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POLICY BRIEF

HOW CLIMATE INFORMATION SERVICES (CIS) CAN HELP PASTORALISTS IN THE HORN OF AFRICA

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Summary

This brief focuses on the unique context of pastoralists' climate information services (CIS) and explores opportunities and barriers for developing CIS tailored to pastoralists' needs. It examines the process of producing and delivering CIS to pastoralist communities and presents case studies of initiatives currently implemented in pastoral areas. The brief concludes with some key considerations for scaling up effective CIS in pastoral regions.

Key findings

- Despite greater availability, the use of CIS remains limited among pastoralists in the Horn of Africa (HoA).
- Pastoralists face a number of barriers to accessing CIS, including mobility, remoteness, weak telecommunications infrastructure, low mobile phone ownership, low literacy levels and gender disparities. Addressing these barriers is key to increasing CIS access and use.
- Pastoralists will use CIS when it is timely, localised, context-specific, inclusive of traditional knowledge and disseminated through established social networks. Pastoralists will not use CIS unless it is trusted, relevant and actionable given their available resources.
- Digital CIS may not always effectively reach pastoralists. It is important to balance digital formats with more widely accessible methods for pastoralists.
- Gender disparities in pastoralists' access to and use of CIS must be addressed by considering how climate information is generated and tailored to the needs of both women and men, the communication channels used for its dissemination and women's ability to act on the information they receive.

Introduction

As climate change leads to more frequent droughts and floods, having access to timely and accurate weather and climate information can help pastoralists anticipate, respond and adapt to these hazards. Pastoralists rely heavily on natural resources such as pasture and water for their livestock and livelihoods. Since the quality and quantity of these resources varies with different weather conditions, knowing when and where resources are available can support pastoralists' adaptation efforts. The frequency of shocks in the Horn of Africa (HoA) is expected to increase dramatically by mid-century (Funk et al., 2023); thus developing climate information services (CIS) tailored to pastoralists' needs can help pastoralists to adapt to the impacts of climate change.

The Intergovernmental Panel on Climate Change (IPCC)'s sixth assessment report recognises CIS (see Box 1 for definition) as a key adaptation option with positive outcomes in East Africa (CDKN, 2022). For example, CIS supports decisions on livestock migration in Uganda (Nkuba et al., 2019), informs anticipatory action related to pasture management and fodder storage in Ethiopia (Mercy Corps, 2023a), and reduces conflict between pastoralists and farmers in the Sahel (Mertz et al., 2016).

Moreover, investing in CIS can reduce the need for costly humanitarian and relief efforts when disasters strike. Cabot-Venton (2018) estimated that investing in drought resilience saves $287 million annually in the HoA compared to providing humanitarian assistance.

Yet, despite its potential in resilience-building and risk reduction, the use of CIS remains limited among pastoralists in the HoA, with studies indicating low access and usage rates in Kenya, Ethiopia, Uganda and Somaliland (Ochieng et al., 2021; Mercy Corps, 2023a; 2023b; Rigby et al., 2023). For example, in Baringo County, Kenya, only one third of pastoralists access climate information (Ochieng et al., 2021), and in Ethiopia, only a small percentage of pastoral households have access to short-term (5%) and medium- to long-term (4%) forecasts (Mercy Corps, 2023b).

In contrast, evidence from East Africa suggests that while pastoralists' use of CIS is limited, farmers are using it in a variety of circumstances (Vaughan et al., 2019). There is growing availability of CIS among farmers in the HoA, with investments, research and policies focusing on developing digital CIS tailored to agricultural sectors such as crops, dairy and horticulture.

For example, the iCow app and the iShamba SMS/call service provide climate and farming information to smallholder farmers in Kenya. At the same time, the FASTA storm forecasting app serves fishers and farmers across East Africa. The iShamba hotline has over 500,000 users across Kenya and has reached nine million users through the associated 'Shamba Shape Up' TV show in Kenya, Tanzania and Uganda (PlantVillage, 2024).

In Ethiopia, the Lersha app provides climate agrometeorological advisories bundled with information on farming inputs, mechanisation services and financial services to over 200,000 smallholder farmers (AICCRA, 2023). The 8028 Farmers' Hotline is used by almost six million farmers, and Digital Green's agrometeorological advisories support around half a million farmers. This represents 8% and 1% of Ethiopia's total farming population, respectively (Kropff et al., 2023).

BOX 1: CLIMATE INFORMATION SERVICES (CIS)?

- CIS is the provision of timely, tailored weather and climate information to inform action to reduce climate-related losses and enhance benefits (Vaughan and Dessai, 2014).
- Weather and climate information can range from forecasts – short-term (1–7 days), medium-term (1–3 weeks), and sub-seasonal to seasonal (1–6 months) – to projections over the longer term (annual, decadal and longer) (Warner et al., 2022).
- Weather and climate information are often accompanied by agrometeorological advisories to support effective decision-making on actions such as for pasture management and migration.
- Weather and climate information may comprise both scientific information and traditional knowledge.

Source: author.

Developing and delivering CIS to pastoralists

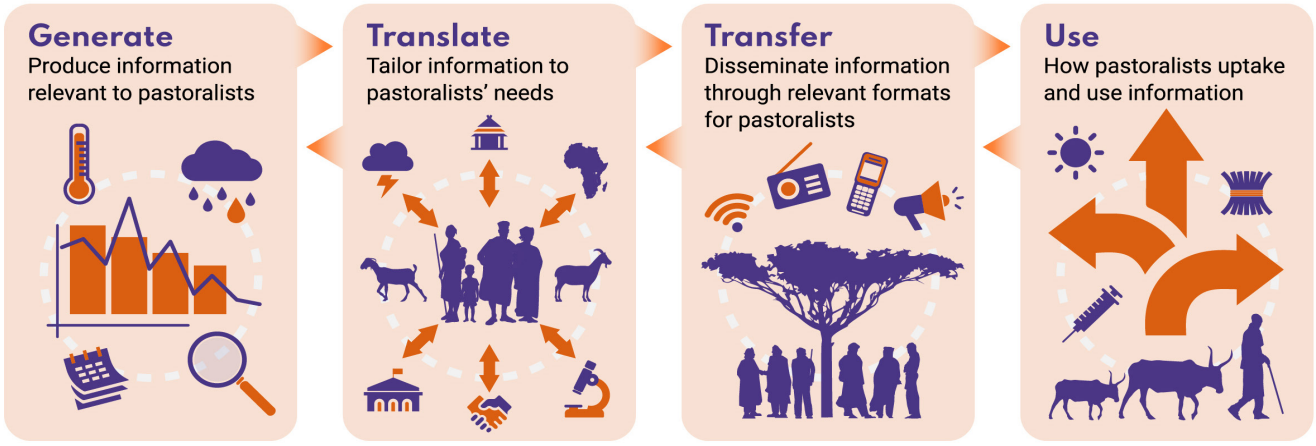
The effectiveness of CIS in enabling climate adaptation relies on four interconnected 'pillars': 1) the generation of useful information, 2) the translation into decision-relevant knowledge, 3) the transfer of information to users, and 4) users' capacity to understand and act on the information they receive (Grossi and Dinku, 2022; Figure 1). This approach recognises the interdependence of providers and users, whereby any weaknesses in the process can undermine the overall

effectiveness of the system. Therefore, feedback loops and end-user participation, ideally through collaborative and participatory approaches, are essential to tailor information to meet user needs (Vincent et al., 2018).

These approaches ensure that CIS is useful and usable, effectively translating and transferring information to enable adaptation (Vincent et al., 2018). Collaborative methods such as participatory scenario planning (PSP) have been widely used across Africa to integrate local knowledge into the production and translation of CIS, thus enhancing CIS utility and usability (CARE, 2018). For example, PSP is utilised with pastoralists in Ethiopia to share and interpret forecasts and make them relevant and useful for adaptation (CARE, 2019) (see case study Box 2).

Below, each of the four pillars is examined within the context of pastoralist-relevant CIS.

FIGURE 1: THE FOUR PILLARS OF CLIMATE INFORMATION SERVICES (CIS) FOR PASTORALISTS



Source: SPARC. Adapted from Grossi and Dinku (2022).

BOX 2: CASE STUDY: PARTICIPATORY SCENARIO PLANNING (PSP) APPLIED IN ETHIOPIA'S LOWLANDS

Country/ies: Ethiopia

Partners: Disaster risk management bureaus at regional and woreda levels; Mercy Corps; CARE; private sector agribusinesses

Generate: Blend of scientific weather and climate data, and traditional forecasts

Translate: PSP workshops held 1–2 months before rain onset bring together government, community and private sector to co-produce forecasts. Forecasts are tailored to specific woredas and present scenarios, 'above normal', 'normal' and 'below normal', accompanied by advisories outlining responses to each scenario

Transfer: SMS, email, social media, voice blast, radio and television, Lersha digital platform

Use: Actions on pasture management, storage of fodder and destocking animals

Source: Mercy Corps (2023a).

1. Generate: Produce information relevant to pastoralists

In the HoA, CIS is provided by: national meteorological and hydrological services (NMHS) such as Kenya's Meteorological Department (KMD) and Ethiopia's National Meteorology Agency (NMA); regional institutions such as IGAD's Climate Prediction and Application Centre (ICPAC); and continental and global providers such as the African Centre of Meteorological Applications for Development (ACMAD) and the Famine Early Warning Systems Network (FEWSNET). These agencies give increasingly accurate climate forecasts, with models able to accurately anticipate seven out of eight dry seasons in the HoA since 2016 (Funk et al., 2023). This increased accuracy offers opportunities for more effective CIS available to pastoralists. However, some places in the region, such as Somalia and Somaliland, lack formalised meteorological services, leading to challenges in CIS provision (Rigby et al., 2023).

To effectively serve pastoralists, forecasts must match their unique decision-making needs (Table 1). These needs include information on rainfall onset, flood forecasts, drought warnings, livestock disease risks, and predictions on pasture and water availability in different areas. Pastoralists use this information to plan the purchase of supplementary fodder, decide on transhumance destinations, and prevent conflicts with farmers (Nkiaka et al., 2019; Vaughan et al., 2019). For example, in Uganda, pastoralists use rainfall onset and drought information to make decisions regarding livestock movements, seeking military escorts to new areas, selling firewood and charcoal, and purchasing veterinary drugs (Egeru, 2016). Unlike farmers, pastoralists have a different set of decisions to make, resulting in fewer types of information being useful to them (Vaughan et al., 2019).

Most CIS provided to pastoralists focuses on short- and medium-range forecasts, along with seasonal forecasts, but gives limited information on long-term forecasts (Ofoegbu et al., 2018). Pastoralists value short-term, real-time information on weather and forage conditions over long-term forecasts since this aligns with their highly flexible production systems that emphasise mobility in response to changing environmental conditions (Luseno et al., 2003). While a rational strategy given pastoralists' production systems, this suggests that CIS for pastoralists prioritises short-term over longer-term adaptation strategies.

As mobile phone usage and network coverage grow in pastoral regions, so do opportunities to systematically crowdsource and provide feedback on localised resource information. These approaches can help address data scarcity by directly collecting data on the ground. While there are limited examples of this in action among pastoralists, KAZNET – a mobile-based platform for crowdsourcing livestock market information – is being implemented and scaled up in Northern Kenya and Southern Ethiopia to collect and disseminate high-quality, user-friendly information on rangeland condition and livestock markets (Banerjee et al., 2018) (see case study Box 3).

TABLE 1: PASTORALISTS' INFORMATION NEEDS, THEIR TIMESCALE AND USE IN DECISION-MAKING

Timescale	Type of information	Use in decision-making
Short-range (1–7 days) forecast	Daily forecasts of temperature, rainfall and wind. Alerts for extreme weather events – heavy rainfall, storms, lightning strikes	Scheduling livestock movements, identifying suitable grazing areas, planning for short-term weather shocks like storms
Medium-range (1–3 weeks) forecast	Rainfall expectations, temperature trends. Early warnings for the likelihood of drought or floods	Decisions related to grazing patterns, water resource management, and potential risks such as disease outbreaks
Seasonal (1–6 months) forecast	Expected trends in temperature, rainfall; onset and cessation of the rains Agrometeorological advisories – guidance on likely impacts on pasture and water availability	Longer-term planning, such as estimating forage availability, anticipating periods of scarcity, making decisions about herd sizes and movements, planning purchase of fodder and veterinary drugs
Long-range (annual, decadal) climate projections	Expected climate trends for the upcoming year. Anticipating climate-related risks such as changing rainfall patterns	Decisions related to breeding strategies, land-use planning

Source: author.

BOX 3: CASE STUDY: KAZNET

Country/ies: Kenya, Ethiopia

Partners: ILRI, Ona (software engineering company), Kenyan State Department of Livestock, pastoralists

Generate: Mobile data collection platform, crowdsourcing of livestock market data and rangeland condition, feed and forage, crowdsourced geo-tagged pictures of livestock and rangelands

Translate: Livestock market data, agrometeorological advisories on rangeland condition

Transfer: Mobile phone app, SMS, web application dashboard

Use: Informs pastoral decisions prior to selling or buying livestock in markets; used as a platform for institutions for data collection and monitoring

Source: Banerjee et al. (2018).

2. Translate: Tailor information to pastoralists' needs

Translating climate information into pastoralist-relevant knowledge requires tailoring of the information for pastoralists' planning and decision-making needs. NMHS often collaborate with agricultural research institutions and pastoralist end-users to tailor climate information into practical advice for pastoralists. However, a gap frequently exists between the information provided and pastoralists' actual needs, leading to low adoption rates of existing CIS.

Pastoralists often lack local, context-specific climate information, as forecasts may not be downscaled to the local level. Additionally, information may not be delivered in a timely manner, making it difficult for pastoralists to access forecasts at the time they are needed for decision-making (Radeny et al., 2019). Pastoralists also prefer forecasts that are accompanied by agrometeorological advisories, offering actionable guidance on herd management, pasture and livelihoods. The absence of such advisories can limit the usefulness of the information for pastoralist decision-making (Coulibaly et al., 2015).

Pastoralist communities in the HoA, such as the Karamojong in Uganda and the Borana and Afar in Ethiopia, also favour traditional forecasts over scientific ones (Egeru, 2016; Balehegn et al., 2019; Ayal et al., 2015; Radeny et al., 2019; Nkuba et al., 2019). They often perceive indigenous knowledge as more reliable and integrate it alongside or instead of scientific forecasts. While incorporating indigenous knowledge into climate information can enhance trust and willingness to use scientific forecasts (Radeny et al., 2019), much of the existing CIS neglects this aspect, leading to low adoption rates. There is limited evidence of indigenous knowledge being integrated into CIS in Africa; it is primarily documented and occasionally used to refine or contextualise forecasts (Ofoegbu and New, 2022).

Technical language can be a barrier to the adoption of CIS. Pastoralists prefer indigenous forecasts because they are easier to understand, stem from local experiences, and are communicated in local languages (Radeny et al., 2019). This preference also matches the lower education levels found in pastoral areas (Coulibaly et al., 2015). Using clear and simple, non-technical language can enhance the understanding and uptake of CIS (Warner et al., 2022). For example, in northern Kenya, pastoralists prefer visual information, graphics, and audio recordings in local languages for clear communication of information (Mercy Corps, 2023d).

There are also gender-differentiated needs in CIS (see Box 4), due to different priorities, constraints and decision-making roles between men and women. Studies among farmers show that CIS needs vary based on gendered roles and responsibilities (Gumucio et al., 2020). Similarly, in pastoralist communities, where gender roles are distinct and adaptation strategies are gendered (Vincent, 2022), women and men will likely require different climate and weather information. For instance, women, typically responsible for house management and water collection, may prioritise information on water availability and food security. In contrast, men, who are responsible for livestock management and the primary providers for the family, may prioritise livestock-related information, pasture availability and market opportunities.

BOX 4: DIFFERENTIATED GENDER NEEDS IN PASTORALIST CIS

Gender considerations are crucial across all aspects of pastoralists CIS, influencing how information is generated and tailored to the needs of both women and men, the communication channels through which CIS is disseminated, and the ability to act on the information.

However, there has been minimal attention to gender-specific needs, especially in the case of pastoralists. CIS is often criticised for being gender-blind, failing to recognise gender equality, diversity, and the specific needs of women in accessing and using climate information (CARE, 2021). Women and men pastoralists experience different levels of risk, vulnerability and resource access, leading to distinct requirements for CIS. Gender barriers such as unequal access to mobile phones and digital services (GSMA, 2023b) exacerbate these disparities, while gender norms may hinder women's agency in decision-making even if they receive CIS (Bullock and Katothya, 2022).

To address these gender disparities, CIS should be tailored to gender-specific needs, considering differences in the ability to access and act upon the information. Efforts to enhance gender equity should empower women to access, understand and effectively use CIS. It is essential to design CIS with lower levels of mobile phone ownership and literacy among women to ensure equitable access. Utilising a mix of digital and non-digital methods can facilitate women's inclusion. Further research is needed to understand the gender-differentiated CIS needs in pastoral contexts and to develop tailored solutions for both women and men.

Source: author.

Although some evidence suggests differences in CIS preferences between pastoralist men and women (e.g. in Tanzania (Coulibaly et al., 2015)), more research is needed. Moreover, as gender roles evolve within pastoralist communities, especially amid increasing climate variability, with women assuming greater decision-making responsibilities while men migrate with livestock in search of pasture or employment opportunities (Galwab et al., 2024), the information needs of men and women are likely to shift accordingly.

Developing tailored CIS and advisories to address these challenges can be complex, time-consuming and resource-intensive, especially for NMHS with limited resources (Mercy Corps, 2023c). Involving the private sector can help fill these gaps (Mercy Corps, 2023c). Decentralised governments and local organisations can also facilitate the customisation and downscaling of this knowledge for local use. For example, in Kenya, the decentralisation of governance to county governments has improved the tailoring of climate risk information and advisory services to pastoralists' needs (Ofoegbu et al., 2018).

Co-production approaches involving multiple stakeholders play a key role in tailoring information to user needs, ensuring its usefulness and usability, and facilitating effective translation and transfer for adaptation (Vincent et al., 2018). These efforts facilitate the production and translation of tailored advisories, ensuring their relevance and effectiveness for pastoralists, while also building capacity for their effective use.

3. Transfer: Disseminate information through relevant formats for pastoralists

The dissemination of CIS influences how pastoralists are able to access and use it. In the HoA, pastoralists predominantly access climate information through traditional channels, such as radio, community gatherings, and word of mouth, such as at livestock markets or water points, or among friends and family (Egeru, 2016; Rigby et al., 2023; Mercy Corps, 2023d). Radio remains a primary source of CIS in many pastoral regions due its widespread coverage and accessibility (Coulibaly et al., 2015; Hampson et al., 2014; Radeny et al., 2019).

Traditional networks and informal methods are also key channels for receiving and sharing climate information in pastoralist regions of Uganda, Somaliland and Kenya, with the most trusted and reliable information commonly shared among family and friends (Rigby et al., 2023). For example, in Somaliland, elders and community representatives act as gatekeepers of CIS (Rigby et al., 2023); while in Karamoja, Uganda, elders, traditional healers and medicine men are key sources of traditional climate knowledge (Egeru, 2016). This reliance on traditional knowledge reflects its effectiveness over time, providing pastoralists with a sense of identity and control, rooted in their familiarity and experience with these practices (Egeru, 2016). Leveraging these informal networks and traditional

communication systems facilitates the effective transmission of CIS within pastoral communities.

The private sector can play a valuable role in disseminating CIS to pastoralists. In Ethiopia, agribusinesses receive climate information from the government and provide guidance to their customers or suppliers (Mercy Corps, 2023a). Extension agents are also important in CIS dissemination, especially in countries like Ethiopia with well-established agricultural extension systems (Hansen et al., 2022). Strengthening these systems could facilitate the integration of pastoral management advice with weather and climate information, expanding outreach to pastoral communities. However, their effectiveness can be limited by challenges like inadequate resources, training and staff (Mercy Corps, 2023b).

There is increasing emphasis on digital methods such as SMS, websites, emails and mobile phone apps for disseminating CIS due to their cost-effectiveness and ability to deliver localised information (Hansen et al., 2022). With the increasing use of mobile phones among pastoralists (Parlasca, 2021), and improved internet connectivity in sub-Saharan Africa (GSMA, 2023a), there are opportunities to develop digital CIS tailored for pastoralists.

Mobile phones are well suited to pastoral livelihoods characterised by mobility and reliance on oral communication methods, offering valuable information for herd management, accessing updates on pasture and water availability, weather forecasts, market prices, conflict avoidance, and receiving remittances (Parlasca, 2021). Despite the availability of some mobile apps and services specifically designed for pastoralists, including AfriScout and MyAnga (see case study Boxes 5 and 6), they are not widely accessible or adopted, with phones primarily used for sharing information within social networks and through word of mouth (Butt, 2015; Rigby et al., 2023).

Access to digital CIS remains a challenge in pastoral areas due to barriers such as weak digital infrastructure, low mobile phone ownership, limited digital literacy and gender disparities (Kropff et al., 2023; Mercy Corps, 2023b). Despite increasing mobile phone ownership and internet usage, insufficient investment in telecommunications and other infrastructure has led to inadequate network coverage and internet services in pastoralist regions compared to other areas. For instance, in Ethiopia, only 18% of pastoralist households own a mobile phone and 8% use the internet, exacerbated by inadequate access to electricity, particularly in arid and semi-arid lands (ASALs) (Mercy Corps, 2023b). Additionally, low levels of literacy and digital literacy further hinder pastoralists' ability to access and interpret CIS effectively. For example, low literacy levels have been an obstacle to the scale-up and adoption of the MyAnga app (see Box 6).

There are also gender disparities within pastoral households that contribute to unequal access to CIS, with women particularly excluded from digital CIS due to lower ownership and access to mobile phones compared to men (GSMA, 2023b). In sub-Saharan Africa's low- and middle-income countries in 2022, women were 13% less likely to own a mobile phone than men, increasing to 28% for smartphone ownership, and 36% less likely to use mobile internet than men (GSMA, 2023b). These disparities are more pronounced in rural areas, among individuals with lower literacy, low incomes, disabilities, and in older age groups (GSMA, 2023b) (see Box 4).

BOX 5: CASE STUDY 'AfriScout' APP

Country/ies: Kenya, Ethiopia

Partners: Global communities, Google, iHub, pastoralists

Generate: Satellite imagery data from the normalised difference vegetation index (NDVI), updated every 10 days; crowdsourced knowledge

Translate: Weather forecasts, pasture and water availability using localised topographical grazing maps, estimation of migration distances, market information, disease and conflict sites. The AfriScout app is implemented using two models: 1) AfriScout steward model disseminates only information, 2) AfriScout regen model disseminates information and grazing planning advice

Transfer: AfriScout smartphone app – field agents raise awareness, recruit users and train pastoralists on the app

Use: Informs decision-making on migration and rangeland management

Sources: Turnbull and Harrison (2024); Banerjee et al. (2018).

BOX 6: CASE STUDY 'MyAnga' ('MY WEATHER') APP

Country/ies: Kenya

Partners: aWhere weather data company, Amfratech (ICT-telecommunications firm), Technical Centre for Agricultural and Rural Cooperation, the Kenya Livestock Marketing Council

Generate: Uses global weather station and satellite data to generate a grid of virtual weather stations spaced 9 x 9 km apart covering the globe

Translate: Daily localised (ward-based) weather forecasts for the next seven days, rainfall distribution in the past 30 days, agrometeorological advisories on weather and pasture conditions

Transfer: Mobile phone app, SMS (available in five local languages), voice calls, web portal dashboard

Use: Informs decision-making on migration, storing food

Sources: GIZ (2021); Njagi (2021).

Gender and equity disparities extend to the dissemination and delivery of non-digital CIS, with men typically having better access than women (Vaughan et al., 2019). In Kenya's ASALs, men access a wider range of CIS sources compared to women (Bullock and Katothya, 2022). Additionally, wealthier households in these regions often access CIS through government agencies and extension agents, while poorer households have limited access to these networks and minimal access to CIS (Apgar et al., 2017). Moreover, the dispersed and remote nature of pastoralist communities, coupled with their mobility, poses logistical challenges in effectively delivering CIS.

Many of these barriers echo the longstanding challenges that have historically marginalised pastoralists from development services. To address these challenges and ensure equitable access to CIS, it is important to design CIS with lower levels of mobile phone ownership and literacy rates in mind, especially among women. Combining digital and non-digital methods can prevent exclusion of disadvantaged groups, including women. The most effective dissemination methods should enable interaction and feedback with pastoralist end-users, utilising multiple channels to reach diverse audiences.

4. Use: How pastoralists uptake and use information

Even when CIS is accessible, few pastoralists use it to inform their livelihood and adaptation activities. For CIS to effectively reduce vulnerability, pastoralists must not only access and receive the information, but also understand and act upon it. The assumption is that pastoralists use CIS to decide on adaptation strategies such as managing pasture or adjusting mobility. However, the uptake and action on CIS are influenced by four key factors: trust, choice, resources and authority.

Firstly, some pastoralists may not trust the CIS and prefer local sources. Trust in both the source and the content of CIS affects its uptake (Bullock and Katothya, 2022). Trust is enhanced if the CIS is endorsed by respected community members such as elders (Rigby et al., 2023). Additionally, pastoralists' trust and willingness to apply scientific forecasts increases when the forecasts are integrated with indigenous knowledge (Radeny et al., 2019; Nkiaka et al., 2019).

Secondly, some pastoralists may choose not to act on the CIS they receive if they perceive the information to be irrelevant to their livelihood objectives. For example, pastoralists may opt not to destock because livestock accumulation serves as a risk management strategy or due to ongoing livestock rebuilding following livestock raiding, as shown in Karamoja (Egeru, 2016).

Thirdly, some pastoralists may lack the resources needed to act on the CIS. This could include limited access to suggested risk-mitigating strategies such as storing or purchasing fodder. For example, pastoralists in Karamoja face financial constraints that prevent them from implementing the advised investments mentioned in CIS (Egeru, 2016). Similar challenges are observed among pastoral communities in Ethiopia and South Africa (Bryan et al., 2009). In Kenya's ASALs, the lack of resources or productive assets, such as livestock lost to drought, is a key factor that prevents the poor and ultra-poor from acting upon and benefiting from CIS (Apgar et al., 2017).

Fourthly, some pastoralists may lack the authority to act on the CIS. Structured inequalities or norms may exist that particularly affect women's ability to act on the received information. Despite having access to CIS, gender norms surrounding women's agency in decision-making can prevent them from acting on the information received (Bullock and Katothya, 2022). For example, women pastoralists in Tanzania faced challenges in utilising the CIS provided due to their limited control over productive resources (Coulibaly et al., 2015).

Finally, pastoralist communities tend to take collective rather than individual action through traditional decision-making processes. They collaborate on water and pasture management, send scouts to investigate pasture conditions, and coordinate migratory movements. This emphasises the importance of integrating CIS into collective decision-making for communal action, often guided by elders or customary institutions, and considering the community as collective beneficiaries rather than individual users (Rigby et al., 2023). Even when individuals receive CIS, mutual sharing of information and collective decision-making and action are integral parts of the process (Mercy Corps, 2023d).

Conclusion

The findings emphasise several key considerations for designing and delivering CIS tailored to pastoralists. These include understanding the local context, social networks, language, infrastructure, technology and literacy levels. Pastoralists value timely, localised, context-specific, easy-to-understand information that integrates agrometeorological advisories and traditional knowledge to enhance relevance. They prefer CIS to be disseminated through trusted networks and familiar community forums, allowing for joint discussion and collective action based on CIS. Leveraging existing communication channels can enhance acceptance and adoption of CIS. Achieving this requires a well-designed co-production process with pastoralists central to that process.

While some studies across the HoA (e.g. Bullock and Katothya, 2022; Rigby et al., 2023) have indicated a demand for CIS among pastoralists and there is some existing use, the reach and uptake of CIS remains limited. This underscores the need to integrate CIS into a broader adaptation approach for pastoralists. CIS is not the primary solution for strengthening pastoralist adaptation and livelihoods; rather, it needs to be part of a comprehensive set of strategies tailored to its unique context. This necessitates developing interventions that integrate traditional knowledge, build trust, consider gender dynamics and traditional customary institutions, promote collective action, facilitate access to resources and co-develop approaches. These principles could equally apply to any pastoralist-focused adaptation approach. Strengthening pastoralists' access to resources such as land, inputs and finance is essential to enable effective implementation of the recommended actions based on CIS, particularly for the poorest and most vulnerable.

The findings also suggest that relying solely on digital methods for developing CIS for pastoralists may not be the most effective approach. Despite increasing network penetration and mobile phone ownership, challenges persist in some areas. To enhance impact, it is beneficial to use multiple dissemination channels such as radio, SMS and extension agents, building on what pastoralists already access. Combining digital tools with simple and relevant dissemination methods can enhance effectiveness. Additionally, leveraging social networks for dissemination. and promoting collective action can also improve uptake. Efforts should also address infrastructure limitations, the mobile gender gap and digital literacy, through initiatives to improve connectivity and targeted education and training programmes. These measures could enhance the use of digital CIS among pastoralists.

Gender disparities in pastoralists' access and use of CIS highlight the importance of adopting gender-sensitive approaches to ensure equitable access for both men and women. Information should be customised to address gender-specific roles and needs, and dissemination strategies should be adjusted accordingly. Additionally, differences in the ability to act on information based on gender should be considered. Ensuring that CIS is accessible and understandable for women, especially in rural and marginalised pastoral communities, is essential for ensuring inclusivity and equitable access.

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