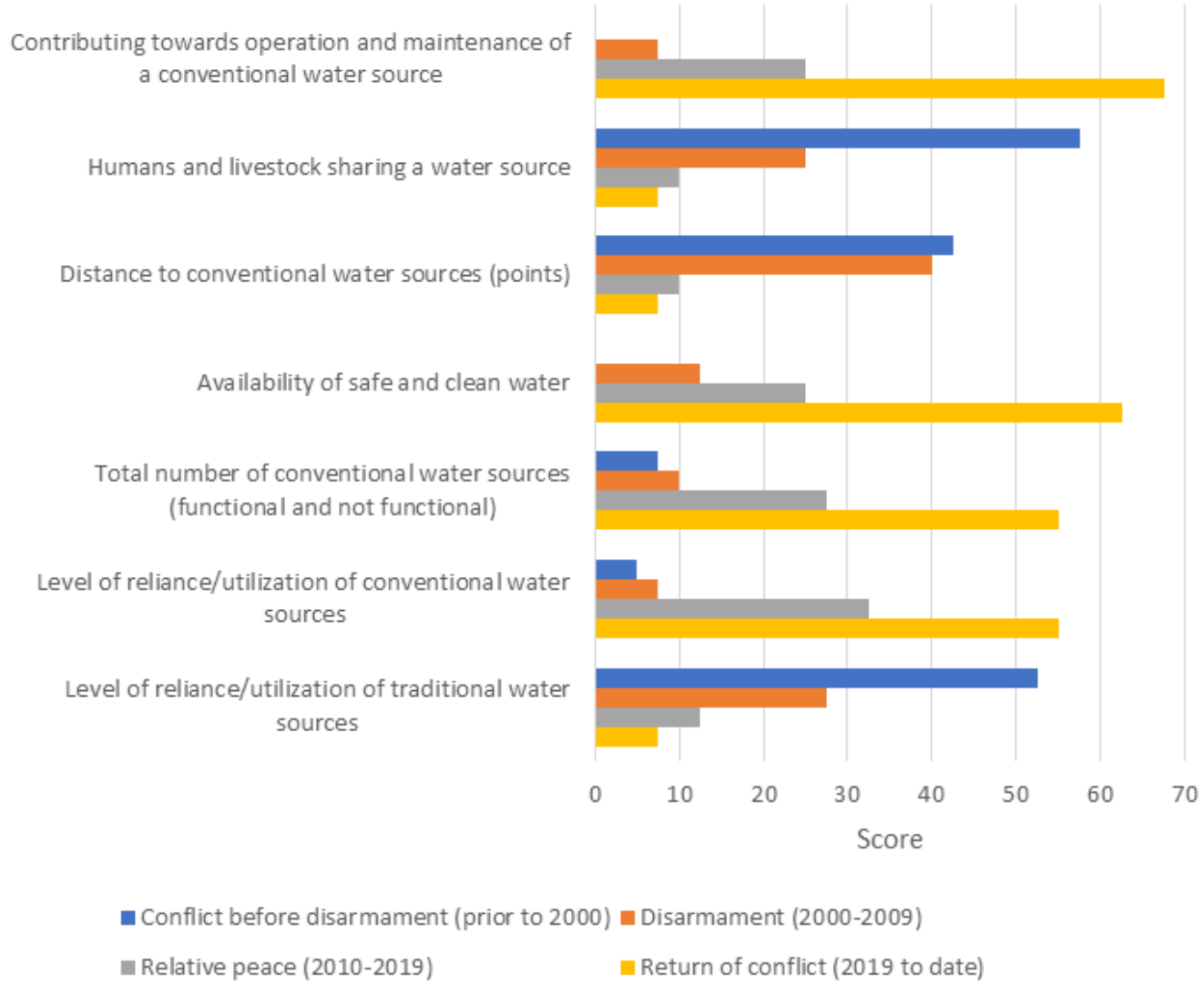

Figure 3.19 Trends in reliance on traditional and introduced water sources, and related changes in Kapuserion, Amudat.

for repairs from community's contribution; cleanliness of the borehole; educating people on the responsible use of the borehole; asking for community contributions towards repair kits; and having a fenced borehole. However, Tables 3.2 to 3.4 illustrate the limited functionality of new water facilities, including boreholes, and communities relate functionality directly to management (for example, see Table 3.7). For example, for introduced systems of management, participants explained that even where the right criteria were used for the selection of committee members, committees could be constrained by poor transparency and accountability when managing maintenance funds, the hidden/vested interests of some of the committee members, inability of community members to contribute to the use and maintenance of a facility, and poor motivation of committee members. See Figures 3.20 and 3.21 for examples of poor management of water facilities. However, some communities have overcome these issues by calling for regular public meetings through their representatives, to summon dormant or dishonest committee members or for committee members to give an account to the entire community. These representatives take the lead in calling for meetings, with support of the entire community, and they include traditional, political (local council level), and local government leadership. Other strategies include peer shaming and pressure, peer learning from active committees, and motivating committees by contributing towards use, operation, and maintenance of facilities.

Some recent shifts in new facilities and water management were exemplified in the case of the

Table 3.7 Links between the management and functionality of introduced water facilities.

Name and location of facility	Functionality of water facility	Performance of the management committee
Valley tank		
Kalekeyto	3	3
Kangikenoi	4	4
Kaichom	1	1
Kalemkitoe	3	0
Borehole with hand pump		
Kaleketyo	4	4
Alemreng	1	1
Cherelac-ghaun	3	4
Katapodin	2	2
Renoi	0	0

Source: FGD, Kaleketyo village, Losidok sub-county, Amudat District

Note: Participants considered a scale of 0 to 4, with 0 representing "not functional" and 4 representing "fully functional." They then assigned numbers of facility type to each level of functionality

Figure 3.20 A broken borehole in Lokale, Moroto indicates local management problems.

Figure 3.21 Cattle drinking water directly from a valley tank in Napitara, Amudat indicates weak enforcement of user access and practices.

Kobebe dam.[28] Traditionally, Kobebe was a wet season grazing area and belonged to the Matheniko. The use of resources in this area by other communities such as the Jie and the Turkana was negotiated with the Matheniko through traditional mechanisms such as *etamam*. With the establishment of Kobebe dam, the area was gazetted as a wildlife reserve and several shifts occurred: a shift in use from a wet season to a dry season grazing area; ownership was transferred to the Uganda Wildlife Authority and local authorities; negotiating access to resources changed to liaising with a committee rather than using the traditional mechanism (*etamam*).

3.2.3. Integration of traditional and introduced systems for designing and managing natural resources

3.2.3.1. Types of integration

While the review showed clear differences between traditional and introduced resources management systems, there were also marked variations in the extent and ways in which the two systems were integrated. However, across the four districts, the evolution of hybrid systems in some areas has been largely an unplanned, ad hoc process. This pattern of integration has previously been observed among Usangu communities in Tanzania.[29]

In terms of elements of traditional water facilities that have been adopted and adapted during the design of introduced facilities:

- Traditional livestock drinking troughs, made of wood (*atuba*) were used outside a watering point so that animals do not drink directly from a water source and contaminate it. Conventional systems have integrated this practice by using concrete troughs and placing them slightly farther way from the water source.
- Modern valley tanks and dams are similar in form to the traditional *ngataparin* that were dug by hand, although the valley tanks and dams are larger and deeper.

28 The Kobebe dam is located about 50 km from Moroto town and was constructed by the Ministry of Environment and Water in 2010; it was designed to serve over 3,000 livestock. It cost Ugandan shillings (UGX) 6.7 billion to construct, equivalent to about US$4 million.

29 Cleaver, 2001.

There are also examples of elements of traditional water management being integrated into water committees:

- Traditionally, different types of people were selected to manage water resources, including: elders, whose role was advisory and monitoring of water use; youths, whose role was implementing the decisions of the elders; and women, who controlled watering schedules at the water source. Conventional management systems have similar arrangements by defining different categories of people who should be on water committees. For example, of the nine committee members, three or four members should be women.
- Traditional systems considered women to be stronger in the control and protection of water sources than men. Communities have adapted this experience for the management of conventional water sources by making women responsible for collecting money for borehole repairs.
- In the traditional system, water sources along herd migration routes are established around settlements that have governing teams/groups. The same migration routes are used today, and, where modern water resources have been established, mobile herders have to work with the committees governing these water resources.
- The traditional use of emissaries and recognition of authority and ownership of water resources to allow for granting of rights and privileges for watering livestock have been integrated with recognition of formal structures such as local council representatives. In the FGD at Losidongoror Village, Lokopo sub-county, the participants described the process as follows:

The Matheniko are our brothers, the Turkana come to negotiate. This is how it goes. The Matheniko come to Lopeei, Lopeei asks Lokopo, do we have water? Then we say yes or no. The Matheniko will say, "… these people (Turkana) are saying there is no water in Turkana. Kijaasi robo *(please receive them). Then it is brought to the meetings. The LCIs, LCIIs, LCIIIs, and the elders consider their plea, then we give them the water. They bless the water by killing a bull, then we discuss conditions, and they then use the water easily.*

Traditionally, livestock are slaughtered to bless a process or activity and confirm community agreement or commitment. In some areas, a bull or goat is now slaughtered when a borehole is drilled as a sign of community contribution and, to some extent, ownership. Household cash contributions for borehole maintenance show that people are now using cash as well as livestock for "payments" related to water facilities.

Despite the examples above, as already stated, the overall level of functionality of introduced water facilities is low. Communities attribute this to weak management. There are cases where the integration has not happened or where dilution of cultural practices is evident. For example:

- Due to increasing reliance on introduced water resources, communities are losing their indigenous knowledge on water prospecting and constructing traditional structures. Communities noted that it is only the Turkana who still dig water resources.
- The use of water committees has weakened the role of the elders in society and in water governance. Their voice is no longer heard, and they are often asked, "You are saying this and that as who?"
- People migrated according to their clans in the past (e.g., Ngiporokori, Merimong, Ngoleret, etc.), and each of these groups/clans created their own water sources specific to them. However, today, this has been destabilized, with people migrating to fit in to an already set system of introduced water sources.

3.2.3.2. Integration challenges and complexities

Although there are examples of integrated water management, at community level there is a general feeling that local people are not consulted about water or rangeland management, and their involvement is peripheral. For managing dams, the community role has been reduced to providing labor, i.e., the opening and closing of water mains (taps) to control the flow of water. Furthermore, in the case of dams, communities feel that if they had been consulted they would not have introduced fish because when the fish die, they spoil the water. Plus, the dams were established where traditional resources already existed, and these had belonged to particular communities for generations. After dam construction was completed, communities had no direct control and voice, and people who were once owners of local water resources were invited to meetings to brief them on access and use like other users.

The kind of process outlined above explains why communities wait for others, such as government, to provide solutions. This situation undermines integration and appreciation of formal systems, and the

traditional systems see government as a cause of their current state of weakness.
Another concern is that the young generation is generally moving away from the traditional knowledge systems, especially those related to water resources. They have become accustomed to more modern water resources and have transitioned in knowledge, practice, and preference. However, they still have considerable knowledge on rangeland resources, where government interventions and those of development partners have been negligible.

Further complexity arises due to the expansion of cultivated land and corresponding decline in pasture, with apparent government support. For example, in the FGD at Losidongoror, Lokopo sub-county, participants noted that, "*When it comes to opening land for cultivation, there is a tractor but when it is about desilting a water source* (for livestock), *they want us to contribute, why?*" While it is beyond the scope of the review to examine the benefits of livestock versus cultivation, increased reliance on crops is risky in much of Karamoja precisely because of rainfall variability.[30] Related to wider issues of land ownership and land use, elite capture is also evident at community level. In part, this involves elites taking advantage of people's vulnerability by ensuring information asymmetry, i.e., the community does not have full information about a particular facility or process. For example, there were cases of personalization of facilities, with user payments going to individuals who are accountable to no one, not even to the community. In some cases, these individuals sit on water committees.

30 Cullis, 2018.

4. RANGELAND RESOURCE DYNAMICS AND MANAGEMENT

4.1. GRAZING RESOURCES FORMS AND PATTERNS

4.1.1. Grazing resources availability, access, and use

Over time, rangeland availability, access, and use tend to follow trends in conflict and peace in the sub-region, as illustrated in Figure 4.1:

- In the period to 1999, there was relatively good access and availability of pasture and browse. Armed groups and individuals were active during this period. Local access rights were enforced "through the barrel of a gun," and there was a balance of power.
- During the disarmament period, the movement of herds was heavily restricted, and so pasture and browse were available but not easily accessible or used.
- The period between 2010 to 2019 was relatively peaceful and saw good availability, access, and use of rangeland resources.
- The current period of renewed conflict is characterized by limited availability of pasture, and limited access and use.

Although the decline in rangeland access, availability, and use has varied across districts in the period from 2019,[31] three main causes were noted:

- Recurrent drought episodes, affecting pasture availability;
- Restrictions on internal mobility due to intertribal conflict; for example, the Pokot in Amudat had a significant reduction in grazing resources during the period of this review. In the adjacent districts of Nakapiripirit and Nabilatuk, grazing resources were abundant, but the Pokot had limited access because they

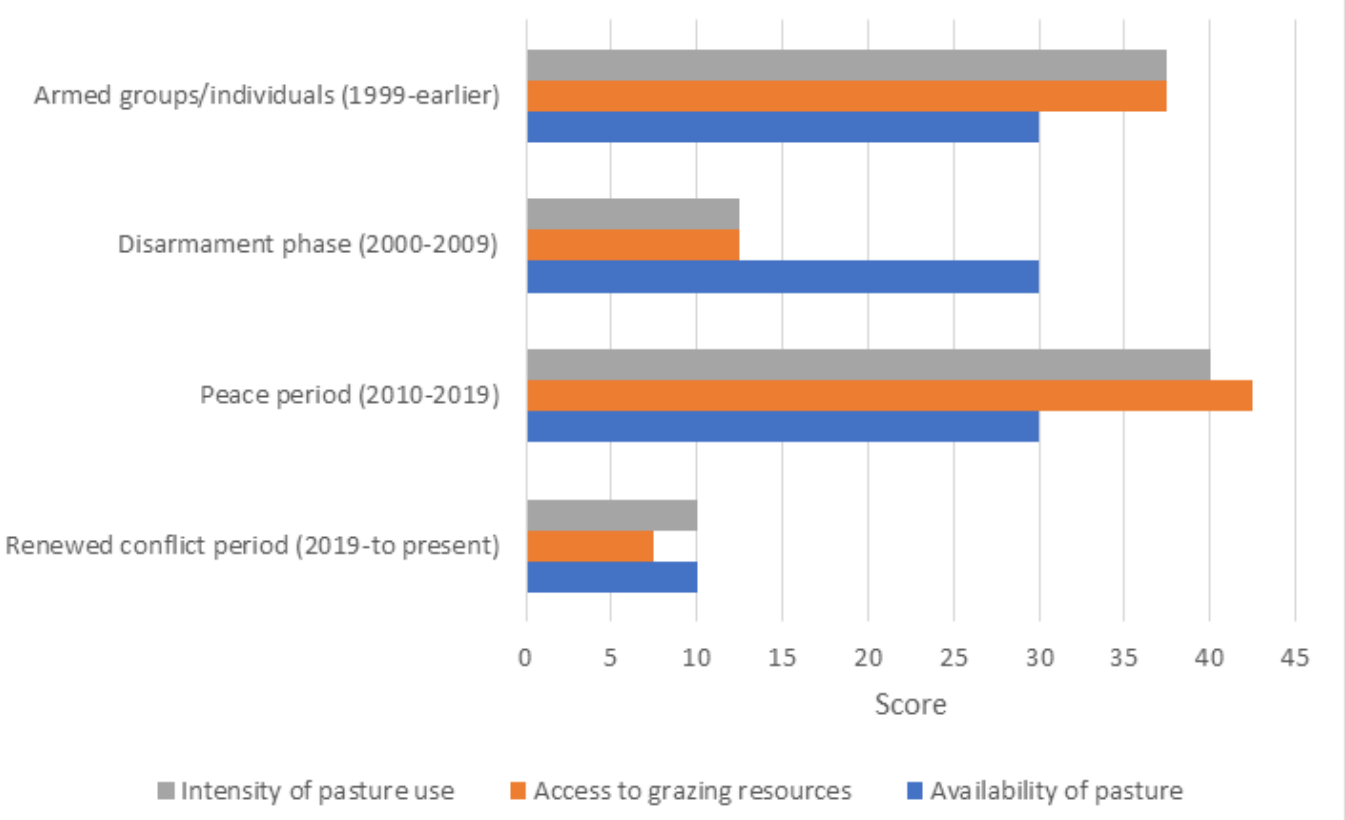

Figure 4.1 Trends in rangeland resources availability, access, and level of use in Lokale, Moroto District.

31 It is important to note that the districts in Karamoja have rather taken tribal administrative boundaries; Amudat for Pokot, Moroto for Matheniko, Napak for Bokora, Kotido for Jie, among others.

were believed to be the orchestrators of raids in the two districts; as such, they were unwelcome to graze;
- Restrictions in mobility outside the sub-region into the lower plains of Teso, Lango, and Acholi were a result of Government of Uganda restrictions and the intensification of agricultural and urbanization activities in those locations. People now avoid going to these previous grazing areas as a matter of self-preservation and avoidance of conflict. The current spate of conflict is beyond livestock rustling.

4.1.2. Grazing resources trends and patterns

Analysis of remote sensing and NDVI data shows patterns of vegetation cover in Karamoja that are broadly similar to community perspectives. The period 2000 to 2008 shows good vegetation cover, implying good availability of browse and pasture, followed by a slight increase in cover to 2017 (Figure 4.2). The period 2018 to 2022 shows a marked decline in vegetation cover, implying reduced availability of pasture and browse. Accordingly, participants noted that grazing resources in the current times become marginally available by the month of July in most locations.

Spatially, the amount of pasture and browse in the sub-region varied by season and by year over the 22-year period for which data are available (Figure 4.3). Grasslands dominated forage availability in the early years, but woodland becomes more important in later years. For example, dry season grassland availability declined from a range of 25,633–67,652 kg/ha in 2000 to a range of 8,879–13,034 kg/ha in 2022. During the same period, there was a marked spatial expansion of thickets and shrubs (the yellow areas in Figure 4.3). These changes were explained as follows:
- FGDs indicated that the sub-region has experienced repeated dry conditions. These dry conditions could be leading to reduced grass cover and increase in woody vegetation.
- Especially in the central plains, former grasslands were converted into farmlands, and these farmlands, when abandoned, especially in the dry seasons, are rapidly colonized by woody vegetation of thicket nature.

4.1.3. Grazing resources fluxes based on onset, end, and duration of greenness time

The Karamoja sub-region is a water-limited environment[32] where the availability of rangeland can be measured by the onset of greenness (OGT), the end of greenness (EGT), and the duration of greenness (DOG); DOG indicates the length of the growing season.

Compiled OGT, EGT, and DOG data over 22 years show four clusters of OGT, with the earliest growth occurring in central parts of the sub-region around the fourth week of March and the latest OGT seen in the first to second week of April, also in central parts of the sub-region (Figure 4.4). This is the period when graze and browse for livestock become available. Large swathes of the region show almost simultaneous EGT

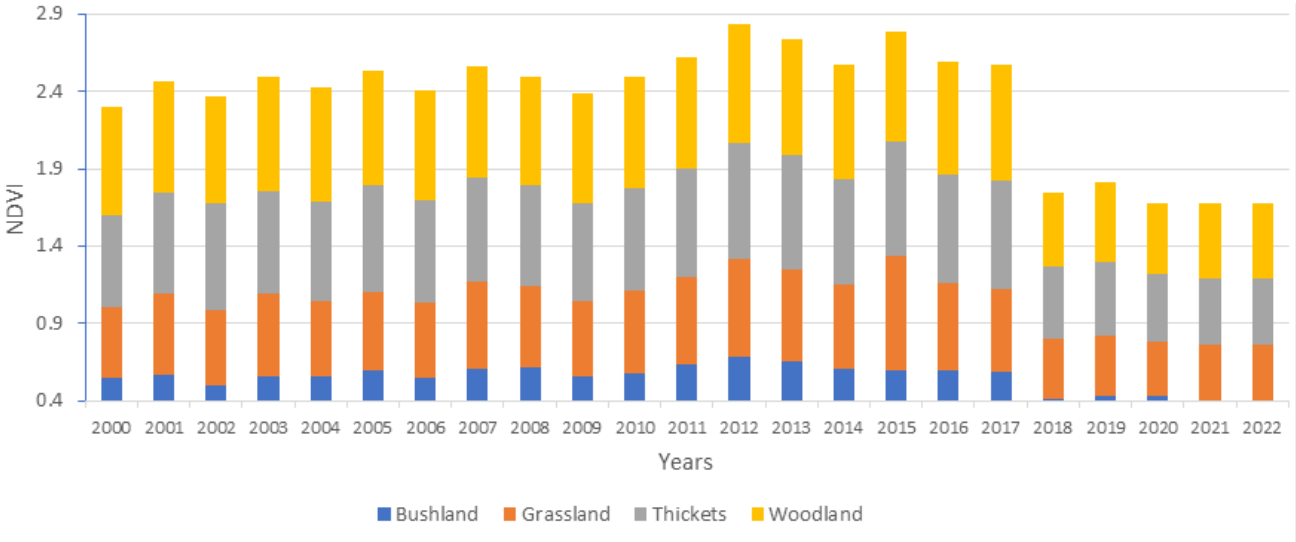

Figure 4.2 Trends in vegetation cover in Karamoja, 2000 to 2022.

32 Mugerwa et al., 2014.

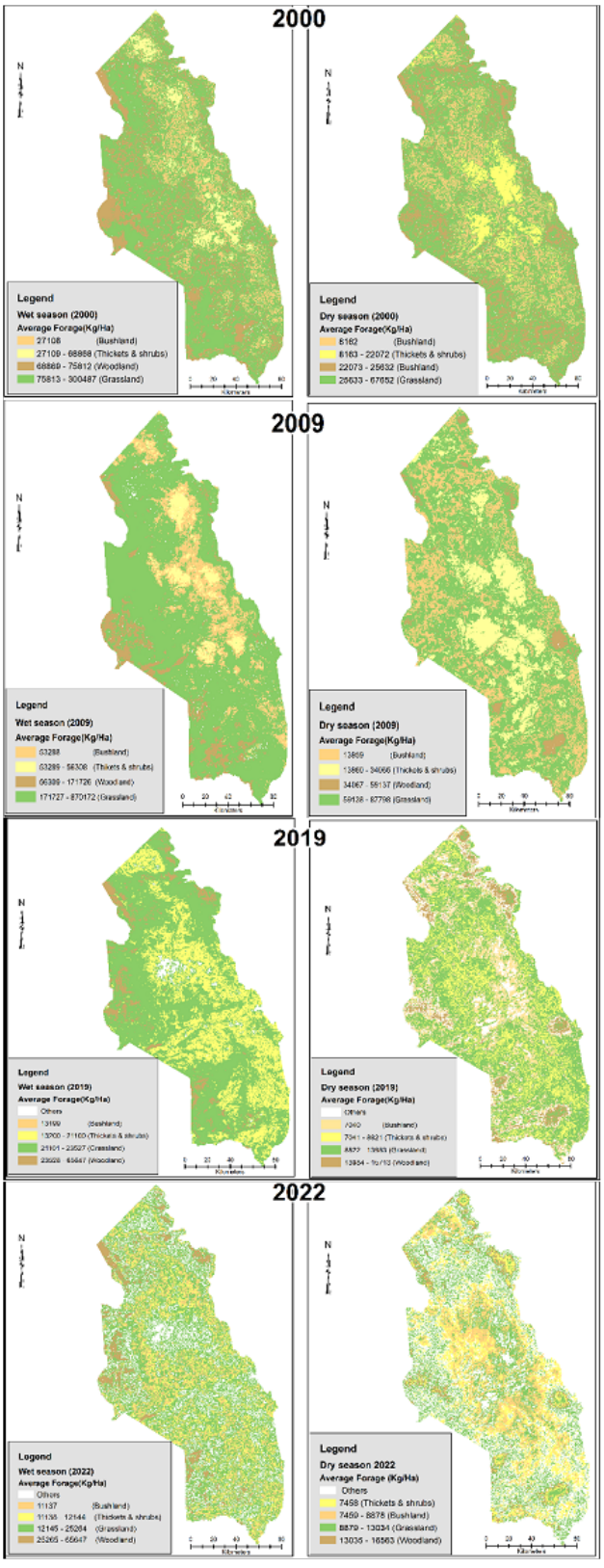

Figure 4.3 Wet and dry season forage availability in Karamoja over time.

in early to mid-September. At this time, herders begin to migrate as pastures decline in the wet season grazing areas.

In general, DOG increases moving from central to western and northern areas, including parts of Karenga, Kaabong, and Kotido Districts. These are the most vital dry season grazing areas within Karamoja, as confirmed by FGDs and key informants. One FGD reported that, "*In the dry season we go to Loongor and share grass with Ngikacherio. Loongor is the store of the Jie of this area.*"

Analysis of the specific patterns over the differentiated land cover types revealed variability for OGT, EGT, and DOG for all the 22 years of interest. Onset of greenness that depicts the picking up of vegetation vigor following periods of low activity over the 22 years revealed variability, with the earliest onset recorded as day 58th (130th), 62nd (110th), 64th (105th), and 74th (126th) for woodlands, bushland, thickets, and grasslands respectively. The bracketed numbers represented respective average dates of late onset of greenness time for the respective land covers that form the key grazing resources and grazing grounds. Similarly, the EGT varied across the grazing resources landscapes, ranging from 93rd (333rd), 150th (270th), 167th (331st), and 196th (293rd) for woodlands, thickets and shrub lands, bushlands, and grasslands respectively. The bracketed numbers represented the uppermost EGT observations, while the nonbracketed ones represent the earliest citations of EGT for respective land covers in the landscape. These variabilities point to the inherent heterogeneity of grazing resources[33] over the Karamoja landscape, with some periods of the years revealing an early availability while other periods reveal a very late availability as well as early decline and late decline of grazing resources. As such, there is significantly high uncertainty of grazing resources in the sub-region.

4.2. PREFERRED GRAZING RESOURCES

Participants' preferred types of graze and browse are summarized in Table 4.1. They equally noted that there were some introduced grazing resources (e.g., napier, calliandra, Rhodes grass, elephant grass, and lablab). However, their traditional ones performed better. One of the participants noted that, "*Because theirs also look like ours, there is no need to spend time and energy cultivating them.*" This was in reference to the introduced pasture resources. There are similarities and differences

33 Egeru et al., 2020.

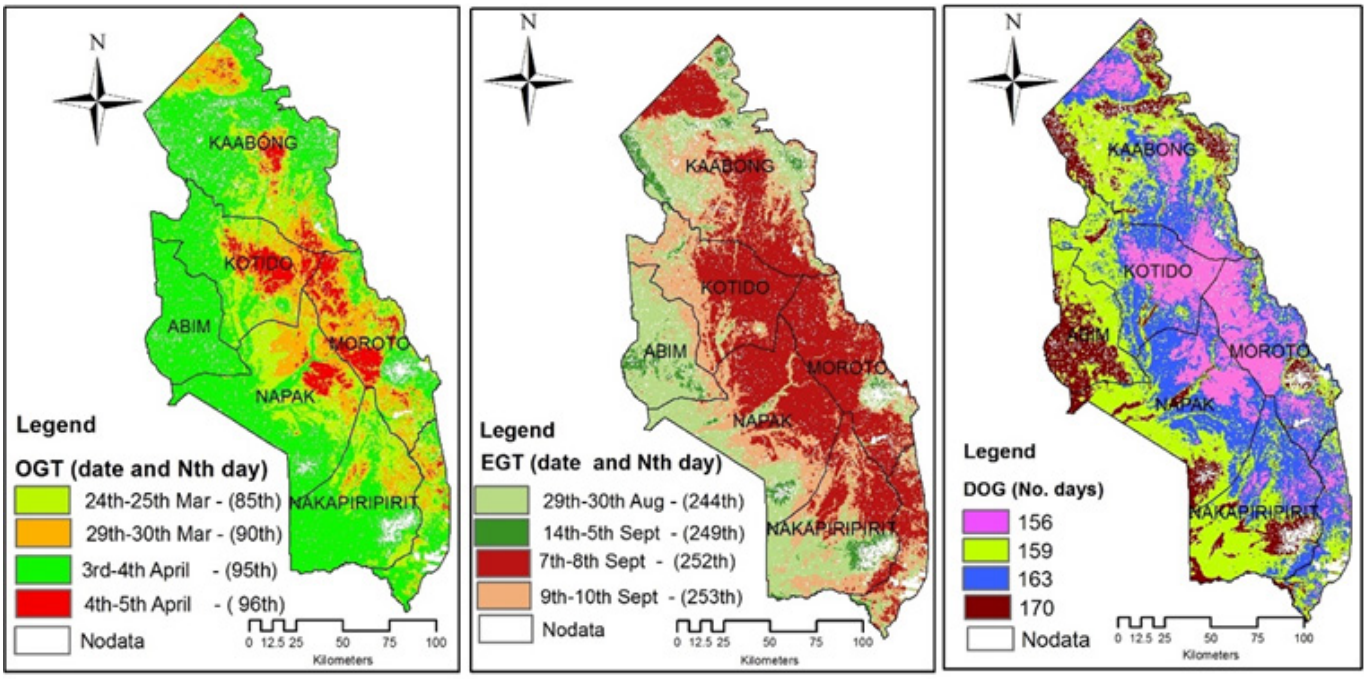

Figure 4.4 Aggregate onset, end, and duration of greenness time in Karamoja, 2000 to 2022.

Table 4.1 Grasses and browse grazing resources.

	Location	Important types/species
Grasses	Moroto District, Lotisan sub-county, Akwapua village	Grasses for cattle and goats: *elet, eesut, atuko, elepane, losaricho, esiloit, emuria, asuguru* Grasses for camels: *losaricho, abutachwee, ador, eliaro, lokaala, akuleu, ekaleruk, esuguru, ema*
	Amudat District, Loroo sub-county, Nailoit-Kongorok village	On mountains: *seretiyon (emuria), chaya (ejao), chepirion (esiloit), pekon (enyimanyim), ngilet (elet), ples (enyurnyur), churkechir, kimokona (ekaudu-udu, tumot ekou)*
	Kotido District, Kotido sub-county, Nayete 1 village	*Nyemuria, ngisilo* (at swamps), *elepane, eliaro, ebobolet, ngiletio, nyeewat* (at swamps), *nyatuko, ekipiit, nyema, nyekala, nyebiu, nyekou, nyemogorat, nyekutukuta chwee, ebiriwae* (at swamps), *nyesaali, nyekauda*
Other plants	Moroto District, Lotisan sub-county, Akwapua village	Plants for cattle: *edurukoit, eyaraboth, epie, echoke* Plants for goats: *etirae, aareng, ngakalio, ekaliyo, ekeeru, achogorum, ekuir, alila, eroronyit, ekapelimen, edurukoit, eyaraboth, epie, echoke* Plants for camels: *emekui, ekorete, ekadeli, ekuir, eligoi, alila, ngirega, aur-mosing, etirae, epoo, ekadwelwae, erogorogoite, engomo, ekeeru, etirir, ngaturgeso, eteteleit, epetet, esekon* Wild fruits for camels: *ngadekala, amugit, ngakolil, ekaleruk, eome, akaideit, edaldalasikin*
	Amudat District, Kongorok sub-county, Naloit village	For goats and camels: *kiptaru (ekurao), toronwo (engitiyo), kempirwo (eteteleit), molkotwo (epodo), manampelion (ekuir), sitet (ekali), renaa (ekoromae), tuyunwo (ekorete)*
	Kotido District, Kotido sub-county, Nayete 1 village	*nyekalie, akere, ekabeko, eereng, etirae, ekorete, ekodekodioi, epeeru, nyegirigirei, eboore, nyeleto, eyelo, ekapangiteng, nyekaale, elimoit, ekapelimen, nyeminit, epongae, edome, etulelo, eligoi* (mainly for camels), *etiir, nyeror, eusugu, engayom, ekadweluae*

in the feeding practices/resources between communities. Participants listed 36 different grasses that they considered to be good for their livestock. Similarly, they listed at least 56 other plants (woody and nonwoody) often used for shoat and camel browse.[34]

4.3. GRAZING RESOURCES MANAGEMENT

4.3.1. Traditional grazing management practices

Traditional livestock feeding practices are based on the use of natural rangeland, including grasses, herbaceous forage species, trees, and wild plants. Diverse practices are used depending on the time of year, resource access, and specific production objectives but with a strong overall preference for open grazing and browsing (Figure 4.5). Further details on different practices are presented in Table 4.2.

As indicated above, the use of different practices is seasonal, and Figure 4.6 clearly shows how a wider range of practices are used during the dry season and drought as pasture declines on open land.

Results of this exercise reveal that in the wet season, open browsing was predominantly used for goats, but this shifted to feeding on fruits of fig trees in the dry season, with acacia pods providing feed resources across the interphase period (*nait/kitokot*), dry season, and during drought (Figure 4.6). Meanwhile, feeding of cattle (cows)

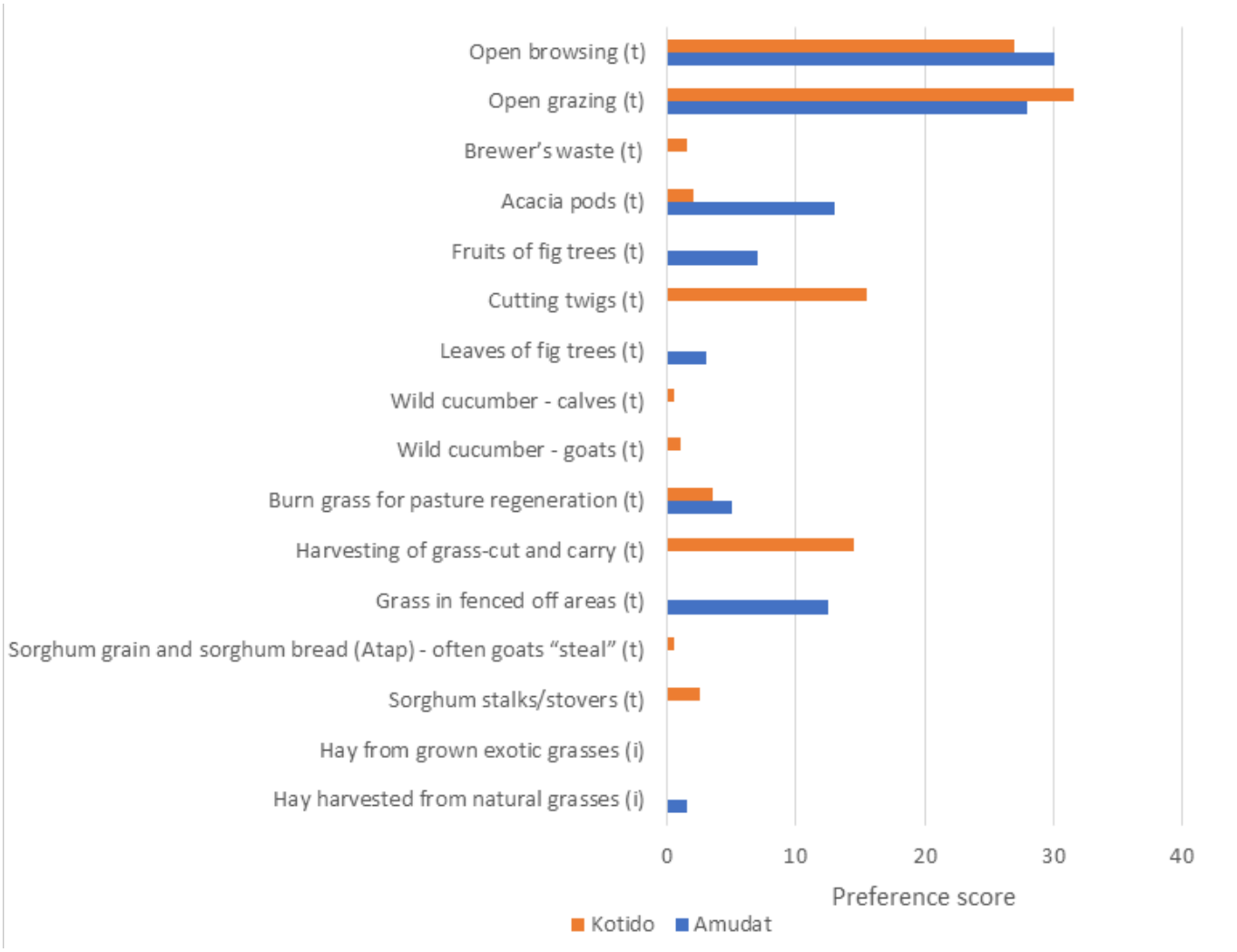

Figure 4.5 Preferred traditional and conventional grazing resources in Kotido and Amudat Districts.[35]

Note: Traditional practice (t); introduced practice (i).

34 The grasses and plants are listed by their local names. Given the short timeframe for the review, it will be important to undertake detailed documentation of the indigenous knowledge of plants and grasses in Karamoja sub-region, including identifying their indicated cultural, medicinal, and other uses.

35 Note that scoring was not successfully completed in Moroto and Napak. As such, those data sets were excluded from the analysis.

Practice	Rainy season	Interphase	Dry season	Drought
Open grazing around homesteads/settlements	•••• ••••• ••••	••• ••	••	
Open grazing–reserved grazing areas around/near homesteads/settlements		•••• ••••• ••••	•• ••• ••	
Open grazing–migration to utilize grass in the neighboring communities			•••• •••• ••••	••• ••• ••
Open grazing–migration to utilize grass in the regions outside Karamoja, e.g., Teso			••• •••	•••• •••••• ••••
Use of grass in fenced-off areas (alaar/kiwanja in Pokot)		•• ••	••• •••• •••	••• •••
Feeding on leaves of fig trees			•• ••• ••	•••• ••••• ••••
Bush burning for regeneration of grass		••• •••	•••• ••••••• ••••	
Feeding hay baled from natural grass			•••• •••••• ••••	•• ••• ••
Feeding hay baled from planted exotic grass			•••• •••••• ••••	•• ••• ••
Open browsing of trees	••• •••• •••	••• •••	•• ••	
Feeding on fruits of fig trees			•••• •••••• ••••	•• ••• ••
Feeding on acacia pods		••• •••	•••• ••••• ••••	••

Figure 4.6 Seasonal use of rangeland resources for cattle and goat production, Kaaron village, Amudat District.

is logically organized to match the gradual seasonal calendar. As such, open grazing in grasses around the homesteads and nearer areas is largely practiced during the wet season. This transitions to the utilization of open grazing in the reserved grazing areas near settlements in the interphase period. Open grazing through migration to utilize grasses in the neighboring communities and regions is then practiced during the dry season and drought periods (Figure 4.6). Bush burning commences during the interphase period and intensifies during the dry season to facilitate grass regeneration.

Table 4.2 Traditional grazing resources management practices.

Practice	Description
Grazing reserves–communal	The communal grazing reserves are known as *ngapeeror* in Ngakarimojong and *kokwo mogh* or *chambilwasitat* in Pokot. These are reserved grazing grounds for dry season grazing and are utilized under societal/traditional rules passed by elders. Grazing is only allowed at certain times of year, and each tribal community has structured its own exclusions. For example, the Matheniko of Moroto indicated Lokisile while the Pokot of Amudat in Loroo identified the hills towards the border with Kenya and the lower plains of Katabok as excluded areas. The reserved grazing areas are grazing areas closer to homesteads that are often used in the interphase period and during the dry season.
Enclosures for regeneration– mainly individualized	Fencing off an area (*kiwanja* or *alaar* in Pokot; *apeero* in Ngakarimojong) for pasture regeneration and use in the dry season. This is mainly for feeding weak/sick/old/pregnant cows as well as calves. In Amudat, the practice was common within farmed lands that had hitherto been fenced. Gardens at the riverbanks or swampy areas are fenced off; part of the garden is reserved for grass while maize and other crops are planted in the rest of the garden. When grass matures, it is first harvested for thatching houses or sold, and the remnants are reserved for animals. The owner first allows his own animals to graze but also allows animals of other community members to graze. This practice of sharing allows reciprocity such that his animals are also allowed to graze in other people's enclosures. Grazing in the enclosures is done on a rotational basis—one enclosure after the other—for the entire dry season depending on grass density/abundance, and for the few animals that remain at home as others move to dry season grazing areas. Community members reiterated that there are about 50 enclosures along the Kanyangareng River that belong to residents of Kaaron village. In Kotido, if a person is grazing their animals in private enclosures, they might be excluded from communal grazing areas. This will be disastrous for your animals when grass is depleted in the enclosures; thus the practice is not preferred in Kotido. Notably, in areas with high availability of pasture and water all year round, fencing off is not practiced. This means that the practice is more a product of competition in access to scarce resources by individual livestock owners, with the aim to have a reserve for their animals in the dry season.
Harvesting and gathering of acacia pods, fig tree fruits, and leaves and wild cucumbers as feed resources	Use of acacia pods (*sakaram* in Pokot; *ngitit* in Ngakarimojong) for feeding goats. Pods from *Acacia camplacantha*, *Acacia nilotica*, and *Acacia seyal* can all be used as feed. The pods are gathered from the ground, knocked from trees with sticks, or the trees are shaken to release the pods. Use of fig tree fruits (*makany mokongwo* in Pokot) and leaves (*sokogho mokongwo* in Pokot) for feeding cows and goats. In Kotido, wild cucumber (*ngadekela*) is used for feeding goats.
Open and free grazing	All participants agreed with the notion of free and open grazing as one of the mechanisms for controlling grazing intensity, as well as securing access to grazing resources occurring at landscape level. They recognized that some pastures are better at certain times of years, and they distinguished between salty pastures and nonsalty pastures in specific locations.
Crop residues, grain, and bread as feed resources	Sorghum stover/stalks (*ngakasirim* in Ngakarimojong)–animals feed on them after sorghum is harvested. Sorghum grain and bread (*atap*) are also used for feeding goats.

Table 4.2 Traditional grazing resources management practices (continued).

Practice	Description
Traditional grass cutting for hay	Though used on a small scale, this practice was used to feed calves, lambs, and kids around the homes (*ere*) as well as weak/sick/old/lame cows and goats.
Regenerative burning of open grazing lands	This was considered to be one of the most important strategies for ensuring availability of tender pasture resources. Herders monitor locations that could have reached a level necessary for fresh pastures to regrow during the dry season. Burning was noted to have additional benefits, including: tick control; scaring and reducing predators that would attack livestock; creating clear visibility to limit enemy intrusions; creating paths for ease of goats, sheep, and other smaller ruminants to access pasture; and for hunting rats.
Controlled burning	Participants indicated that they occasionally perform controlled burning in order to protect the reserved grazing grounds (their stores) so that wildfire from elsewhere does not clear the pasture lands. Second, it enables them to have gradual transitions of grazing across the seasons, gradually moving from *pengat* (wet), *kitokot* (interphase), *komoi* (dry), and to the *pekhat* (drought) period. There is variation in this practice. In Kotido, there is "no burning of grasses" at the swamps; they are reserved for animals that remain at home when others move to the mobile camps (kraals) in the dry season. Additionally, burning of grass has been prohibited and can only be accidental. This is because the dry season grazing areas cannot be accessed because of insecurity, and communities cannot afford to lose the little pasture around homesteads through burning. People can burn *elepanae* (an abundant grass species) and it regenerates; this is only when it is sanctioned by the community through the elders. But burning *elet* (the common grass species around homesteads and main grazing areas) might lead to its extinction and the consequences might be dire at this time, as the far grazing areas cannot be accessed because of insecurity. The grass around homesteads is prone to termite attack, so people cannot burn the little available. However, in places with a lot of predators, the community through the elders can sanction the burning of that particular area. The other thing that compels the community to burn grass is to allow regeneration of grass for sheep; sheep do not like tall grass, and this makes rearing/herding of sheep more difficult than that of cattle (cattle can graze tall grass).
Regulation of burning cycles	Participants indicated that they exercise local authority through traditional systems to control unnecessary burning of pastures. Burning is unacceptable if the right season has not arrived. Those burning before the culturally accepted time are sanctioned based on the local customs.
Noncutting of trees and bushes	This management practice is more prevalent in Amudat, where bushes are more pristine. All Karamoja districts have formal bylaws/ordinances on cutting of trees and bushes, but these laws are not implemented. Participants in Amudat said they implement bush and tree preservation because of cultural attitudes. It is believed that, "*If you burn charcoal, you will be poor or a curse will follow you.*" Through these actions, browse for goats, sheep, and camels is locally available in the district.

4.3.2. Introduced grazing and forage management practices

There have been some efforts to introduce practices in Karamoja related to pasture management and forage production. However, as some of the practices are very similar to the traditional practices described in Table 4.2, there is often a grey area about what constitutes a "new" or "improved" practice relative to what people were already doing. Some communities reported more introduced strategies/practices than others, and this

was attributed to the availability of the resource, the level of diversification of grazing resources, community acceptance of a practice, and adaptation to the increasing scarcity of resources.

In general, introduced interventions were less preferred compared to traditional grazing practices (Figure 4.5). However, when scored separately (but based on their limited experience), communities ranked the introduced grazing resource interventions in the following order of preference: first, hay making from natural pasture (where some benefits have been seen); second, growing grass (did not see any benefits); and third, fencing off an area for pasture regeneration (did not see any benefits). Further notes are provided in Table 4.3.

Key informants reported that several of these newly introduced grazing and forage management practices had limited success. In general, this was because interventions were project driven and once a project ended, the interventions also ended. In addition:

- Communities do not see the need to spend time cultivating grasses that are similar in form with the locally available grasses in the rangelands;
- Limited integration of the intervention into community practices and indigenous knowledge;
- Differences in the incentives regarding the introductions; while for the researchers and civil society it is often anchored in the need to build the resilience of local communities, the local communities on the other hand see these projects as simply a means to earning an alternative livelihood through casual labor provision;
- Short duration of the interventions, meaning that they are unable to induce behavioral change among the pastoral and agropastoral communities that have for long depended on naturally established grazing resources;
- Highly variable weather in the region that often limits both introduced pastures and traditional pastures;
- Piloting could yield some success if done with individuals (on plots of individuals), and the group approach was used mainly for purposes of training.

Table 4.3 Introduced pasture management and forage production practices.

Conventional management practice	Description
Prohibition of burning	Participants knew about this practice. However, their compliance is negligible. In one of the FGDs in Amudat, one of the participants noted that, "*Even if government comes, we shall never stop burning, because we know how, when, and where to burn*."
Controlling and negotiating agricultural fields' establishment	FGD participants felt that cultivation was one of the threats to their grazing lands. Accordingly, they had taken decisions to restrict locations where farming fields would be established. Expansion of farm fields would follow negotiations at community level. In the FGD in Namoruakwangan village, Napak District, the participants noted that, "*If a man had the power of a tractor, he still would not be allowed to open an expansive farmland to the detriment of the rest. In our case, the man who owns a tractor also owns livestock. If he buys a tractor to increase cultivation activity, he will thereafter acquire more livestock from the proceeds of cultivation*."
Fencing for recovery	Participants observed that some form of fencing was introduced in a demonstration area around Lokitisan but noted that livestock were not allowed to graze in the fenced area. Fencing has been done using both traditional materials such as thorns, and wire mesh or barbed wire. Some pilots were implemented by an international NGO (INGO) in Achorichor.
Grass seeding	As part of restoration process, grass seeding was done through oversowing on the patches of land without removing other grasses. The oversown grasses are managed to enable regrowth. The local grasses that were considered part of this activity include *atuko* and *elet*.

Table 4.3 Introduced pasture management and forage production practices (continued).

Conventional management practice	Description
Growing exotic grasses	The practice of growing exotic grasses has been piloted in the sub-region. In Amudat, it is locally called *parasus* (Pokot), meaning a farm of grass. It was piloted with women's groups, using farmer field schools. The plot ("farm") was donated by a community member but later repossessed on account of lack of benefits even to group members. Community members highlighted the following challenges associated with this activity: • The grasses were planted late in the year—after the first and the usually heavy rains. These grasses are susceptible to drier conditions. • The grass dried due to failed rains, and the dry grass was destroyed by termites. In addition, the experimental plot was wrongly sited on a drier piece of land. In the view of the community, planting grass on a wetland would have been a better option given that this type of grass requires a lot of water. • Although these exotic grasses need a lot of water to grow, there was no provision for irrigation or watering when rains failed. • Group members preferred that animals be released to feed on the grass on the farm rather than cutting and taking the grass to animals at home. • Excluding animals of nongroup members was unacceptable even to group members. As a community that practices collectivism and social support, such exclusions from benefits of the activity would lead to exclusion of group members from community activities and related benefits. • Group members were discouraged by lack of benefits. In Kotido, this practice is called *akitare nginyaa a ngatuk; akipit nginyaa*. It has been piloted by NGOs and government with mixed-gender groups in farmer field schools. There were also a few individuals who tried it on their private land. Whereas the group-based approach failed, there was some success among individuals. Several factors explained the failures experienced among the group established pilots, including: • Experimental farms belonged to groups, but land was donated by individuals. • Livestock invaded the grass plots, and the grasses were limited in variety—only two species were tried. • There was insufficient rainfall. There was no provision for water for irrigating the pasture. These grasses are not fit for drier areas but for areas with a lot of water. • Poor fencing—animals destroyed the grass, especially goats. Some invasion into the farms was intentionally done by certain livestock owners. Attempts to ask for compensation or apply penalties resulted in conflict. • Late planting of grass—not well timed for better growth. • No benefits seen/accrued—no incentive or motivation to work. Communities expected the following benefits: source of income (income from baled hay); increased milk production and weight gain for animals that fed on it; expansion of the plots/farms if found to be useful. • Elite capture—in some areas, individuals (top group committee members, especially the educated) took over the group farms and individualized the benefits. They cut the grass for their own animals; they also harvested and sold grass (gained income). Some individuals had to employ people to fetch water to irrigate the grass. Group land was reportedly individualized in some places. • Community was against an intervention that accrues benefits to a few people.

Table 4.3 Introduced pasture management and forage production practices (continued).

Conventional management practice	Description
Growing exotic grasses	• Insecurity—people could not concentrate on the plots because of insecurity and because of government arrests during disarmament. Insecurity also displaced people and animals from areas with pasture farms. The farms were located in distant, insecure areas. • Fear that the intervention might stimulate privatization/individualization of land (grabbing of land that is meant for communal and free grazing) and this would lead to land-related conflict. • Superstitions associated with: fears that one might be called a witch (that you are bewitching rain so that grass for open or free grazing does not grow); and that the practice of planting and harvesting grass in the neighborhood of gardens will attract blame if the crops fail. You will be called a witch. There is the belief that if you grow grass, God won't be happy and will not bring rain. According to communities, growing these grasses could be the reason why rains have failed consecutively in the last few years. "*Why should we grow grass when God is making them available in abundance everywhere for free?*" (FGD, Chachaun village, Rengen sub-county, Kotido District; FGD, Lomudit village, Nakapelimoru sub-county, Kotido District).
Livestock feed relief	During drought, feed relief for livestock has been provided through the distribution of grass and salt blocks. In Kotido, it is locally called *nginyaa lu aenitae lu akori apukan lu arukito ka abalangit*. This practice only supported a few animals, and insufficient quantities of feed were distributed. In groups, people were reluctant to discuss the benefits of this practice because they do not want others to benefit, or because of the fear that their cows will be bewitched. Also, as the feed supply was limited, they feared competition, and they were waiting until they accrue enough benefits and become wealthy (are a class above others) before they share their experiences. This situation implied that the feed support was beneficial but only for those who received the feed. Consultation with one recipient of feed seemed to confirm this, as the following benefits were described: • Reduced livestock movement to distant and insecure areas where natural salt licks are available, especially for special types of livestock such as the lactating, old, and weak cows; • Reduced the number of animals getting lost in the grazing areas as they look for salty grasses or salt licks; • Improved body condition of weak bulls, which were later able to fetch higher prices; • Increased milk production—good for lactating animals; • Accelerated the growth of calves; • Bought land using proceeds from sale of milk and live animals; • Improved appearance or hair coat of animals (shiny and original color returned, i.e., the beauty of the animal returned).
Ploughing and seeding	Some demonstrations involved ploughing of gardens and planting of specific grass species in Loburuk (Moroto) and Poron (Napak). Key informants noted that there were earlier experimental sites in Nakapiripirit, but these collapsed after project closure.

Table 4.3 Introduced pasture management and forage production practices (continued).

Conventional management practice	Description
Hay making/hay baling	Participants noted that there had been efforts to train communities on hay making. For example, communities in Loroo, Amudat District had been trained by Millenium Promise (an NGO). Meanwhile, a key informant noted that Nabuin Zonal Agriculture Research Institute had piloted hay making, including teaching the communities on the process of hay making and the distribution of Chloris gayana (Rhodes grass). Participants in the FGD in Lokale noted that hay making is something they have heard about while participants in Napak noted that, "*Our cows will not eat that dry grass when cut, they can eat dry grass but it has to be standing*." In Amudat, this activity is locally called *muutata cheminingwa* in Pokot while in Kotido/Moroto/Napak, it is locally called *akinger nginyaa angibaren*; *akiruk/akidich/akichakchak nginyaa*. Hay baling faced numerous challenges, such as: • Difficult to get grass to cut when rain is insufficient or fails; • Disturbance from animals if the plot is not well fenced; • Lack of or poor storage facilities for bales—animals access and feed on them. If rained on, they rot and lose taste, so animals refuse to eat; if stored on trees, strong winds in the dry season damage the bales and they are prone to theft; • Bales can be destroyed by termites; • Breakdown of baling machine; • Animals do not like dry grass; • Communities do not approve of benefits going to a few people; rather they prefer that the whole community benefits. Benefits being enjoyed by a few people would lead to their exclusion and denial of social support at the time of crisis; • Can only work with few animals. Cannot support the number of animals currently owned because the quantity harvested is often small; • Snakes were hiding in the hay bales, and this discouraged people; • Cutting grass is time-consuming and labor-intensive, and there is little incentive to do it; • At a certain time of the year, good grasses can only be found in insecure places—insecurity limits access, and there were cases of people who were being attacked by raiders or asked to show the locations of animals.
Grasses–alley, boundary, and buffer planting	Participants indicated that some interventions such as planting of grasses locally called *lokipi* has been undertaken, especially around valley tanks and earth dams. However, this has not been spread beyond these facilities to the communities.
Browse trees planted along farm hedges	In experimental plots, participants noted trees that could serve as browse had been planted along the hedges. These trees were *ekorete*, *ekodokodoi*, *ekapelimen*, *epia*, *ekaliya*, and *etopojo*. However, they wondered why these trees were not used as livestock feed.

Similarly, communities saw limited functionality or benefits from the introduced practices. At the time of this review, none of the assessed external interventions were functional. In terms of benefits, only hay harvesting from natural grasses showed some impact during project implementation. Community expectations from these new practices included:

- Increased availability of grasses, especially in the dry season;
- Use of grass to feed weak animals in the dry season so they become healthy—healthy animals sold at better prices;
- Increased milk production in animals fed on these grasses. This would increase milk availability for household consumption and sale as surplus milk is often sold to generate income, especially in the dry season;

- Increased household savings through saving part of the money from sale of animals and milk. They had anticipated their household savings in the Village Savings and Loan Association groups would be boosted;
- Increase in the number of weak and milking animals left at home when others migrate to dry season grazing areas;
- Increase in the number of animals that remain at home so as to increase availability of rumen ingesta from eructation for use to treat people with mental illnesses in the dry season when most of animals have moved to kraals. This is a common practice among the Pokot in Amudat District.

4.3.3. Drivers of rangeland changes over time

Both rainfall and grazing intensity are known to be key determinants of the availability of grasses and rangeland productivity in semi-arid areas.[36] In Karamoja, the diversity and abundance of important and nutritious grasses was generally perceived to have been higher during the period of conflict (before 1999) and before disarmament (2000 to 2009). During these periods, access to grazing resources was generally possible because balance of power was maintained through the barrel of the gun. The abundance and diversity of grasses could thus be explained by the perceived high rainfall as well as limited grazing pressure.

It is well known that local conflicts can limit access to rangelands in dryland areas of Africa,[37] and Karamoja has experienced similar challenges (see Figure 4.1). As shown in Figure 4.7, in Naklesia village (Kotido District), the diversity and abundance of nutritious grasses declined during disarmament and the following period of relative peace (2010 to 2019), but access

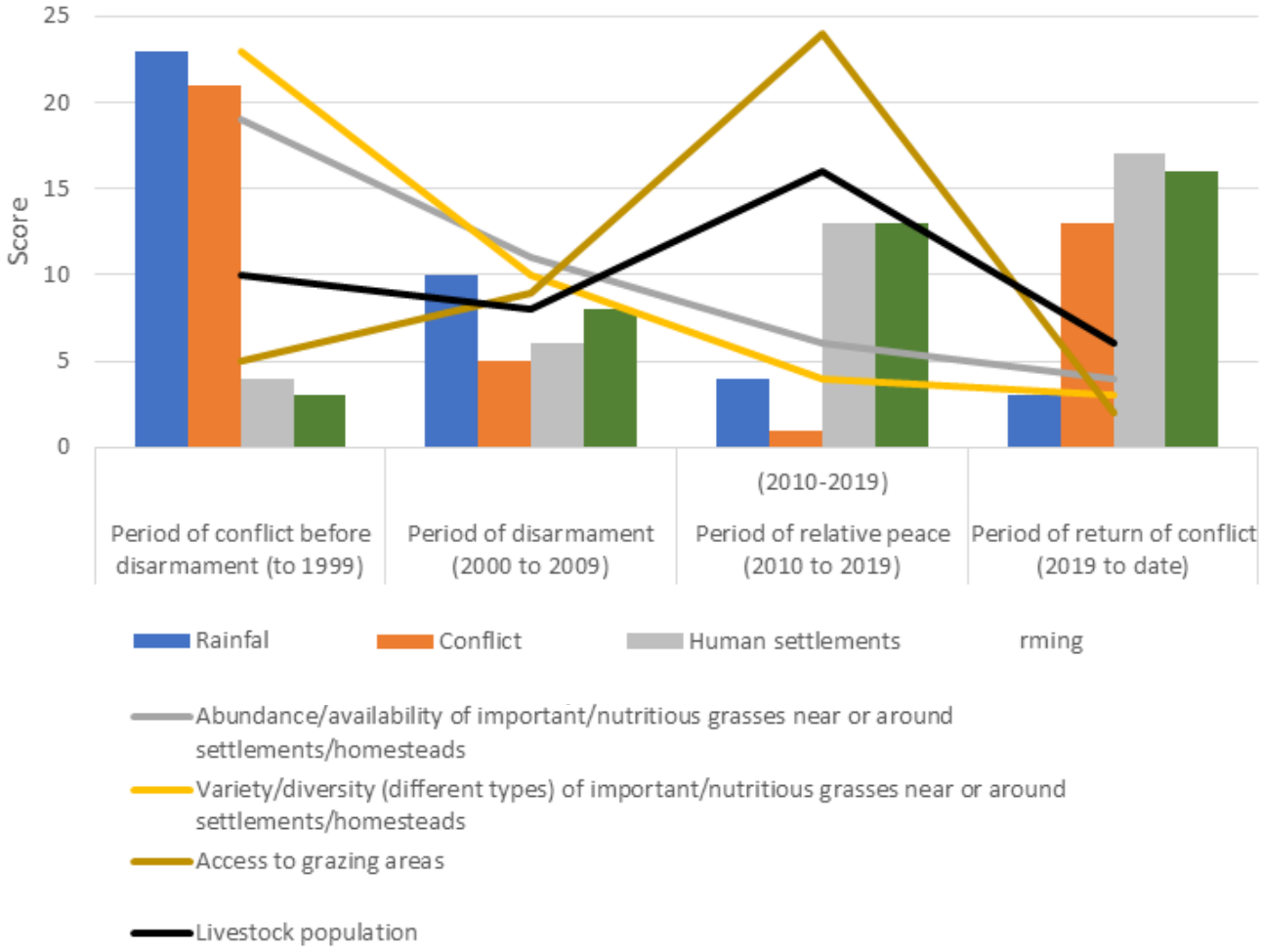

Figure 4.7 Grazing resources patterns and perceived drivers through time, Naklesia village, Kotido District.

36 Pfeiffer et al., 2019.

37 For example, see Berger, 2003.

increased during the latter. There has also been a notable increase in human settlements and farming, and these are seen as local drivers of declining pasture availability. Also see Figure 4.3, showing long-term declines in grassland productivity. As reported by communities, these long-term changes impact on livelihoods, most especially on livestock population, milk production, and livestock health. Also note the difference in pasture accessibility over time between an area in Moroto District (Figure 4.1) and Kotido (Figure 4.7), illustrating the difference in conflict intensity between locations.

Beyond the general patterns described above:

- There is free-range grazing in the rangelands, with each grazing group being aware of which direction and location to utilize during a specific period.
- In the past, grazing by the herders happened across community landscapes (*ngitela*); however, this is not possible today because of insecurity.
- Traditionally, the leaders of grazing management were the kraal leaders, *ngikungui* (diviners), and *ngikarwook* (the notables).
- Emissaries (*koryang, loteng, lotingorok*) would meet communities ahead of time to assist with planning livestock movements and explaining to them the extent of drought conditions and the locations of available pastures.
- When livestock disease outbreaks occurred, affected and nonaffected herds were positioned in separate watering and grazing locations to prevent herd mixing. Elders (*ngikasikou*) were very strong in the administration of this system.
- Local indicators were used for monitoring grazing resources; for example, depending on the grasslands, some would appear "quasi smoky" (*epurui*) as if there is a fire burning. If such were happening, then livestock would not be taken there (*italeo ngitela ngulu*).
- Herds were structured, so cows with calves would be sent home while the main herd remained at the kraal.

Participants provided insights into the changing nature of rangeland availability and access, and local management practices. With regards to management, it was reported that respect for elders has reduced, and likewise, when traditional rules were broken, there was less disciplinary action now than in the past. This was attributed to the weakening of the elder's authority (Table 4.4).

4.3.4. Current disarmament practices and their impacts

During the government disarmament program from 2000 to 2009, livestock mobility and access to traditional pastures were severely constrained. Under the disarmament program, a widespread system of "protected kraals" was set up by the Uganda People's Defence Force (UPDF) in which herds were forcibly restrained in enclosures and access to pastures was controlled by the UPDF. This led to abnormal concentrations of livestock in the enclosures and related disease outbreaks, and drastically reduced access to good-quality pastures. The overall impact was increased livestock mortality, for example:

> *An assessment by a Tufts team documented the extent of animal losses following the introduction of the protected kraals.*[38] *Coincidentally, this team also worked in Nangolmuria village in Kotido, where they estimated that 41% of the total herd had been lost between entering the protected kraals in 2008 and the time of data collection in early 2013. In two sites in Kaabong, herd losses since entering protected kraals were 39% and 47% for kraals entered in 2008 and 2007 respectively.*[39]

These losses are reflected in Figure 4.7, which shows a declining livestock population during disarmament and a later increase in population after disarmament. During the current review, similar control measures were evident under the ongoing government disarmament efforts:

- All livestock—cattle, goats, sheep, and others—are kept in the military barracks by the UPDF, and their release for grazing is decided by the military.
- Grazing resources in the immediate area are often depleted very quickly because of the restrictions by the military on how far those grazing can go.
- There is repetitive grazing, with no new types of pastures accessed during a particular period.
- Owing to concentrated grazing, livestock disease incidence is often high in the protected kraals under the guard of the army.

38 Burns et al., 2013.

39 Cited by Stites et al., 2016.

Table 4.4 Past and present changes observed by communities in grazing resources and management systems.

Indicator	Past	Present
Respect for elders' authority for organized grazing	High	Low–youths not respecting elders' authority
Elders applying disciplinary action if someone is found grazing in reserved areas or if found burning grass without it being sanctioned	Strongly applied	Weakly applied because of the weakening elders' authority and the increasing disrespect from the youths
Abundance/availability of important grasses and plants for animals	High	Reduced by: frequent droughts/increased rain failures; increased livestock population; increasing human settlements on grazing areas; increasing land under cultivation
Pasture regeneration after burning	High–enough rain	Low–less rain
Human settlements on wet season grazing areas	Few	Increased and disorganized, leading to shrinking of grazing land
Human settlements on dry season grazing areas	None–was not allowed	Increasing–this is fueled by the increasing need for farmland. This has an impact on abundance and variety of pasture and trees important for livestock.
Farming	Low	Increased–affects access to and size of pasture land, and affects pasture availability around homesteads
Availability/abundance of nutritious ("salty") grass near settlements/ homesteads	High	Reduced by less rain, and this has an impact on milk production and health of animals. Most nutritious grasses such as *ngilet*, *mokona*, *alepana*, and *surkechir* require a lot of water to grow. Currently, animals have to be moved long distances to areas with salty licks. Some people have resorted to buying salt/mineral blocks for animals (Amudat). Signs of craving/mineral deficiency in animals–eating clothes, soap, and soil.
Availability of nutritious grasses in the distant grazing areas	High	High–nutritious pastures still exist in the distant areas. However, access is limited by insecurity and lack of water close to these areas.
Variety/diversity of important grasses and plants (bushy vegetation) near settlements	High	Diversity of grasses reduced by rainfall failures/droughts and farming activities. The following priority nutritious grasses have disappeared around settlements–atuko, elet, nyemaa, esiloit. Diversity of trees (including tree cover/ abundance) around settlements has been reduced by cutting for building houses, fencing of homesteads and gardens, charcoal burning, expansion of gardens.

Table 4.4 Past and present changes observed by communities in grazing resources and management systems (continued).

Movement to areas with salty licks	Less common due to abundance of "salty" grass	More common due to reduction in "salty" grass
Purchase of salt/mineral blocks for animals	Not done	Becoming common (Amudat)
Impact of insecurity on livestock's access to distant areas with abundant and nutritious pasture	Less impact because people were armed	High impact because of less protection of animals and people by government
Level of protection/security of animals and people so they can access grazing resources	High because people were armed	Limited protection from government
Grazing hours per day	Many	Reduced by insecurity and protected kraal system
Period that animals spend in an area before pasture is depleted.	Longer because of low livestock population and security	Shortened by: insecurity–compels animals to be concentrated in one place (increase livestock density per area per time); increase in livestock population (some animals coming from Kenya–case of Amudat)
Exclusion of certain groups from grazing areas	No exclusion. Pastoral areas are characterized by challenges such as insecurity that require collective action.	Exclusion seen in areas where community elites have zoned off some grazing areas
Privatization of grazing areas	Not practiced	Done by community elites in some areas, and this will potentially cause internal conflicts.
Ability of pasture to withstand harsh conditions, e.g., drought	High–because of the preceding high amounts of rainfall	Low–because of less rainfall. Some grass species have disappeared.
Ability of grass to regenerate after grazing or drought or burning	High–because of enough rain	Low or no regeneration–because of low rainfall
Ability of grasses to make animals satisfied or provide animals with the nutrients/energy required	High satisfaction of animals	Animals not getting satisfied because of low vigor/strength of grasses. Vigor reduced by low rainfall
Vigor/strength of grasses	High vigor	Low vigor because of low rainfall

With these livestock movement restrictions in place, it can be expected that levels of livestock mortality will reach similar levels to those seen during the earlier disarmament program in 2000 to 2009.

4.3.5. Integration of traditional and conventional grazing resources management systems

Discussion of the integration of traditional and introduced systems of rangeland management are complex at the current time because "introduced" systems include those introduced by NGOs and government (with improved rangeland or livelihoods objectives), and the current system of livestock "protection" under the UPDF (presumably with security-related objectives). Despite this, participants identified the following potential linkages between traditional systems and aid/government programs:

- Pasture reseeding should use local grass seeds and take account of traditional pasture management.
- Mapping of migration routes could combine traditional knowledge (e.g., through the use of participatory mapping) with information from satellites and telephones, thereby supporting an integrated management system.
- Grazing rights based on maintenance of peace and peaceful coexistence has been passed on

from the traditional grazing management system to the conventional management system; in the conventional management system, herders seek authority and clearance to move their herds to a given location from local authorities, police, and military services prior to any movement happening. During the course of this review (May to June, 2023), the Pokot in Amudat were already experiencing substantial deterioration in pasture quality due to intensified grazing but could not migrate to the lower plains of Nakapiripirit and Nabilatuk where better pastures existed because of insecurity.

- Under introduced systems, use traditional kraal locations and ensure basic services to these locations, including security.
- Better integrate conventional research systems with indigenous knowledge systems. Use participatory research approaches to fully document indigenous knowledge on rangeland resources, and, for example, link local names for plant species and their qualities to scientific plant names. When pilot pasture demonstrations are used, codesign and coevaluate these pilots, and jointly agree on how livestock will access the areas used.
- The traditional system of emissaries for planning livestock movements and negotiating access has been extended to the present context, with the emissaries meeting with District Local Government leadership and Uganda police, and, where present, the UPDF.

The relative permanency of the military barracks in Karamoja and the strategy of limiting livestock movement for security reasons is creating localized land degradation. In the FGD at Nasinyon village, Kacheri sub-county in Kotido District, participants noted that, "*If government was appreciating our ways of using water and grass, they would be migrating from military facilities like we used to but, for years, the cows have not migrated*."

5. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The general conclusions from the review are:

- There is still a substantial and unmet demand for reliable, well-sited, and safe water facilities in the four districts of Karamoja visited by the review team.
- The overarching challenge with water development is that new water facilities are localized in terms of being physically present at community level and they are not well localized in terms of community or joint ownership, or community or comanagement.
- Despite having well-established traditional management systems and rules in place for indigenous water resources, these are not being transferred to introduced water facilities management. The net result is limited functionality of introduced water resources and limited community commitment or capacity to maintain these resources.
- Water development has focused on "hard inputs" such as construction, with less emphasis on "soft inputs" and meaningful participatory processes to ensure community involvement in planning, execution, and management.
- There is generally a preference for water facilities that supply water all year round, with agropastoral and pastoralist communities' preference being to secure access to rangeland and water resources during both the dry season and drought episodes. However, three important challenges are evident in fulfilling this need:
    - Access to substantial areas of good-quality rangeland is restricted by insecurity; these resources become unused while accessible areas become overgrazed. Conflict management is critical for maximizing the use of the rangelands that are currently available but not accessible.
    - Other dry season rangeland areas are underused because of limited water availability; in terms of the siting of new facilities to support efficient rangeland access, water development projects are not well aligned with pastoralists' priorities.
    - Grazing resources over the region are variable but are generally better in the southern and western plains of Karamoja. However, there is an overall trend of declining access to grasslands over the sub-region traceable from around 2017; this is evident from remote sensing data (Figure 4.3) and is corroborated by indigenous knowledge (e.g., Figure 4.7). The drivers of this trend are declining rainfall, increased and unregulated settlement and farming, and conflict. At the time of the review, access to productive rangeland was further hindered by disarmament strategies that include the forced containment of livestock near military barracks, cessation of livestock mobility, and localized land degradation. When similar strategies were used in the previous disarmament program, from 2000 to 2009, outcomes included substantial livestock mortality, with associated impacts on human livelihoods and nutrition.

More specific conclusions are:

- Communities have detailed and accurate indigenous knowledge on local water and grazing resources. This conclusion fits with a substantial body of literature on pastoralism in East Africa that documents and validates pastoralists' indigenous knowledge on natural resources. Communities describe the temporal and spatial use of these resources, enumerate them, and explain the pros and cons of each type of water resource. The human health benefits of clean water are well known locally. Drawing on their own systems and practices, local people are also very familiar with important concepts such as ownership, management, and payment in relation to water and rangeland resources; in some locations, people contribute to the cost of borehole maintenance. Despite this, there is limited community involvement in selecting appropriate types of water facility, and the design, siting, and management of new water facilities. Water development is mainly a "top-down" process.
- Although commonalities exist across communities and areas in terms of preferences for introduced water facilities, there is also considerable variation in the use and access of different indigenous resources. This

relates to variations in local geography and topography, and the physical presence of some natural water resources in some areas and not others. These variations point to the importance of local, context-specific analysis with communities when designing water interventions.

- Traditional systems of managing water and rangeland are well established. In the case of water, specific traditional resources can be owned by a community or household, and ownership carries the responsibility for management. The implication for newly introduced facilities is that if communities feel no sense of ownership, they also feel no responsibility for maintenance. While traditional systems and rules exist, it is also variable due to the declining authority of elders in some areas.
- Community preferences for specific types of introduced water facilities are partly guided by the extent to which a facility is seen to be working. Overall, many water facilities that were intended to supply water during the dry season or drought have limited functionality, e.g., due to management challenges, especially linked to the need for desilting. To illustrate the functionality issue, boreholes were the most common type of water facility introduced in Lokopo sub-county (Napak District), Rikitae sub-county (Kotido District), and Katabok sub-county (Amudat District) (Tables 3.2 to 3.4), but only 15/35, 6/25, and 4/27 boreholes respectively were rated as fully functional at the time of the assessment.
- Communities describe in detail the pros and cons of different introduced water facilities. For example, boreholes are praised for providing safe water and reducing water-borne diseases but are faulted for high maintenance costs, high user fees, and poor management. High maintenance costs and unavailable local skills for repair are associated mainly with boreholes fitted with solar pumps and windmills, and these boreholes provide water only when there is enough sunshine and wind respectively. Despite these issues, there is a strong preference for solar-powered boreholes, especially among women. This is explained by the relatively high functionality of these boreholes and, when fitted with taps, easy extraction of the water.
- Similarly, the benefits of surface water facilities such as valley tanks and earth dams are well recognized locally, but are prone to siltation, water contamination, and associated with high desilting costs. Communities are also aware of major problems with the technical design and construction of some water facilities, such as insufficient holding capacity and poor engineering.
- A general model for water and rangeland development has included the introduction of local committees. However, these groups seem only to work effectively when they are strongly but informally reinforced by traditional systems. Despite this, formal integration of indigenous and conventional management systems is absent, and people are not being empowered to actively engage in management structures and processes.
- Integration has generally been minimal, and there is no clear deliberate effort between the developers of conventional water and grazing resources to tap into the indigenous knowledge systems. Most of the observed integrations that have happened appear coincidental in nature.
- Where apparent success in integration has been registered in water resources management, especially in the larger dams, the motives of noncommunity actors have centered on avoidance of conflict and using community members to manage potential escalation of conflict.

RECOMMENDATIONS

This review was conducted at a time when some international aid donors are moving towards localization strategies and when localization is increasingly seen as an essential aspect of climate adaptation. The review recommendations assume that a localization framing has potential to radically shift the current top-down approaches to water and rangeland development in Karamoja towards community-level leadership/management, ownership, and resource control. In practice, this means developing partnerships between technical experts and communities, and co-assessing, co-designing, co-implementation, co-monitoring, and co-evaluating water and rangeland plans and activities. It also means agreeing on long-term roles and responsibilities, including payment where relevant, for the maintenance and management of new facilities or systems. These processes require a mix of indigenous and technical knowledge, as well as hybrid management approaches that combine traditional institutional experience with "formal" approaches. Therefore, the following recommendations are proposed:

- Support forums and dialogue to reach a common understanding among stakeholders of

localization principles, and how these principles apply to water and rangeland development in Karamoja.

- Develop guidelines and tools to enable practitioners to work closely with communities at all stages of a typical project cycle: initial assessment; design; implementation; monitoring; and evaluation. Develop indicators and methods to measure localization at each stage. Additionally, draw on experiences with effective localized approaches to land and water planning from other dryland areas of East Africa when developing these guidelines, as well as experiences with participatory methods for the joint analysis of water and range issues.
- Build the capacity of stakeholders in communities, local and international NGOs, and local government to use these guidelines and tools; support their coordinated use across areas and programs.
- Support flexible programming that enables variations according to local contexts, community priorities, and long-term commitments.

The review highlights the impacts of insecurity on rangeland access in Karamoja and recommends further efforts to build peace in Karamoja to make best use of rangeland that is currently unused. The review recognizes that the recommendations above will be difficult to apply if insecurity persists, because they require prolonged engagement with communities. Integrated approaches to rangeland management are potentially valuable but will be severely constrained by current disarmament strategies that forcibly limit livestock mobility. It follows that an important role for aid organizations is liaison with government actors to enable communities to regain control over livestock management and movement, and thereby limit excessive loss of livestock.

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