ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE
CGIAR
ILRI RESEARCH BRIEF 114
September 2022

Digital innovations for high-frequency ground truthing and monitoring of household welfare in pastoral communities

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Key messages

- The diets of pastoralists are changing as they cope with the impacts of drought and other climate shocks.
- Tracking commodities that pastoralists consume helps in understanding how the supply of these commodities influences the diets of pastoralists, and consequently their nutrition status.
- Near real-time assessment of pastoralists households' coping mechanisms to climate shocks and scarcity provides an opportunity for prompt data-driven solutions to constraints faced by pastoral households.
- Digital innovations offer an opportunity to collect data that could otherwise be very difficult to collect in such settings. These tools are suitable for tracking fast moving indicators, provide early warning information, and are crucial to inform anticipatory action.
- There is need for investments in cost-effective information gathering mechanisms in pastoral areas to understand the mechanisms through which shocks impact livelihoods.

1 Introduction

Pastoralists occupy approximately 40% of Africa's landmass (Union 2013). A large proportion of this landmass is arid and semi-arid lands (ASALs) characterized by low and erratic rainfall. Pastoral systems and livelihoods are vulnerable to climatic shocks. Climatic shocks cause spatial and temporal uncertainty of pasture and water resources (Aberra and Abdulahi 2015). The adverse impacts of climatic shocks manifest in several forms including livestock mortality, increased food insecurity, malnutrition and conflict (Walker et al. 2022). It is estimated that the ongoing drought in the Horn of Africa has claimed over 7 million livestock which in turn has led to almost 7 million children suffering from acute malnutrition (ReliefWeb 2022).

Despite their harsh environment and climate challenges, pastoral livestock production systems contribute significantly to national and regional economies (Walker et al. 2022). For example, livestock contributes an estimated 57% of the regional agricultural gross domestic product (AGDP) in the Intergovernmental Authority on Development (IGAD) countries. Therefore, efforts to enhance and sustain the contribution of pastoral livestock systems to economic development must address the adverse impacts of climatic shocks. A critical step towards tackling climatic shocks is understanding the mechanisms through which such shocks impact pastoral systems and livelihoods. However, the pathway of impact from climatic shocks to household welfare is not well understood in pastoral settings. One reason for this gap is the complexity of collecting data in the fragile and remote pastoral environments. Yet there is an urgent need to understand the relationship between climate shocks and the coping strategies available, and the intra-seasonal variability in household welfare (Bell et al. 2016). This information would be helpful to inform anticipatory action and the designing of interventions for building resilience of pastoralist systems and livelihoods in the long-term.

Past efforts to gather information in pastoral settings largely relied on traditional surveys. While useful, this approach is expensive to deploy in remote resource-constrained regions, which limits sampling representativeness (Wilde et al. 2019). Consequently, there is underrepresentation of remote areas in national-level surveys and reduced frequency of data collection. This makes tracking of dynamic indicators of household well-being extremely challenging (Giroux et al. 2019). Meanwhile, the telecommunication landscape is rapidly changing in pastoral areas. Ownership of mobile phones has increased tremendously and is revolutionizing communication and data gathering in the pastoral settings (Jenet et al. 2016).

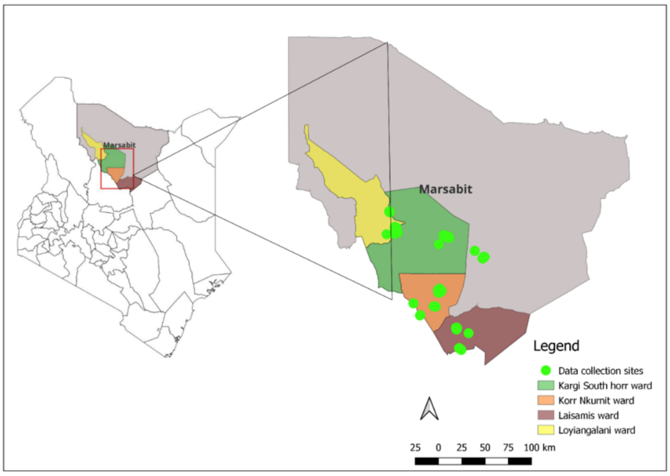
In efforts to close these gaps, the International Livestock Research Institute (ILRI) and partners have been working on innovative prototypes of data collection platforms. Among the specific approaches implemented by ILRI and partners include the use of digital innovations for a near real-time collection of data at high frequency in remote locations. The approach uses crowdsourcing techniques, where data are collected and submitted by pastoralists themselves, and provides a variety of expanded capabilities which in addition to supporting data collection, facilitate feedback provision (Chelanga et al. 2022; Lepariyo et al. 2020; Naibei et al. 2017). Building on successful pilots of the data collection platforms, sentinel zones have been set up in the drylands of Kenya and Ethiopia, for collection and dissemination of high-frequency and multi-dimensional data through the digital platform.[1] Data on key environmental and socio-economic indicators are being collected to inform technical design and quality assessment of initiatives in the region. This brief describes the approach, presents preliminary results from the data, and summarizes the lessons learned so far.

1. https://www.drylandinnovations.com/dirisha provides detailed information on setting up sentinel clusters.

2 Study area

The sentinel zones have been set up in Marsabit County (Merille, Korr, Kargi and Olturot) in northern Kenya and in Borena region (Saba-Elwaye, Harweyu-Yabello, Higo-Dubluk and Magole-Dillo) in southern Ethiopia. This brief focuses on the sentinel zone in Marsabit County in Kenya (Figure 1).

Figure 1: Kenya study site.



3 Data collection platform and approach

The digital micro-tasking platform is designed to allow for flexibility in dynamically responding to data needs in space and time and collects higher resolution data than is currently available for any type of data from these regions. Tasks are geofenced so that they can be matched to local environmental conditions and to ensure that they are performed within specified locations, such as livestock markets. Indicators are monitored at two levels: (1) community level and (2) household level.

i. Community-level data

Data is collected by contributors using a flexible micro-tasking platform developed and tested by ILRI and partners in pastoral areas since 2016 (Figure 2). Market information includes volumes of livestock sold, livestock prices, and body condition of different types of livestock. Images of the livestock are also submitted as verification mechanisms for the collected data (Chelanga et al. 2022; Alulu et al. 2020). In addition, the platform collects information on temporal forage condition (Chelanga et al. 2022).

ii. Household-level data

Data is collected by households using a picture-based mobile app, that does not require numeracy or literacy, this is a key feature when working with households from pastoral areas. The survey questions are presented in form of audio and icons, allowing for collection of more granular data, and addressing the issues of recall bias (Figure 3). Since these data are collected by the households, the frequency with which they are collected allows for near real-time information on fast moving indicators. In addition, the platform supports real time provision of customized feedback on selected indicators to households based on their input (Lepariyo et al. 2020).

Figure 2. KAZNET task selection screen.

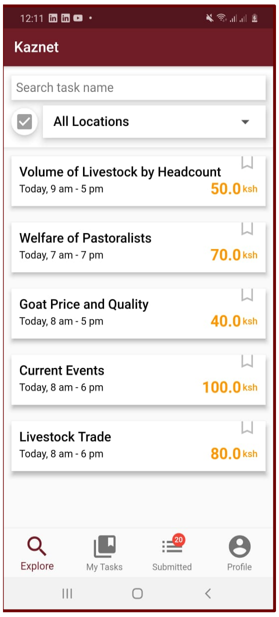
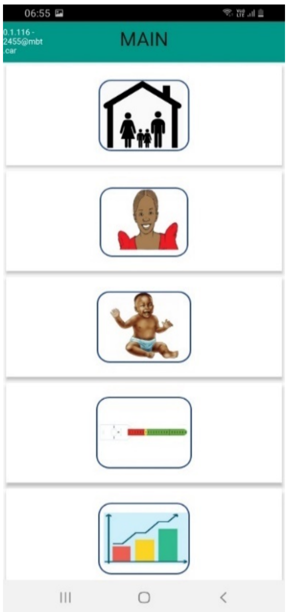


Figure 3. Household app home screen.

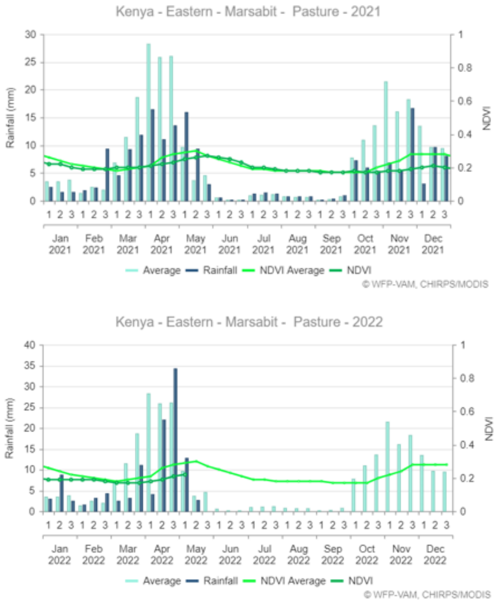


Though the brief describes the two levels of data collection, the focus of the remaining sections is on the household-level data collection and key results from analyzing those data.

iii Data collection

The research team intentionally selected eight households from each of the four sentinel clusters that constitute the Marsabit sentinel. The caregivers where trained on using the data collection tool. Data collection started in July 2021. The households' tasks were grouped into four categories according to the topic of the survey task: household, caregiver, child mid-upper arm circumference (MUAC) and child update. During the setup of the sentinel zone, Marsabit County had had two failed rains (long rains and short rains of 2021). Figure 4 shows vegetation condition and rainfall performance for 2021 and 2022 compared to seasonal averages.

Figure 4. Marsabit county normalized difference vegetation index (NDVI) and rainfall.



Source: Dataviz/vam/ WFP 2021 and 2022

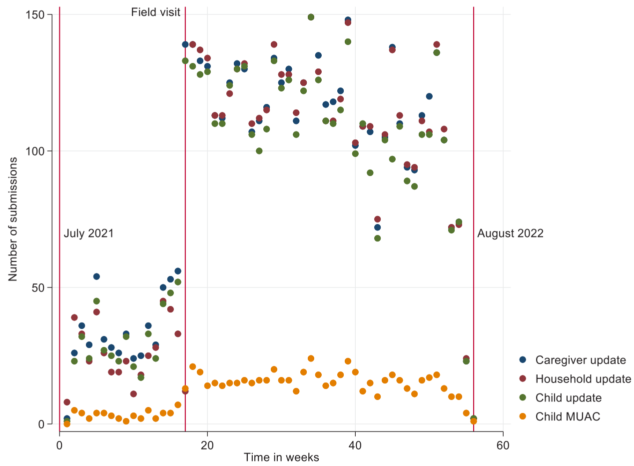
4 Results

The following section illustrates trends observed from the data collected. As mentioned previously, the region had drought conditions during the entire data collection period. Specifically, the collected data reflect households' coping with long-term drought and are probably quite different than one would expect during normal conditions.

The selected households submitted data on four surveys: caregiver, child, household, and child MUAC. As show in Figure 5, there was a great increase in submission on week 17 of data collection, this was attributed to a field visit by the research team to monitor progress and retrain the households.

The result section explores dietary data obtained from the approach, even though the approach collected data on multiple indicators.

Figure 5: Weekly survey submissions.



i Dietary data

Dietary data was collected using a dietary diversity approach was based on 16 food groups as shown in Table 1 (FAO 2016)[2]. Caregivers who are primarily

2. This provides some flexibility in constructing different indices.

responsible for meals preparation in the household, responded to a set of questions on a 24-hour recall basis. The daily collection was intended to capture day-to-day variability in food consumption that could be introduced by temporal pasture conditions, migration, periodic access to markets, or cultural cycles in consumption. Caregivers answered these questions about themselves, an index child[3] and the household.

a) Household consumption

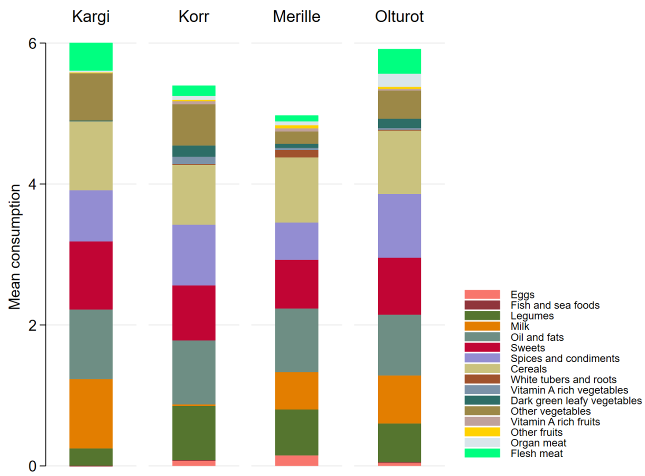
Table 1 presents the proportion of households that consumed the different food groups. The most consumed food groups are oil and fats (92%), cereals (91%), sweets (82%); and spices, condiments and beverages (77%). The least consumed food group was fish and sea foods (0.04%). These results are consistent with findings from the report of the Marsabit County Smart Survey (2019) which showed that the five most consumed food groups are cereals (98%), oils and fats (94.7%), sweets (93.7%) and condiments (85.9%) while the least consumed food group is fish and sea foods (3.2%). The proportion of households consuming milk over the survey period was 49%, which is slightly lower compared with the proportion (67.3%) reported in the Marsabit County Smart Survey of 2019. This decline could be attributed to the pasture conditions, since milk availability is largely determined by forage conditions.

Table 1: Summary of food groups consumption

Food group	N	Mean	Std. Dev.
Eggs	5,092	.066	.248
Fish and sea foods	5,093	.004	.063
Legumes	5,093	.568	.495
Milk and milk products	5,092	.493	.500
Oil and fats	5,093	.919	.274
Sweets	5,092	.818	.386
Spices, beverages, and condiments	5,092	.773	.419
Cereals	5,093	.911	.285
White tubers and roots	5,093	.022	.148
Vitamin A-rich vegetables	5,092	.049	.216
Dark green leafy vegetables	5,092	.095	.294
Other vegetables	5,092	.499	.500
Vitamin A-rich fruits	5,092	.029	.167
Other fruits	5,092	.021	.145
Organ meat	5,093	.074	.261
Flesh meat	5,093	.239	.427

Disaggregated analysis of consumption data by sentinel cluster reveals important differences in milk consumption (Figure 6). The proportion of households consuming milk is highest in Kargi (98.3%) and lowest in Korr (0.02%). A sizable proportion of households in Merille (65%) and Olturot (55%) also consume milk. Milk consumed by households in the sentinel clusters is mostly from own production indicating that variability in consumption could be due to coping strategies employed in the different sentinel clusters. Particularly in Kargi where we observe high proportion of households consuming milk, this could be attributed to migratory patterns of livestock, a strategy that allows households to have access to milk. Conversely, in Korr where milk consumption is low, this could be attributed to worse forage conditions forcing livestock to migrate further, thus decreasing household milk access. Interestingly, we observe that households in Korr reported to have consumed legumes (77%) of the time, compared to (25%) of the time in Kargi. Therefore, suggesting that when households don't have access to milk, they consume more legumes as shown by the interchanging observations in Korr and Kargi.

Figure 6: Relative distribution of food groups consumption by sentinel cluster.



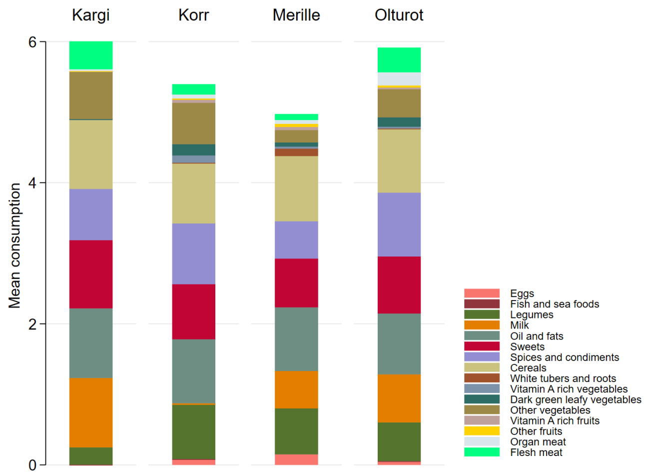
b) Consumption dynamics

To observe trends and tease out dynamics, we looked at reporting of food consumption by day of the week. This is particularly important to assess the supply of commodities that are not directly produced by pastoral households, which is mostly through weekly livestock markets and small urban centres, and influences the kind of food consumed on a particular day. We observed a similar trend of food groups consumed in all days of the week in Kargi, Korr and Olturot, with little to no variation in each of the mentioned sentinel cluster (Figure 7). However, in Kargi dark green leafy vegetables were not consumed in most days of the week. In Merille, households reported consuming a greater variety of food groups compared with the other three sentinel clusters. Households in Merille are located closer to the main highway than the others and potentially benefit from

3 An index child is the selected child in a household to participate and repeated measurements are done for the child over time (< 5 years).

access to more variety of food as a result. Furthermore, there is a well-established livestock market in Merille that is held every Thursday, which could also be a source of various commodities.

Figure 7: Relative distribution of food groups consumption by day of the week in each sentinel cluster.



5 Discussion and conclusion

The preliminary results from the data provide insights and trends on how pastoral diets could be changing as they cope with the impacts of drought. These findings can help in understanding climate shocks faced by households and how they cope with these shocks. Intrahousehold allocation of resources changes especially in times of scarcity due to climate shocks and variability which affects livelihoods (Harris-Fry et al. 2017). Being able to observe these changes in near real-time resolution provides an opportunity for prompt data-driven solutions to constraints faced by pastoral households.

Households in all the Marsabit sentinel clusters are mostly dependent on livestock for their livelihoods. Tracking the commodities that they consume but do not produce is important in understanding how the supply of these commodities influences the diets of pastoralists, and consequently their nutrition status. As demonstrated, digital innovations can provide data that could otherwise be very difficult to collect in such settings. In addition, the agility of the approach as discussed by Chelanga et al. (2022), makes this approach suitable for tracking acute malnutrition indicators. There is therefore an urgent need for investments in cost-effective information gathering mechanisms in pastoral areas to increase market players, thereby sustaining local livelihoods, easing stress, avoiding conflict, and helping governments to empower pastoralist to build their resilience.

Acknowledgements

The authors and research team would like to thank this project donors: International Development Research Centre (IDRC), the Accelerating the Impact of CGIAR Climate Research for Africa (AICCRA), and the Foreign, Commonwealth & Development Office (FCDO). We also express our gratitude to the participating households and contributors.

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Watson Lepariyo, Rupsha R Banerjee, Vincent Alulu and Kelvin Shikuku work for ILRI.

Photo credit

Page 1, Caregiver measuring her child's arm using a MUAC tape. (Photo credit: ILRI/Kabir Dhanji).

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Acknowledgment

ILRI thanks all donors and organizations which globally support its work through their contributions to the CGIAR Trust Fund.