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TECHNICAL REPORT

DO NEW PERMANENT WATER SUPPLIES IN THE DRYLANDS HELP BUILD RESILIENCE?

The impacts of new boreholes on coping with drought in
Ethiopia and Kenya

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About SPARC

Climate change, armed conflict, environmental fragility and weak governance, and the impact these have on natural resource-based livelihoods, are among the key drivers of both crisis and poverty for communities in some of the world's most vulnerable and conflict-affected countries.

Supporting Pastoralism and Agriculture in Recurrent and Protracted Crises (SPARC) aims to generate evidence and address knowledge gaps to build the resilience of millions of pastoralists, agro-pastoralists and farmers in these communities in sub-Saharan Africa and the Middle East.

We strive to create impact by using research and evidence to develop knowledge that improves how the UK Foreign, Commonwealth & Development Office (FCDO), donors, non-governmental organisations, local and national governments, and civil society can empower these communities in the context of climate change.

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ACRONYMS

ASALs	arid and semi-arid lands
ATM	automatic teller machine
CCCF	County Climate Change Fund
CGIAR	Consultative Group on International Agricultural Research
CHC	Centre for Humanitarian Change
CMC	community management committee
DRC	Democratic Republic of Congo
FAO	UN Food and Agriculture Organization
FGD	focus group discussion
GW4R	Groundwater for Resilience
IRC	International Rescue Committee
KII	key informant interview
NGO	non-governmental organisation
PWS	public water supply
SPARC	Supporting Pastoralism and Agriculture in Recurrent Crises
SWALIM	Somalia Water and Land Information Management
SWIFT	Sustainable Water, Sanitation and Hygiene in Fragile Contexts Consortium
UNICEF	United Nations Children's Fund
WASH	water, sanitation and hygiene
WASHCO	water, sanitation and hygiene committee

EXECUTIVE SUMMARY

Rationale

This report presents the outcome of a study investigating the impact of new water supplies on resilience to climate change in arid and semi-arid lands (ASALs) in the Horn of Africa, specifically in Kenya and Ethiopia. This research examines the narrative that new water supplies in fragile areas build resilience for households and communities. The study was conducted under the Supporting Pastoralism and Agriculture in Recurrent Crises (SPARC) research programme by the Centre for Humanitarian Change (CHC) in collaboration with the Centre for Research and Development in the Drylands (CRDD).

Key findings

The study explored the impacts of permanent water supplies in the two study areas through a causal framework with plausible causal chains leading from a new water source to resilience. Findings for each of the causal factors are as follows.

- 1. Functionality and reliability:** Fewer than 60% of boreholes visited in Kenya and 50% in Ethiopia were functional. Many boreholes were providing saline water, considered unpalatable by users. Of the 17 boreholes within the study area in Kenya, only 2 were functional and providing fresh, non-saline, water at the time of the study. This had not been recorded.
- 2. Water governance:** Water supplies were managed by a mix of formal and indigenous systems. Formal systems often lacked accountability and were prone to corruption. Indigenous systems were more effective in managing resources but were often sidelined or overwhelmed by aid interventions.
- 3. Economic outcomes:** Boreholes did not significantly support irrigation or other economic activities except for livestock production. Water sales provided some economic benefits but were often captured by elites.
- 4. Livestock and rangeland:** Permanent water supplies led to overgrazing and rangeland degradation. Mobility, a key resilience strategy for pastoralists, was undermined by permanent settlements around water points. Study participants reported a general trend in deteriorating quality of rangeland and productivity of livestock. Water supplies appeared to be contributing to this but were not the only driver.
- 5. Drought coping:** Boreholes did not significantly reduce livestock losses during the 2021–23 drought. Pastoralists with permanent water supplies did not cope better than others in such a prolonged and widespread drought. Permanent water supplies disrupted traditional pastoralist systems, especially in Somali Region in Ethiopia, where they are relatively new.

- 6. Social outcomes:** Water supplies had mixed impacts on social cohesion. At household level, women benefited from reduced water-fetching burdens but faced other challenges related to workloads and expectation to generate income for the household. At community level, corruption allegations and elite capture of water resources were common, undermining trust in governance. In some cases, water projects had been used to advance claims for resources, leading to conflict.
- 7. Health and well-being:** Women appreciated the opportunity to settle closer to education, health and water services. However, saline water led to health issues, so improved access to water did not always lead to better health outcomes.

Conclusions

- **Inconvenient truths:** The narrative that permanent water supplies lead to resilience is oversimplified. It hides the complexities of pastoralist systems in which permanent water supplies have both positive and negative impacts. Water resources are important for pastoral livelihoods but only if their installation, governance and management are closely aligned to other elements that inform the sustainable practice of pastoralism. Water supply projects often ignore this fact. Politics and patterns of social exclusion threaten to expose the most vulnerable people to risk despite increased water development. Claims that communities have better access to water, and can therefore cope better with drought, ignore the fact that water supplies are saline and cause health problems for both people and livestock.
- **Trade-offs:** Water points bring both benefits and disadvantages. The main trade-off is between static and dynamic systems, with permanent water supplies often leading to settlement and reduced mobility, which exacerbates conflict over pastures and may also lead to degradation of rangelands. The second trade-off is between addressing one symptom of stress, water scarcity, at the expense of others. Solving water scarcity problems through multiple water supplies across the landscape is at odds with broader thinking about systems resilience. The trade-off between water quality and water availability is considered acceptable by many water development actors but not by pastoralists who demand fresh and reliable water supplies.
- **Governance issues:** Water development has been politicised and used to claim rights over other natural resources. How water development is implemented imposes formal management systems that often undermine indigenous resource management. The indigenous/informal¹ governance links management of water to the management of rangeland because it is based on people's lives and livelihoods. The formal system does not make this link, as it is based on technical, sectoral issues, treating water in isolation. This fundamental disconnect has led to poor development strategies based on misunderstanding of the pastoral system and rangelands management.

¹ Neither of the terms 'indigenous' or 'informal' is perfect. 'Indigenous' stresses the local origins of an institution, but communities borrow ideas from others and the term would never be used for a system of local origin in a so-called 'developed' context. 'Informality' takes the perspective of the state or the outsider and suggests that the local systems are less rule-based and are of secondary normative importance. This is not the perspective of the insider.

Way forward

The conclusions of this study indicate the need for significant changes in how water development actors approach investments in pastoralist areas. It is important to recognise the trade-offs inherent in the system and explicitly outline the pros and cons of new or rehabilitated water supplies in water development plans. The change in approach starts with acknowledging that mobile pastoralism remains the key adaptation strategy for pastoralist communities in the Horn of Africa and that water has to fit into a wider 'landscape' approach to resource use. Careful analysis of the potential disruption to grazing and settlement patterns is required, alongside honest assessment, not assumptions, of the health and welfare benefits, particularly for women and children.

The strengths of indigenous governance need to be enhanced as part of a more flexible model of governance for pastoralist water supplies. To complete due diligence for water projects, aid actors must be prepared to go back to the project after some time and monitor the impacts, both positive and negative, and gain a better understanding of how the water intervention has changed lives and livelihoods, including during a drought period. The final section of this report provides more specific recommendations on how these changes can be achieved by government and non-government water actors in the Horn of Africa.

1. INTRODUCTION

1.1 Background

Permanent water supplies have been assumed to have a positive impact on climate resilience but there are also concerns about potential negative impacts. There are fears that water supply developments in the arid and semi-arid lands (ASALs) can change grazing patterns, increase settlement and create conflicts. A recent study by the Centre for Humanitarian Change (CHC) and the Rift Valley Institute (RVI) for the World Bank found that there were complicated dynamics that appeared to influence whether or not water investments led to better resilience, and that this had been surprisingly understudied (Balfour, 2024). Since it is critical that planning for water investments is informed by evidence, and not just rhetoric, the Supporting Pastoralism and Agriculture in Recurrent Crises (SPARC) research programme joined with CHC for a deeper investigation into the assumed link between water investments in ASALs and resilience.

The study aimed to investigate whether new water supplies in fragile ecosystems really make households and communities more resilient in the face of climate change, and how far current policy and practice reflect the evidence of impact of new water supplies.

1.2 Research methodology²

The research study arose from a gap in the existing evidence of the impacts on resilience of water supply developments in ASALs in the Horn of Africa. This was confirmed by a light literature review focused on literature from between 2017 and 2023, to allow for a comparison of people's coping strategies in the droughts of 2017 and 2021. Some earlier water developments going back 10 years were also included in the review. We looked in particular for any documented evidence of impacts on specific groups of people, including women and nomadic pastoralists. A summary of this review, which underpinned the design of the research approach, is presented below in Section 2. This review threw up questions about how the label 'resilience' was being used in water development policy and practice, leading to the commissioning of a more focused desk study, specifically exploring narratives of different stakeholders around new water supplies and household resilience in ASALs, and the policies and strategies of development actors on climate change adaptation and climate resilience in ASALs in relation to water supplies (Kioko et al., 2025).

To understand the impact of new water supplies on resilience to climate change, the study looked for sites in Kenya and Ethiopia, where new water supplies had been developed between the last two significant droughts in the Horn of Africa, in 2017 and in 2021. Since we wanted to see how new water sources had affected people's ability to cope in the drought, sites were selected where we were led to believe that the water developments had been successful. Two of the study authors led research teams in March and April 2024,

² The outline of the methodological approach in the main body of the report is simplified, giving just enough detail for a reader to understand the overall approach in order to appreciate what evidence was gathered and how conclusions were drawn. A more detailed description of the methodology is presented in the Appendix.

one in Dagahbur and Geshamo districts in Somali Regional State, Ethiopia and the other in Marsabit County in Kenya, to understand these water developments from as wide a range of perspectives as possible.

We set out to answer three questions:

1. What has the impact of new water supplies in ASALs been on people's resilience to drought?
2. How far will any changes provide longer-term resilience to climate change impacts?
3. What are the different perceptions of the impacts of new water supplies on people's strategies for achieving resilience and adapting to climate change?

For each question, we were concerned to explore why there might be different answers for different people, whether based on location, gender, identity, wealth or power, etc., and what gave rise to these answers.

The study teams visited four sites in Marsabit in four different sub-counties and five sites in two districts in Somali Region (Geshamo and Dagahbur) (Figure 1). The Appendix includes further details.

Information was also triangulated by studying time series of geo-physical maps and remote sensing data, looking at changes in vegetation and water index patterns of land use, and land degradation around water supplies.

We looked for impacts of water sources on resilience from as many perspectives as possible. Drawing on the literature and consultations with experts in the subject, we identified all the plausible causal chains leading from a new water source to well-being and livelihood outcomes, which are essential to resilience, as broadly understood. These included through affecting productivity, people's available time (for men and for women), their health, and wider impacts on the rangeland itself – on settlement patterns, social networks and local governance and collective agency.

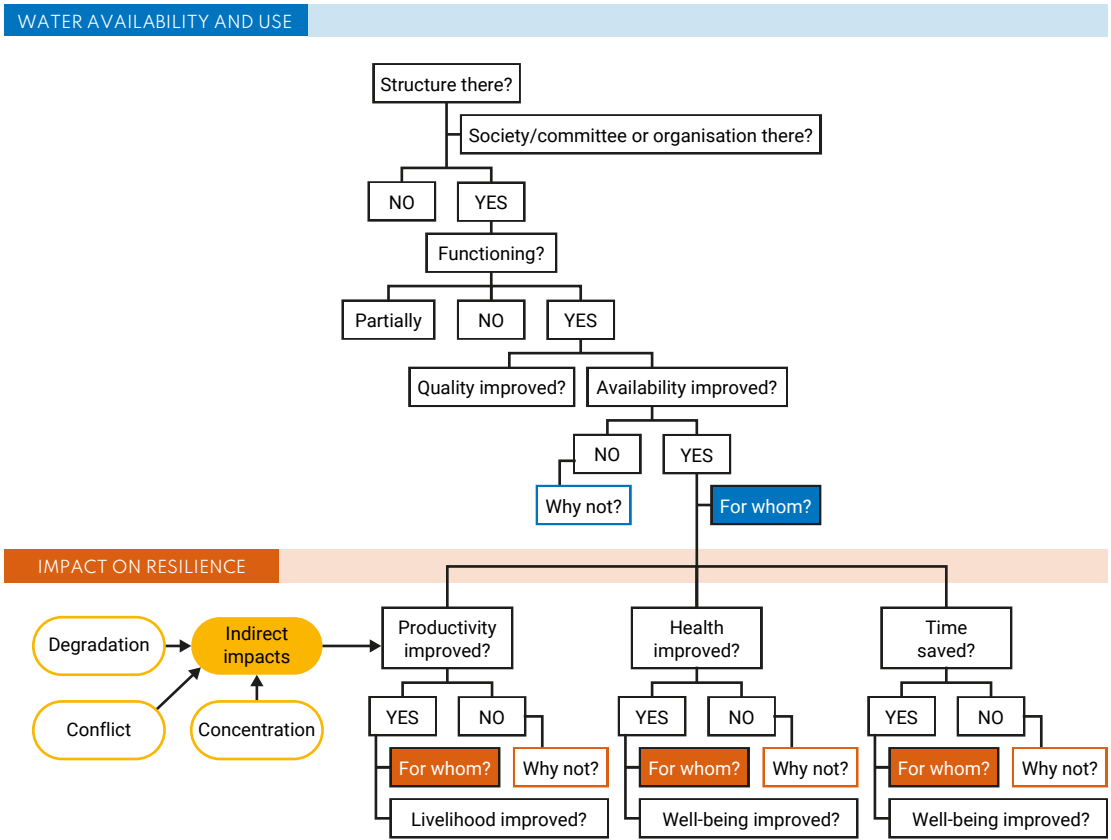
The causal map that provided the analytical framework is shown in Figure 2. Although the research sites were chosen because they were believed to be successful, we nevertheless started the investigation with questions about the functioning of the water supply.

FIGURE 1: FOCUS GROUP DISCUSSION, GESHAMO, SOMALI REGION



Source: Masresha Taye, April 2024

FIGURE 2: ANALYTICAL FRAMEWORK FOR RESILIENCE IMPACTS OF WATER SUPPLIES



Source: Authors

2. LITERATURE REVIEW: WHAT WAS ALREADY KNOWN ABOUT NEW WATER SOURCES AND RESILIENCE IN ASALS?

HEADLINES

- There is very little documented evidence of climate resilience impacts of water supply investments in dryland areas.
- Most of the literature discusses the resilience of the water supply – both the infrastructure and the sustainable management of the supply. This is an important contribution to people's resilience to drought but is not the same as the contribution of water supplies to the resilience of people.

2.1 Evidence of impact on resilience

Approaches to water development in dryland areas include: development of groundwater resources through boreholes for domestic and productive uses, capturing more surface water in the soil (pans and sand dams), soil and water conservation, and water harvesting (Mtisi, 2013). Water and climate resilience are closely linked in these fragile environments. Access to and availability of water determines who has access to the pasture/grazing areas. Ultimately this affects household resilience to climate shocks and/or the stability of the pastoral livelihood system (Nassef and Belayhun, 2012). Permanent water supplies are usually thought to have positive impacts on climate resilience, and many resilience project reports make this claim (USAID, 2020; BORESHA, 2020). However, despite billions of dollars spent on resilience projects in the Horn of Africa, researchers and practitioners are finding very little evidence of these intended impacts (Mohamed 2025; Alliance for Global Water Adaptation, 2024).

A study completed by Rift Valley Institute and CHC for the World Bank Groundwater for Resilience (GW4R) project looked at links between groundwater, fragility, conflict and resilience. The study was limited in scope but concluded that groundwater development does not always produce resilience outcomes. It identified some pre-conditions required for genuine resilience-building in fragile areas. Although increasing water access by establishing new boreholes lessens water insecurity in the short term, the potential negative impacts on rangeland that result from increased settlement and grazing, and on groundwater yields from over-extraction, can outweigh the benefits if not carefully managed (Balfour, 2024).

In much of the grey literature, resilience outcomes are often claimed or assumed, based on a weak interpretation of proxy indicators and without demonstrating an intervention's contribution to how the beneficiaries coped with the next drought (Kioko et al., 2025). Some projects appear to create resilience as an almost unintended consequence and not through the planned pathways, as illustrated in the case study from the Democratic Republic of Congo (DRC) in Box 1.

BOX 1: INDIRECT CONTRIBUTIONS TO RESILIENCE IN DRC

From 2014 to 2019, an EU SAGE project was implemented by Join for Water in the Ituri province of DRC. The intervention assisted community management committees (CMCs) to improve water, sanitation and hygiene (WASH) service delivery performance by strengthening management capacities and establishing them as legal entities. The improved governance structure was an entry point to legalise the inclusion of a diverse group of community members and build accountability mechanisms to enhance integrity and build trust. As the process evolved, the collaboration created new dynamics and brought authorities and the community closer together.

One of the major conclusions was that 'this change of mentality of the actors is perhaps the most promising result, on which other actions in the future can be built' (Tillet et al., 2020). The development of peace-building capacities within the WASH system (such as incentivising collaboration, building systems of accountability, and ensuring inclusion of a cross-section of the community) led to strengthened social cohesion between the communities and authorities and reduced negative misconceptions. The strengthened social cohesion has created a foundation for building resilience capacities of the CMCs, which will ultimately enable sustainable WASH outcomes.

Source: Case study in Grieve (2023)

The limited evidence from academic literature suggests that the impact of new water supplies in ASAL areas on resilience to drought varies depending on the specific context. In some cases, water development can exacerbate drought vulnerability instead of building resilience. For example, in sub-Saharan Africa, the construction of small water infrastructure can relieve water shortages in the short term but, without adequate governance, can erode traditional adaptation practices and lead to long-term impacts such as sedentism, overgrazing, rangeland degradation and groundwater depletion (Piemontese et al., 2024). Conversely, effective governance can manage risks, resolve conflict and ensure sustainable resource use (Pertaub, 2024)

Much of the literature focuses on the resilience of the water supply services rather than the resilience of the individuals, communities or their livelihoods. In Ethiopia, prioritising access to groundwater through multiple improved water sources and technologies, supported by monitoring and proactive operation and maintenance, increases rural water supply resilience during droughts (MacDonald et al., 2019). This study suggests that installing boreholes equipped with handpumps, even with collection times of more than 30 minutes, can improve resilience to drought and mitigate the negative impacts experienced by communities. However, to achieve safe, reliable water supply services, resilience needs to consider both infrastructure and management at the household and community

level (Charles et al, 2022). Understanding these interactions between the environment, infrastructure and management can help to inform development of more climate-resilient water services and inform how to measure climate resilience and water security in drinking water supplies (Howard et al., 2021).

The resilience of water supply systems and the resilience of livelihoods are related but not the same. ASAL livelihoods depend on reliable or resilient water supplies but this alone is not enough to ensure resilience. Overall, the review found very few studies that examined the relationship between access to new or additional water sources and community or individual resilience to drought in pastoralist areas.

2.2 Providing long-term resilience to climate change

Climate change will have significant impacts on water resources, and it is crucial to plan, develop and operate water infrastructures in a resilient manner to adapt to these changes (Muller, 2021). This suggests that managing current climate variability through resilient water infrastructure is an effective approach to strengthening the ability of communities and countries to foresee, manage and adapt to the long-term impacts of climate change on water-related activities (Muller, 2021).

Resilient water supply projects have mixed results in East Africa and hence resilience to climate change cannot be assumed as an outcome. A recent study in Kenya (Bedelian et al., 2022) looked at 62 water investments in the five pilot counties funded by the County Climate Change Fund (CCCCF). The CCCCf aims to finance public goods investments focused on the water sector to increase the resilience of communities to climate change. The study found that, in the dry season, only 52% of the systems were functional. The remaining 48% were providing limited or no water and therefore not contributing to the communities' resilience or adaptation to climate change.

Water supplies studied in Ethiopia and Nepal (Nijhawan, 2022) had low-to-moderate resilience to climate change. Service management and institutional support were weak in both countries. The data from Ethiopia and Nepal suggests that many water supplies in rural and small-town communities are unlikely to be resilient to future climate change without increased investment and support. None of the studies reviewed provided evidence of the role of water supplies in supporting pastoralists' resilience to climate change.

2.3 New water supplies undermining pastoralist resilience

There is some evidence to suggest that the development and management of new water sources in ASALs can have negative impacts on people's ability to cope with drought. Unsustainable patterns of development in the drylands over several decades have produced water supplies and settlement with no regard for pastoralist dynamics and mobility (Pertaub, 2024)

The construction of small water infrastructures in sub-Saharan Africa has short-term benefits in improving water availability for agro-pastoralists during extreme droughts. However, their long-term effects on the resilience of drylands communities remain unclear. The gaps in understanding the complexities of pastoralist resilience strategies seems to be at the core of the difficulties in recording evidence of water supply impacts (Kioko et al., 2025).

Negative impacts on the environment have been documented where there has been extensive development of permanent water supplies (Gomes, 2006). Concentrations of stationary livestock have led to increasing degradation and severe overgrazing of the rangelands, with a corresponding decrease in biodiversity and the quality of available pastures.

The excessive extraction of groundwater from wells can lead to the depletion of aquifers. This can reduce the availability of water during drought periods when surface water sources are limited. Communities depending on groundwater as a reliable source in emergencies may face water scarcity and challenges in coping with drought conditions (Healy et al., 2018; FAO/SWALIM, 2012; Paron, 2023).

The development of new water sources often requires significant investments, which sometimes come with a specific agenda for the investor, and which may disproportionately benefit certain groups or communities. Similarly, requirements to recover the costs of the investment, or at least full operation and maintenance cost, mean tariffs are set high. This can perpetuate existing socioeconomic inequalities, making it harder for marginalised populations to cope with drought. Limited access to these new water sources can exacerbate vulnerability and increase dependency on inadequate alternative water sources such as contaminated or unreliable water supplies (Healy et al., 2018; Balfour, 2024).

In arid regions, water scarcity can lead to increased competition and conflicts over water resources. The introduction of new water sources may exacerbate existing tensions and conflicts, especially when the distribution and allocation of water resources are not equitable (Opitz-Stapleton et al., 2022). Disputes over water rights, usage and management can further hinder people's ability to cope with drought by diverting resources and attention away from drought relief and adaptation strategies (Catley et al., 2016; USAID, 2022). However, the narrative that water scarcity leads to conflict has been challenged (Balfour, 2024; Ward and Ruckstuhl, 2017) and there are many examples of widespread stress over water leading to collaboration rather than conflict.

While these negative impacts can occur, they are not inherent to the development of new water sources. Adopting water development policies that are not focused only on settlement, and that support rather than undermine pastoralist livelihoods, can have significant resilience benefits. This was demonstrated in Chad, where small, temporary rain-fed ponds along transhumant routes were particularly popular among herders (Hesse et al., 2013). Proper planning, management and governance can help mitigate negative effects and ensure the sustainable and equitable use of water resources in ASALs (Healy et al., 2018; Kohlitz et al., 2019).

2.4 Summary

The limited available literature indicates that new water supplies can make communities more resilient to climate shocks and climate change, subject to certain conditions. Aligning new water projects to specific contexts backed by a more holistic understanding of how water supplies are used within a pastoralist or agro-pastoralist system is key (Healy et al., 2018; Pertaub, 2024). Failure to do this is a major explanation for why many water supply initiatives do not deliver resilience outcomes. Other major requirements (Nijhawan et al., 2022; MacDonald et al., 2019; Piemontese et al., 2024; Balfour, 2024) include the following:

- reliable and sustainable water supplies with affordable (subsidised) technical support for monitoring and maintenance to make sure they keep providing water when its most needed;
- full assessment of possible short- and long-term environmental and social impacts on ecological systems and settlement patterns, as well as the sustainability of the water resource itself;
- strong local governance to control use and mitigate damage to rangelands, resolve conflict and build on social networks and capital, preferably through a combination of indigenous and formal institutions;
- time for careful planning and consideration of needs and incentives of multiple stakeholders – users, implementors and policy actors – to ensure that project design gives due consideration to their capacities, needs and aspirations;
- bottom-up, participatory water governance systems, incorporating indigenous knowledge and based on negotiated social contracts with all potential user groups (especially women, who are often excluded from governance, and migrating pastoralists) will be more equitable, legitimate and responsive to the needs of both sedentary and mobile groups.

The literature review highlighted gaps in understanding of how these different conditions influence the resilience outcomes of new water supply investments. The desk study on narratives and framing (Kioko et al., 2025) highlighted problems in the assumptions about water supply impacts in development and resilience programming. It also documented significant weaknesses in the understanding and documentation of the causal pathways between water supply and pastoralist resilience.



Traditional water catchment, Somali Region, Ethiopia.
Photo credit: © Masresha Taye, April 2024

3. BACKGROUND TO WATER DEVELOPMENTS IN THE TWO STUDY AREAS

3.1 Geshamo and Dagahbur districts in Somali Region, Ethiopia

Geshamo is in a remote eastern corner of Ethiopia, where the Somali clans have close ties with Somaliland. Thirty years ago, there was no permanent water in this area, so pastoralists would use it for grazing only in the wet season, trekking to Burau in Somaliland during the dry season. In the 1990s, private water tanks, or *berkads*, were built, which allowed pastoralists to spend more time in Geshamo. The long-running conflict in Somali Region created insecurity and prevented any settlement. After conflict was largely resolved in 2016 (with a peace deal being finalised in 2018), families became more settled. In 2019, UNICEF used modern technology to locate deep groundwater and drill boreholes that provided permanent water for the first time. However, of 20 *kebeles*³ in Geshamo, only 20% had water supplies in 2024.

Land and water resources are owned and controlled by sub-clans and, in the absence of formal government regulation, the seasonal water sources, such as pans and *berkads* are well managed with minimal conflict. However, there are examples of elite capture of water and land, often for political agendas, and direction of development resources is heavily influenced by power dynamics between and within clans in the region.

3.2 Marsabit County in northern Kenya

Marsabit is a vast county in the north of Kenya, bordering Ethiopia, but with very low population (less than 500,000). The research team selected boreholes from each of the four sub-counties to capture the considerable differences in their agro-climatic and socioeconomic conditions. Conflict between tribes is common, which affects access to water and grazing. Since devolution in 2016, the county government and its partners have invested heavily in boreholes to increase water supply, increasing to more than 120 compared to fewer than 10 in the late 1990s.

Salinity of the groundwater is a problem in many parts of the county. In attempting to ensure equal distribution of development benefits between the different sub-counties, water actors have returned to the same settlements and dug repeat boreholes multiple times. This pattern of 'freelance' water development by non-governmental organisations (NGOs) and politicians has resulted in multiple boreholes in the same communities, with a mixture of formal and informal management arrangements. The communities visited for this research all have access to at least two boreholes; one community, Kargi, has eight boreholes but only one of which provides fresh, non-saline water.

3 A *kebele* is the smallest administrative unit in Ethiopia, comprised of a collection of villages.

4. STUDY FINDINGS

4.1 Overview

The research was based around an analytical framework (see Figure 2), which identified a series of interconnected factors related to water supply and outcomes contributing to peoples' resilience to drought in the Horn of Africa. Data collection tools and the data analysis followed this framework and hence the findings below are also presented in a sequence informed by the framework. However, the findings from the field work show a much more complex picture of resilience than is captured by a simple, linear flow diagram of cause and effect.

During analysis, the team moved away from looking at the impact of a single, new borehole on the resilience of a household or community and instead explored how pastoralists use an additional water source as part of a network of natural resources to support lives and livelihoods in drought. The data also raised questions such as 'whose resilience matters?' and about the impact of permanent water supplies on the core features of resilient pastoralism (mobility and security). The sections below attempt to capture findings on these additional questions and present a picture of water and pastoralist resilience.

4.2 Functionality and reliability – is the water supply functioning?

Under 60% (10 of 17) of the boreholes studied in Kenya, and just half of those studied in Ethiopia (4 of 8), were still functional (Table 1). This is below functionality levels reported in national studies in both countries, typically around 70% but often lower (IRC, 2019; Bedelian et al., 2022). Poor rates are particularly surprising for Geshamo where all the boreholes are less than six years old. More worrying is that, out of 17 boreholes visited in Marsabit, only 2 were functioning, available to the community and providing fresh (not saline) drinking water. Similarly, in Geshamo, all four functioning boreholes were reported to be saline and used for drinking only during extreme scarcity.

In Marsabit, a common pattern is that boreholes that are saline are not maintained and stop functioning; new ones are then drilled in the same settlement in an attempt to provide better services.⁴ This pattern of multiple boreholes in each settlement can be attributed to both political influence and urgent relief initiatives in drought emergencies (the need to demonstrate a positive result in the form of new infrastructure). The other argument for an additional borehole in pastoralist areas is to separate water sources for domestic and livestock use, although in practice these uses are never separated in pastoralist systems.

⁴ This strategy is not supported by the hydrogeology, which usually indicates that all boreholes in one area will draw from the same aquifer. If the aquifer is saline, all the boreholes will be saline.

TABLE 1: FUNCTIONALITY OF BOREHOLES IN STUDY AREAS

Kenya			
Site/village	Borehole (name)	Functioning (Y/N)	Considered saline (Y/N)
Kargi	Kargi borehole	Yes	Yes
	Gangeisa borehole	Yes	Yes
	Gatab waraba borehole	No	Yes
	Ririma borehole	Yes	Yes
	Ramo borehole	Yes	Yes
	Dakhane borehole (fresh)	Yes	No
	Urweino borehole	No	No
	Dadabtimlab	No	Yes
Jaldesa	Jaldesa borehole (LMD)	Yes	No
	2016	No – not piped	No
	2018 (World Bank/national government)	Yes – private use	No
Ambalo	Very salty borehole	Yes	Yes
	Less salty borehole	Yes	Yes
Kambi Nyoka – pilot site	Borehole 1	Yes	Yes
	Borehole 2	No	Yes
Bubisa – impromptu site	Borehole 1	No	Yes
	Borehole 2	No	Yes
Total	17	Y – 10 N – 7	Y – 12 N – 5

Ethiopia			
Kebele (borehole) name	District	Functionality (Y/N)	Salinity Level
Wereg 1	Geshamo	Yes	Saline
Wareg 2	Geshamo	No	N/A
Elbahay	Geshamo	No	N/A
Gedi	Geshamo	Yes	Low salinity
Kayder Lebile	Geshamo	No	N/A
Gedi Ar	Dagahbur	Yes	High salinity
Gawlale	Geshamo	Yes	Saline and very hot
Geshamo	Geshamo	No	N/A
Bubisa – impromptu site	Borehole 1	No	Yes
	Borehole 2	No	Yes
Total	8	4 functional 4 non-functional	4 saline

Source: Authors' own

Members of all focus groups reported that boreholes are unreliable, breaking down frequently, and that local government takes a long time to repair them. In some of the study sites, women have several options for domestic water and resort to buying from private suppliers or walking longer distances to find surface water when the borehole is not functioning. Many stakeholders feel government water departments are not allocating sufficient resources to operation and maintenance of water supplies, despite a clear mandate to provide water.

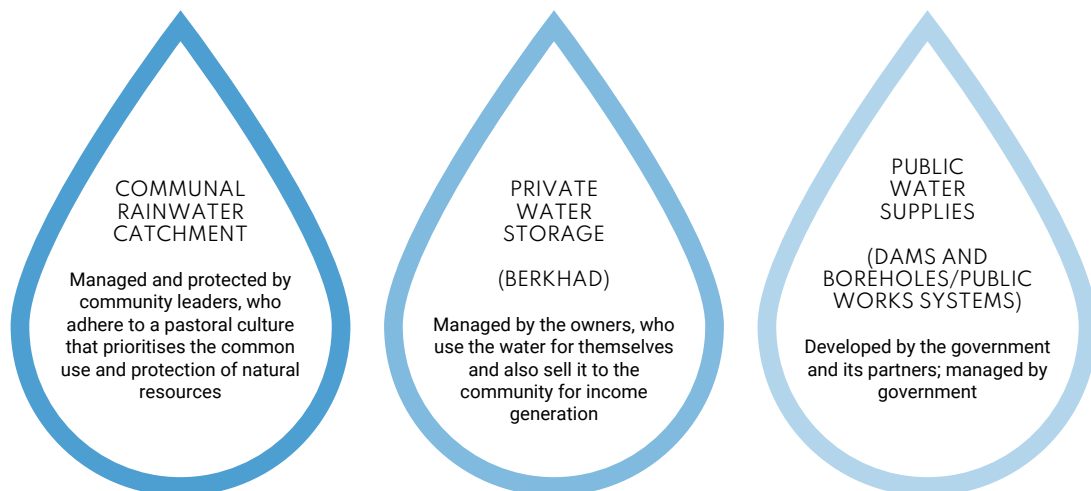
The initiative to replace diesel- with solar-driven pumps is considered to make the water supplies more reliable and resilient. Most communities appreciate the reduced operational costs that comes with solar systems but the design of some supplies, with no storage to cover night-time demand and/or cloudy days, makes them less able to meet needs in the drought. Stakeholders in Marsabit also commented that the solarisation of boreholes in the county has made it difficult to enforce the closure of contingency boreholes outside drought periods.

4.3 Water use and access – has availability of water improved?

4.3.1 Water governance

In Ethiopia, water supplies are characterised as communal, private or public, with distinct management systems for each (see Figure 3). This typology was described clearly in Ethiopia but it is similar in the rest of the region.

FIGURE 3: DESCRIPTION OF TYPES OF WATER SUPPLIES IN SOMALI REGION



Source: Authors

In other parts of Ethiopia and in Kenya, there is less distinction between public and communal water supplies; community-based committees are established to manage the supplies after they are built or rehabilitated. In Ethiopia, despite the standardised water, sanitation and hygiene committee (WASHCO) model, public water systems belong to the 'state' and are the responsibility of the district water office. By contrast in Kenya, rural water supplies developed by government and their partners are 'handed over' to communities but there is no common understanding over who owns them. In some cases, the most powerful elders and politicians will influence the formation of a water committee for a

mechanised water supply to retain some control. This politicisation of the community-based management model is common across dryland areas of both countries.

Indigenous ('informal') management systems still exist in both countries and are especially strong in Borana culture where an 'Aba Hereiga' (customary water manager) is responsible for coordinating maintenance and controlling access. This system of governance usually applies to traditional water sources such as shallow wells and rainwater catchments (pans), and is part of a broader governance of natural resources including movement and grazing patterns for herders.

In Geshamo district, each 'village' is the name of a sub-clan. The village where a new borehole is drilled becomes the 'owner', and hence it belongs to a clan although others have access to use it.

When people come to bring in new water supplies, they never take any notice of our local knowledge, and they exclude us from consultations on water management. They don't seem to realise that our community uses a few different water sources, so they end up creating tensions between the different management systems. (Community elder, Gedi Ar)

Government and development actors in both study areas reported that boreholes are managed by formal institutions, involving an elected committee, with repair services provided by local government. This is usually a different set of people from the indigenous governance but the committee members may have been selected by the same elders. In both countries, there is a pattern of formal structures functioning for a while but, when they collapse, the management of resources reverts in part to indigenous systems. One clear example of this was in Wareg in Geshamo, where only one borehole is functional, although it is saline.

The community prefers to use a pan governed by elders using strict bylaws in which herders contribute to operating a small pump to move water to the livestock troughs, and access to water in the pan is restricted.

Women have very little power in any of the governance systems but they lobby and mobilise people to get repairs done, as they are the main users. Even when external aid organisations and government policies require equal representation, or a minimum percentage of women in water committees, this is often a token presence with no real power being given to women.

4.3.2 Access and control

Access and water use by different groups varies across the different sites. Although managers insist that no one is ever refused water, especially in a drought, in practice there are examples of elite capture and prioritising water supply for some uses (e.g. livestock).

During difficult times like drought, vulnerable people and those who come from other places are served first, even from the privately owned water. This is our culture, not something imposed on us by the government. (Focus group, Gashamo)

Access is sometimes controlled by application of exclusive tariffs for visiting herders and families and historic tensions between groups sometimes prevent families from requesting water from a borehole belonging to a rival clan. Managers in Marsabit reported that there are sharing agreements for boreholes to be used by mobile pastoralists, although there is reluctance to provide fully open access because attracting herds from some rival tribes is seen as a conflict risk.

Two attempts at elite capture – one successful, one not – were seen in two villages (Boxes 2 and 3). There is a common pattern to both these examples in which the grabbing of the water supply is backed by politically connected individuals and is more common where there is more than one water supply in a community.

BOX 2: ELITE CAPTURE IN DAGAHBUR, ETHIOPIA

In Gedi Ar in Dagahbur Woreda, an influential water officer from the zonal water office directed resources to develop a borehole in the village. He settled his kinsmen around the borehole and the original owners of the land were pushed out. Clan power dynamics changed after elections and the water officer lost his influence. The clan that had originally owned the land then destroyed the borehole infrastructure and took back the land. The clan members resorted to using traditional *berkads* after the borehole stopped working.



Destroyed borehole infrastructure



Traditional *berkad*

Source: Masresha Taye, April 2024

Within the community surrounding a water supply, access for vulnerable households is guaranteed by waiving fees. This is common practice across the region and committees report that water is provided free to the poorest women. This traditional equity is obviously more complicated, though not impossible, to effect where an automated (water ATM) or smart meter is installed.⁵ In this case, a technical solution to one problem, lack of transparency of funds leading to no resources for maintenance, creates a new problem in a different dimension, the social, because the technical solution has been designed without considering informal social arrangements.

BOX 3: ELITE CAPTURE IN JALDESA, KENYA

In Jaldesa village in Marsabit (close to Marsabit town), a new borehole was drilled during the 2022 drought as part of an initiative to support climate-smart agriculture. This was intended to be a resource for irrigated agriculture and the community helped to prepare communal fields and erect greenhouses. At the time of the research, the borehole was being used for a private horticulture enterprise with vegetables being grown and sold in Marsabit town. There was no community agriculture and the fields and greenhouses were abandoned. The individual concerned had negotiated with the elders and was backed by powerful politicians in the town.

⁵ Pre-paid water metering systems, also called water ATMs, have been introduced in several counties in Kenya. Users have a smart card that they can top up from mobile money (Mpesa), which allows them to collect a fixed amount of water for a fixed price from the automatic water dispenser. (See also SWIFT consortium, 2018).

4.3.3 Water quality

Use of water depends on its quality. Saline water is used for livestock and by households only when no other water is available. There is evidence of households with access to saline borehole water buying in fresh water from other sources to meet domestic needs. Geshamo residents say the saline water from the borehole public water supply (PWS) is used for both domestic and livestock purposes in the drought but in normal periods they prefer to use *berkads* and pans. This obviously has implications for the financial sustainability of the water supplies if income from sale of water is highly seasonal. When the water from the saline borehole has to be used residents prefer to pump it into a *berkhad* to cool it before use (see Figure 4).

The water from the PWS is very salty and it can't be used for drinking or cooking. We mostly use it for watering livestock, particularly during droughts. We buy water from the traditional private water owners and from water trucks and, if it rains, we use rainwater. (Female focus group, Geshamo)

FIGURE 4: WATER FROM A DEEP BOREHOLE IN GESHAMO IS PUMPED INTO AN OPEN POND FOR COOLING



Source: Masresha Taye, April 2024

Very few of the boreholes in Marsabit provide good quality water for domestic use (see Table 1) so, when rainwater catchments dry up, there is a demand for water trucking from many settlements. This leads to over-pumping of some boreholes and irregular supplies to remote communities. The persistent salinity is predictable in the hydrogeological conditions in these areas, and drilling more boreholes has not produced better quality water in most cases.

Kargi has several boreholes but relies on fresh water piped from a borehole around 15 km away in Dakhane. There have been challenges and conflicts over access to this water because people from a specific sub-clan settled around the area but can access water only by tapping into the tank or pipes to Kargi. According to some residents from Dakhane, the more powerful residents of Kargi have refused to allow a permanent water point for them.

Salinity problems are recognised by water actors in Marsabit and some attempts have been made to address this challenge by installing desalination plants (funded by humanitarian aid). However, possibly due to their very complex nature, the desalination plants are not operating effectively. Members of Bubisa community reported that their plant worked well for some months, before starting to discharge water that was even more saline. At the time of the research, this 'fresh' water supply system was dismantled because the metal pipes in the borehole had been rusted by the saline water and the desalination plant needed maintenance which could be done by only the company that supplied it.

4.4 Economic outcomes – has productivity increased?

4.4.1 Agriculture

While many development actors believe that water should be used for irrigated agriculture as a viable, alternative livelihood in rural ASALs, not one of the 25 boreholes visited in Kenya and Ethiopia was supporting irrigation for the local population. The only successful irrigation from a borehole in the study sample had been completely captured by one individual. Many boreholes in northern Kenya are too saline or the water is not enough for all users and priority is given to domestic and livestock use. There has been considerable investment into diversifying pastoralist livelihoods into irrigated agriculture in the Horn of Africa over the last 30 years. There is evidence of multiple attempts to create market or kitchen gardens near boreholes in Marsabit and this is a specific objective of many USAID and World Bank projects in northern Kenya. In many communities, production stopped during the drought due to high demand for water. At other sites, the borehole water is too saline for irrigation and/or the shade-netting infrastructure was destroyed by wind.

The only evidence of successful agricultural production found by the study team was at Jaldesa, where the borehole and related irrigation infrastructure has been taken over by a private individual and is successfully used for irrigated agriculture with vegetables going to market in nearby Marsabit town. This 'elite capture' undermines distribution of economic benefits. In Somali Region, there is irrigation along the Shebelle River but not in Geshamo, where the only income generation from groundwater is from sale of water.

4.4.2 Other economic benefits

In project plans, new boreholes are expected to bring a variety of economic benefits but these are seldom realised. In Geshamo, new boreholes have led to settlements which in turn have created small trading opportunities, for example women sell tea and food items to visiting herders. Although boreholes are expected to save women time from the burden of collecting water, in all study sites women did not consider that any time saved could be used for income-generating activities because domestic tasks still fill their time, especially during a drought.

We have a challenge with borehole operators. The livestock consume water and payment is made but this money is not remitted to the committee... This has made some boreholes look like they are owned by specific clans or even families. (Focus group (WMC), Kargi, Marsabit)

The sale of water from high-yielding boreholes is a potential economic benefit but this income does not seem to be shared or invested in the water supply. Users felt that elite capture undermines distribution of economic benefits. In both research sites, tariffs are not well regulated so elites can charge 'outsiders' more and lack of accountability means there is very little transparency on how revenue is used. New smart meters (water ATMs) in Kenya have potential to solve some of the fee-collection problems and increase income from water sales by reducing 'leakage' and non-payment but, in some cases, communities have already found ways to 'jam' the meters to get free water. In Geshamo, there were savings from the boreholes because user fees are less than the fees for bringing in water by tanker.

Economically, the PWS saves a lot of money for the community. Before it was developed, in this village, a barrel of water cost 400 Birr, and now it's only 50 Birr. (Male, Elder, Geshamo)

4.4.3 Livestock and rangeland

Resilience outcomes are often described in terms of reducing loss of livestock in a drought. This is very difficult to quantify when figures of losses (and survival) are very unreliable – 'no-one tells the truth about the number of livestock they own' (KII interview, Marsabit town, April 2024). A certain level of loss is seen as part of a cycle of herd dynamics but most informants in the study felt that this most recent drought of 2021–2023 was exceptional because it was so long and widespread. Livestock losses were high in this last drought due to the number of successive failed rains and the geographical spread, which meant grazing dried up across the whole region.

In analysing the resilience impact of water supplies, many experts felt that the increased number of permanent water supplies had not had an impact on livestock losses because availability of water was not matched by fodder availability. Livestock losses in Marsabit were very variable across geographic areas and across tribes. Those with camels appeared to have lost fewer animals. Government officials estimated up to 70% livestock loss and high numbers of people 'dropping out' of pastoralism and moving to urban centres.

There is a trade-off between reliable, permanent water and range degradation. People appreciated that new water points closer to grazing areas reduced the long distances that livestock had to walk and which lead to livestock wasting. On the other hand, permanent water supplies attract more livestock, leading to the faster depletion of pasture and so earlier exposure to drought impacts. Many herders also commented on the loss of grazing reserves when permanent water created settlements. This is most obvious in Geshamo, where there was no permanent water before the boreholes were drilled in 2018. Since then, large numbers of livestock relied on the boreholes in the drought, but herders had to buy in fodder or travel far to find grazing. Degradation was observed in a 10 km radius around the boreholes.

It is difficult to attribute reduction in grazing areas and range degradation only to water points. There is a strong perception among study participants of climate change affecting rainfall patterns, increasing drought frequency and reducing quality of grazing. Respondents in both study areas talked about loss of diversity of plant species in the rangelands (see quote below) and the corresponding increase in invasive species. This is supported in the academic literature for sub-Saharan Africa (Timpong-Jones, 2023). Many pastoralists' experience of climate change is the increased frequency of drought and many struggle to talk about long-term impacts and adaptation when the short-term recovery from the recent

drought experience is their most urgent concern. Drought and its associated water and pasture scarcity were the most frequently mentioned impacts of climate change.

Long ago when you were travelling to Marsabit, there was a strong smell of vegetation and from the trees around Hamaleite. This told you that the area was full of nutritious plants and there was lots of vegetation. Today, even after heavy rain, there's no smell of vegetation at all, and this tells us that it doesn't have any nutritive value. It can't boost milk production to provide for the family. (Herder in Kargi)

Women in Somali Region feel that milk production has decreased. They also talked about the decline in the quality of milk from cattle, including its smell and taste and its nutritional benefits, measured by how sustaining it is felt to be.

Perceived climate change impacts must be seen alongside population dynamics and changes in herd structures. Most research shows an increase in absolute livestock numbers but also steep population growth, so overall household herd sizes have reduced. This reduction in herd size is seen as a positive change by some experts as it provides an opportunity to redesign the pastoralist livelihoods in these drought-prone areas, with fewer livestock and more sustainable resource use.

After loss of livestock, there's a good opportunity to build back better and move to a more resilient system with less livestock, more diversification and environmental conservation. (Key informant, Water Department, Marsabit town)

Some pastoralists see these changes in mobility and resource use as critical erosion of pastoralist systems that will leave them more exposed to drought and climate change. In both research areas, there is suspicion that this erosion of pastoralist systems is part of a wider political agenda to discourage mobility and encourage settlement.

4.5 Drought coping – were livelihoods protected or more resilient, and for whom?

The strategies for coping with the extended 2020–22 drought are at the heart of this research. The arguments on resilience can be looked at in two ways: (1) as an outcome of specific water supply interventions; and (2) as a theoretical question of what contribution new water supplies in ASALs can make to resilience. As an evaluation of specific water supplies, we found little impact, because there was not much useful water. For the potential contribution of increased water supplies, the responses present a very mixed picture.

In Marsabit, the government's rhetoric is that functioning boreholes did help pastoralists; to combat drought, more and bigger water supplies are needed. This is part of a push by politicians in Kenya's northern counties to get donors to invest in large-scale water supplies such as mega-dams. It is also part of a persistent belief that more water always adds benefit to the existing livelihoods and that infrastructure development is progress for the northern counties that are 'behind' the rest of the county.

The reality is that there is little evidence that boreholes in Marsabit have reduced drought stress, because, as discussed above, the duration of drought resulted in drying up of all grazing areas within reach and hence heavy livestock losses; and, in any case, so much of the water available is saline.

Superficially, pastoralists in Geshamo, Ethiopia, had a different experience during the drought because the deep boreholes were drilled just before it began. This was the first experience in Geshamo of permanent water supply, and thus of settlements in what had been a grazing area for nomadic families and herds. Respondents felt that, because water was guaranteed, they could import feed and hence cope better with the drought. However, deeper conversations with pastoralists revealed concerns about the changes in pastoralist systems created by permanent water supplies and specifically by the increased settlement around the boreholes and the extent to which this would undermine drought coping over time.

Male pastoralists felt that there was a loss of solidarity and the 'whole system mobility' required for the security of nomadic pastoralism: 'high mobility pastoralism needs a whole system, a whole community'. Related to this are concerns that one or two boreholes in Geshamo undermined traditional practices of high mobility and led to splitting of herds between different areas to manage risk by exploiting differences in conditions between places at any time. They also reported increases in livestock disease because of concentration around boreholes.

BOX 4: SUMMARY OF MOBILE PASTORALIST SYSTEMS IN THE HORN OF AFRICA

Pastoralists traditionally use grazing areas where there are no permanent water sources for grazing in wet seasons to exploit surface water. They maintain grazing areas where there are permanent water points for grazing in the dry season. Some areas are not suitable for grazing in wet seasons because of the prevalence of parasites and because wet conditions can cause diseases. Pastoralists have to manage this in the context of conditions being very variable in unpredictable ways, both from year to year and from place to place. These mobile systems are becoming increasingly difficult due to climate change, politics, population dynamics and natural resource exploitation. But pastoralists are famously adaptable and are coping with the challenges in different ways in different areas (Catley, 2016).

In both countries, there is a more hidden debate about the politicisation of water. Governments across the region have long mistrusted pastoralists and pastoralism and sought to settle people as part of an agenda of establishing control over them and, sometimes, of the natural resources that they own or occupy (Nori, 2022). This was felt most strongly in Somali Region because of longstanding tensions and mistrust around identity. Services, such as education, health and social welfare, are offered in ways that require families to be resident and registered in a settlement. This undermines their mobility and is used as an incentive to take them out of nomadic pastoralism. Some pastoralists are therefore suspicious about hidden motives behind increasing permanent water supplies and settling people around them in the name of drought resilience. The example of Gedi Ar (see Box 2) shows why such suspicions may arise.

Women were more positive about the benefits of permanent water and settlement and how it has helped them cope with drought (see Section 4.7). Typically, the women and children are settled when the male members of the family move with the livestock, so the benefits of settlement are felt most by them. Women are also the ones responsible for all domestic water provision and often caring for young or sick livestock. They bear the burden of having to go far to fetch water, leading to long periods away from home as distance to water increases with severe drought.

There are times when we hand-feed the livestock, and they eat the food because they can't find anything else to eat. Water scarcity is the most challenging problem caused by drought. That's why the development of PWS is good, because it solves this problem. (Female focus group, Geshamo)

Overgrazing around boreholes was reported at all research sites and some informants felt this undermined drought coping. However, many development actors believe climate change, changes in herd composition and population pressure are the main drivers of rangeland degradation and hence drought coping. They therefore deny the contribution of permanent water supplies to this trend. Herders feel that overgrazing is a problem but only where no other grazing reserves remain and mobility is restricted. In Marsabit, local experts recognise that there is a loss of wet-season grazing reserves because areas are now open year-round with permanent water, and this has fundamentally changed wet- and dry-season grazing patterns.

The pattern of drought coping was also variable across different ethnic groups and, to a lesser extent, geographically. Families with camels did better than those with cattle because they can reach areas that are far from permanent water and utilise different rangelands. The drought was widespread and, unlike in previous droughts, there were no areas of the Horn of Africa that had received better rainfall and had more grazing and surface water, which put more pressure on permanent water supplies. Wealthier pastoralists with large herds were able to afford to transport their livestock to grazing areas and buy in fodder and water when needed, so coped better than poorer families. However, pastoralists felt that this drought was so extreme, and the availability of fodder and water so limited, that even wealthy families lost large numbers of animals.

Overall, the research suggests that adding water to a fragile, drought-prone livelihood system is not necessarily a positive addition. In reality, an additional water supply creates a new dynamic and a new 'disruption' to the system, e.g. settlement. It is not possible to have the old mobility plus water; you can only have permanent water with increased grazing pressure and less mobility. Marsabit and Geshamo capture two different time phases in this transition. The changes in the pastoralist system are already evident in the Marsabit cases. In Geshamo, because the water is still so new, they almost have the traditional pastoralist systems plus water, so it may appear to be working, but the herders can already see the water as a disruption and they fear the system change. This system disruption does not seem to be well understood and hence policies continue to recommend new water supplies as the key to drought coping and resilience without recognising the trade-off.

4.6 Social outcomes – did local institutions strengthen social capital?

Learning from aid interventions in Africa has suggested that the main resilience benefit from water is increasing social capital through strengthened water institutions and links with local government (Grieve, 2023). Our study found a very mixed picture regarding social capital and the contribution of strong water institutions. While the appointment of representative community water committees has the potential to bring the community together to make collective decisions about water, social cohesion has been undermined by corruption in committees, and differential treatment of 'external' tribes or marginalised sub-clans e.g. through inflated tariffs. Informants at all levels recognise that there is an accountability deficit within community-based management systems. Repeated stories of embezzlement of funds and mismanagement have undermined confidence in these committees.

Boreholes with significant incomes are a source of conflict. Local leaders who are not involved in the management of water supply think that those involved in the management are benefiting from the income. This tends to drive conflicts because they are looking to access funds as well. (Key informant, county government, Moyale)

The sustainability of water supplies is reflected in community management policies, which expect water sales from borehole-based water supplies to provide enough funds for operation and maintenance. In theory, a well-managed borehole, serving a large population of animals and people, can make a significant income for the institution that manages the water supply, whether this is government, an elite group of pastoralists or a water committee. In reality, funds are collected but, when water systems break down, they are inevitably repaired by government or an NGO once a drought occurs.

Since the water committee has come to expect this, it removes any incentive to use the funds collected for maintenance and dilutes any accountability that the management institution might have to the users. This pattern is illustrated by the rows of aid-agency sign boards telling the story of repeated rehabilitation works every few years (Figure 5). This allows management committees to divert funds. Water management then becomes a source of power and an opportunity for personal financial gain, rather than a responsibility and a service accountable to the community. The rhetoric around the success of community participation and community-based management belies this pattern of failure and internal conflict.

FIGURE 5: MULTIPLE SIGN BOARDS SIGNAL THE MULTIPLE AID INTERVENTIONS AT CAMPI NYOKI, MARSABIT



Source: © Nancy Balfour, April 2024

This contrasts with how indigenous water governance is seen as a responsibility, not as a vehicle for personal power. One thing in common between the formal and informal systems is that both are male-dominated. In both study areas, we found that, where indigenous water management systems are in place, usually around rainwater catchment supplies, there is more social harmony and collaboration. One striking example is the pan in Geshamo where all users contribute fuel and funds to pump water to water troughs to avoid contaminating the water source, following rules set by the elders.

The PWSs bring settlement and a new governance system, such as the water committee. However, the traditional leaders, who are clan-based, have a higher level of governance than the modern system because clan relationships are the highest social bond in Somali pastoral communities. (Focus group, Geshamo)

The evidence around social cohesion in times of scarcity is stronger with deliberate water-sharing to maintain peace with neighbouring tribes/clans, for example in Ambalo in Kenya. Discussants in Geshamo insisted that water was shared with everybody and this maintains good relations between clans. The common rhetoric about competition over water driving conflict is seldom the full story in pastoralist communities (Balfour, 2024), and this study found no examples of conflict over water during the drought.

There were several examples in both Marsabit and Geshamo of major conflict and destruction of property over inequitable water development and/or poor consultation or collaboration with local water leaders. Conflict in Gedi Ar in Dagahbur district (see Box 2) is just one example of politics using water as a means of driving conflict. There were similar stories around power and finance flows in Marsabit (see Box 3 on Jaldesa). Informants noted the lack of government accountability in developing water supplies and how this culture is replicated at community level, with water users not holding committees accountable for financial management and equitable service delivery.

4.7 Health and personal outcomes – did well-being improve?

The savings in women's time and work burden created by new water supplies, closer to homesteads, are often cited as an outcome that indicates resilience to drought. However, many of the water supplies were not functioning at the time of the research, and so they had no impact on health or well-being. Others were reported to be unreliable, so women frequently had to look for water from alternative sources, often open and contaminated. Where the water points were working, most groups and informants reported time-saving as a benefit but this was countered by women in some sites where the water was too salty for domestic use. In Geshamo, women have to buy fresh water for drinking and cooking, and those who cannot afford to buy water travel long distances to fetch fresh water for the family. But, in the severe drought, they did use the borehole water because they had no alternatives, so there were time-saving and cost-saving benefits as well as reduced burden when they were most stressed.

Boreholes affected domestic gender relations in different ways. Before the provision of permanent water in Geshamo, women would get beaten for not completing domestic tasks or being late to bring water, and some felt that the boreholes had reduced this. But settled women reported more expectation on them to bring income to the household.

While school enrolment has increased across the ASALs in the last 10 years, it is difficult to attribute this directly to water supplies. Sedentarisation has increased school attendance, especially for girls, and improved sanitation at schools also increases girls' attendance. This is likely to have long-term benefits for their resilience. However, there were also reports of girls dropping out of school because the domestic workload increased during extreme drought.

Women also appreciate the better access to health services that has come with settlement. It is likely that the impact of water development on health is not as clear as reports indicate.

Global reviews have highlighted the difficulties in attributing improvements in health to WASH improvements (Esteves Mills and Cummings, 2016). In the study areas, most development specialists acknowledge that open defecation is still common, and very few households in these study areas are drinking safe water on a regular basis. Water quality and particularly salinity is an increasing problem across the Horn of Africa region as more groundwater is extracted from unfavourable aquifers. There is anecdotal evidence of serious health impacts of drinking saline water, including diarrhoea and increased occurrence of cancer in some communities. There is very little research to confirm this, but users and health centre staff in Marsabit see a clear correlation between increased health problems and the times when they use water from the boreholes. This contrasts with project completion reports that frequently claim reduction in diarrhoea following their water interventions (Kioko et al., 2025).

We have two boreholes. One is too salty for people to drink. The second one is also salty, but just about bearable. Both boreholes cause diarrhoea when we drink the water from them, and they are not good for livestock during drought. (Community focus group, Ambalo)



Collecting saline water at Bubisa, Marsabit County, Kenya. Photo credit: © Jackson Wachira, April 2024

5. CONCLUSION

The conclusions from this study can be grouped around three main themes as follows.

1. The narrative of the development of permanent water supplies leading to resilience is so strong that inconvenient truths are hidden

There is an easy narrative of pastoralist livelihoods being supported by bringing new water sources, but the reality is not so straightforward. In the latest severe drought (2020–22), people with access to boreholes fared no better than people without boreholes, and experienced more complex patterns of resilience risk being undermined by permanent water supplies. Livestock died because there was not enough fodder: water alone did not protect the pastoralist livelihoods, and yet their main strategy for resilience, i.e. mobility, is being undermined by permanent water and the settlement arising from permanent water sources.

There are benefits from permanent boreholes but they also have negative consequences for mobility, herd management, rangeland and settlement. There is a fundamental contradiction between the development and management of a stand-alone water intervention (e.g. a borehole) as a panacea for resilience and the more holistic approach of the pastoralist system where water is managed as part of the wider resource base, governed by indigenous institutions and including bylaws around grazing and herding behaviour and even social norms.

Despite the strong rhetoric of more people gaining access to water and becoming more resilient, **politics and patterns of social exclusion** dominate the picture of water supplies in dryland areas.

- Claims on water supplies are being used to extend claims on land, which benefit specific individuals or clans.
- The exclusion of the poorest and/or marginalised from access to water exposes them to greater drought vulnerability. At the same time, community committees, created by government and aid actors, appear to reinforce existing power hierarchies and perpetuate a culture of corruption.
- Indigenous knowledge, institutions and systems around water and grazing management are devalued and undermined in the formalisation of water supply management, with decisions around developing new water supplies apparently driven by political agendas, not need.
- Water users feel, when they are engaged, that the consultation process is inadequate and they are under pressure to accept external aid without any control over the how, what and where. In some cases, the frustration over this disempowerment has resulted in destruction of water supplies.
- There is a trend of individualisation and privatisation of water resources, partly driven by policies that encourage commodification.

Well-intentioned aid interventions, new technology and local government initiatives have resulted in many new water supplies being developed. But successful provision of safe domestic water is not the full story. Almost half the water supplies we surveyed are not working. Many of the rest are saline, so only a small number of water supplies are providing good water. A high proportion of the boreholes being used by pastoralists are saline, some to a level way above government standards. Some of the boreholes are too saline to be at all useful; others are too saline for drinking but usable for livestock.

All stakeholders recognise the problem but it has not been systematically documented so investments into saline aquifers continue. Problems of water quality are seldom discussed when new or rehabilitated boreholes are opened, yet they undermine health and well-being outcomes. By ignoring this, authorities and aid agencies are effectively hiding the truth about the outcomes of water developments for intended beneficiaries. They are not developing strategies to deal with salinity, with the result that the necessary research and investment in solutions is lacking.

2. Water for drought resilience in pastoralist areas involves a series of trade-offs

Water points bring both benefits and disadvantages, and both sides should always be considered together in all discussions about new water developments. This is not currently happening. The main trade-off is between **static and dynamic systems**. Pastoralism is by nature a dynamic system. It relies on a careful balance of resource utilisation across time and space and is adapted to varying seasons and shocks. It can make use of a network of widely spread resources across boundaries and has agility to maximise opportunities. Traditional water supplies in the drylands are often seasonal or temporary, which is in tune with a highly mobile livelihood.

The planning of permanent water development is based on a static resource model where water supplies are provided in one place. It is inevitable that people will then settle around it, whether this is an implicit policy objective (as it is often for governments hostile to the idea of mobile pastoralism) or simply not well understood (as may be the case with some aid agencies). While settlement provides benefits, such as better access to services, this is traded against the necessary conditions for successful pastoralist production systems that have made people resilient. A permanent water supply that envisions a static model undermines the inherent features of pastoralism. A permanent water solution may address water scarcity but does not strengthen livelihood resilience.

Developing new boreholes, or rehabilitating old ones, provides relief for water scarcity but only addresses one set of symptoms. Like all livelihood systems, pastoralism requires a careful balance of resources and social capital to be resilient. Solving water scarcity problems through multiple water supplies across the landscape is at odds with broader thinking about systems resilience. In strengthening resilience, it is necessary to appreciate that any one change will influence others, because new water points, for example, change the social dynamics and the livelihood of the people in fundamental ways. Men tend to focus on the impact on herd management (on balance, probably negative), while women focus on the impact on domestic life (on balance, probably positive). But both must be seen in the context of broad change.

Another obvious trade-off is between increased **water availability and poor water quality**. New and rehabilitated boreholes produce greater water quantities available closer to people's

homesteads. They allow people to settle in one place and may enable access to other services such as education and health care. But much of the groundwater being delivered is saline and, in some cases, unusable for domestic purposes. Many stakeholders argue that more water, of any quantity, is better than no water in a drought, so the boreholes are beneficial. Users who are suffering health problems in their family and livestock, and are forced to buy in domestic water or travel long distances to find fresh water, disagree. In the words of one Geshamo elder, 'Only bring a borehole if it is solarised, functioning and the water is sweet'.

There is also a well-established trade-off between **speed and humanitarian relief versus carefully planned, systematic and sustainable investments**. This is often framed around the disconnect between development and humanitarian aid and the proposed solution is a 'nexus' approach. However, in pastoral areas, emergency drought response has become so expected that it is used as a convenient way to avoid allocating resources to water development. Water supplies are allowed to deteriorate because governments and communities know funds will come when there is a drought and they will be given spare parts, water trucking, rehabilitation and system upgrades (e.g. desalination) for free. Drought response is a humanitarian imperative and many respondents in this study recognised that some families would not have survived without external assistance in the long drought of 2021–23. But drought response can be more timely or even anticipatory without undermining indigenous resource planning and management.

3. Politics and the art of not being governed

This study is not unique in showing a pattern of dysfunctional water supplies relying on an externally designed model of community-based management systems more suited to small towns than scattered pastoralist households. Reliance on standard water development practice, drought management and rapid establishment of 'official' committees ignores the more holistic resource governance practised by indigenous institutions. These water management approaches have undermined traditional practices and institutions for governing water and other natural resources by replacing or restricting them.

The informal (indigenous) governance links management of water to management of the rangeland because it is based on people's lives and livelihoods and sees water as part of a system of natural and social capital employed for successful pastoralism. The formal governance system does not make the interconnections, as it is based on technical, sectoral development strategies, treating water in isolation. Where traditional water supplies are operating independently of formal governance, there seems to be some equity, sustainability and mechanisms for resolving disputes between different user groups.

But elite capture is also seen in remote water supplies that are conveniently not part of the formal water governance and operate as a source of revenue for a few wealthy individuals. Water development has been politicised and used as a vehicle for claiming rights over other natural resources – for a community, a political constituency, an ethnic group/clan or even an individual. Pastoralists are resistant to the idea of water supplies being used as a way of promoting a political agenda, either settlement or resource control. Hence, the art of not being governed is well established in some pastoralist areas and there is much to learn from how this works.

6. RECOMMENDATIONS

The conclusions of this study indicate the need for significant changes in how water development actors approach investments in pastoralist areas. It is important to recognise the trade-offs inherent in the system and explicitly outline the pros and cons of new or rehabilitated water supplies in water development plans. The change in approach starts with acknowledging that mobile pastoralism remains the key adaptation strategy for pastoralist communities in the Horn of Africa, and water must fit into a wider 'landscape' approach to resource use. Careful analysis of the potential disruption to grazing and settlement patterns is required alongside honest assessment, not assumptions, of the health and welfare benefits, particularly for women and children.

To complete due diligence for water projects, aid actors must be prepared to go back to the project after some time and monitor the impacts, both positive and negative, and gain a better understanding of how the water intervention has changed lives and livelihoods, including during a drought period. The following specific recommendations detail how positive changes can be achieved by government and non-government water actors in the Horn of Africa.

- 1. Use a landscape approach to integrated resource planning** – Water interventions need to be planned on a 'landscape' or 'system' level. Water development can contribute to strengthening pastoralist systems if it is planned across the whole area used by a particular group rather than within small administrative boundaries or within the water sector alone. Ideally, start with the pastoralist group and design interventions across their whole system. This requires partnership across organisations and departments with different expertise. It also requires balancing the different needs of women and men and ensuring that marginalised groups and individuals have a genuine voice in the decision-making. Lessons can be learnt from [CGIAR Landscape](#) work on agriculture ecosystems (Alliance Bioversity & CIAT and CGIAR, n.d.).
- 2. Reduce conflict and politics** – Water development can never be divorced from politics, because making choices about how resources are used is inherently political. However, a certain kind of politicisation can be reduced by including water development within a comprehensive resource development plan in consultation with all stakeholders – including politicians. But there is also a need to integrate traditional governance mechanisms in the management of water supplies, as the failure to do so enhances social fragmentation and conflict. Alongside this, there is a need for a mindset shift at all levels to allow water users to exercise their right to water and hold management and government accountable for reliable services and potable drinking water. In many remote pastoralist areas, this will need to be linked with resources to provide access to reliable technical support (either private or public) and financial subsidy.
- 3. More haste less speed** – Water development in pastoralist areas should never be rushed, such as by repairing one specific water point as an emergency drought response. With appropriate support, local governance institutions can avoid critical water shortages during a drought by planning ahead for service maintenance and meeting increasing demand in key areas. Ideally, this is the shock-responsive part of the comprehensive natural resource management plan for the area under a pastoralist system.

4. Employ due diligence – Everyone involved in developing water supplies in ASALs has a duty to ensure that they conduct due diligence to avoid negative impacts wherever possible. Due diligence in this context means that there is a responsibility to understand the livelihood systems and power dynamics in the target area and how these will affect and be affected by any proposed development. For example:

- **political interference and elite capture can be minimised** with better analysis and more comprehensive consultation ahead of project interventions. Water planners should explicitly look for risks that water supplies will be appropriated to extend claims over land and/or political constituencies by a specific group or individual. Effective mediation between interested parties and empowering indigenous governance systems to manage these risks is important. Allowing adequate time for consultation with all potential water users, and not rushing into an emergency intervention, is also critical.
- **convening multisectoral groups** can help water actors to gain a better understanding of how pastoralist resources are used together in normal and drought periods. This can then be used to develop water investment plans that are more in line with risk-informed ecosystem development and natural resource management plans
- **adaptive management can be used** to understand the trade-offs and disruption that a water intervention is making to the well-being, livelihoods and drought coping of the intended beneficiaries. Building in resources for real-time learning can lead to real-time adaptation and better design of future programmes.

5. Address water quality challenges – Salinity in groundwater cannot be avoided but the problem can be managed. Strengthening water quality testing and monitoring, and empowering regulatory authorities to enforce water quality legislation, are important to reduce the development of water supplies that are not up to standards for human consumption. Collective efforts are needed to gather evidence on appropriate desalination options for dryland areas, including at household level. Household distillation systems may provide the much-needed fresh water for drinking and cooking. Research institutions and think tanks should study the challenges of operating and maintaining the desalination plants that have been installed at boreholes in northern Kenya, to devise a strategy for saline boreholes that will provide a sustainable option for households dependent on them.

6. Consider some boreholes as contingency – Conservation of natural resources may be better served by 'contingency' boreholes, used in combination with seasonal water supplies and opened on rotation or only as needed in extreme drought rather than permanently. This approach can work only if water authorities support local governance systems to resist political pressure to turn contingency boreholes into permanent settlements.

7. Encourage blended and accountable water governance – Explore existing natural resource governance in each project area and alternatives to the standard development approach of using formal water management models to replace informal ones. Water actors should carefully consider how to blend the strengths of indigenous management with formal systems and allow users a genuine choice and control over water governance. To address the risk that institutions may lack accountability and often turn a social responsibility into a source of personal power, government, water users and aid agencies should hold water management institutions to account. Rewarding poor management by rehabilitating water supplies in every drought allows committees to divert their funds for other uses, including personal benefit.

REFERENCES

- Abebe, D., Bushby, K., Little, P., et al. (2016) *Resilience and risk in pastoralist areas: recent trends in diversified and alternative livelihoods*. USAID East Africa Resilience Learning Project.
- Alliance Bioversity & CIAT and CGIAR (n.d.) 'Multifunctional landscapes' (<https://alliancebioversityciat.org/research-themes/multifunctional-landscapes#:~:text=MULTIFUNCTIONAL%20LANDSCAPES:%20WHAT%20THEY%20ARE,part%20of%20more%20nutritious%20diets>).
- Alliance for Global Water Adaptation, *Conclusions and Recommendations from October 2024 Event - Water Resilience for Economic Resilience in the Context of Climate Change* (2024). Blog (<https://www.alliance4water.org/blog-posts/conclusions-recommendations-water-resilience-for-economic-resilience-in-the-context-of-climate-change-october-2024-event-spain>).
- Balfour, N. (2024) 'Groundwater management in the Horn of Africa: conflict, scarcity, and hybrid governance'. Policy Brief. Washington DC: World Bank Group (<http://documents.worldbank.org/curated/en/099631307172477476/IDU1c41077f215c27147db1a37617403f1366522>).
- Bedelian, C., Bonaya, M., Ibrahim, A.A., et al. (2022) *Improving the functionality of water investments in the drylands*. Ada Consortium (https://www.researchgate.net/publication/367022214_Improving_the_functionality_of_water_investments_in_the_drylands_Learning_from_Kenya's_County_Climate_Change_Fund).
- BORESHA Consortium (2021) 'Increasing Resilience through Cross-border Natural Resource Management in Mandera Triangle'. Technical Brief. Nairobi: BORESHA Consortium (<https://boreshahoa.org/wp-content/uploads/2021/05/NRM-portfolio.pdf>).
- Catley, A., Lind, J. and Scoones, I. (2016) 'The futures of pastoralism in the Horn of Africa: pathways of growth and change' *OIE Revue Scientifique et Technique*, 35(2): 389–403 (<https://doi.org/10.20506/rst.35.2.2524>).
- Charles, K.J., Howard, G., Villalobos Prats, E., et al. (2022) 'Infrastructure alone cannot ensure resilience to weather events in drinking water supplies' *Science of the Total Environment* 813, 151876 (<https://doi.org/10.1016/j.scitotenv.2021.151876>).
- Esteves Mills, J. and Cummings, O. (2016) *The impact of water, sanitation and hygiene on key health and social outcomes: review of evidence*. DFID Evidence Paper (Vol. 7). UNICEF.
- FAO-SWALIM (2012) *Hydrogeological survey and assessment of selected areas in Somaliland and Puntland*. Technical Report No. W-20. Nairobi, Kenya: FAO-SWALIM (GCP/SOM/049/EC) Project.
- Pertaub, D. (2024) *Water governance in pastoralist areas of Africa*. Feed the Future (<https://fic.tufts.edu/wp-content/uploads/Water-Governance-in-Pastoralist-Areas-of-Africa.pdf>).
- Gomes, N. (2006) *Access to water, pastoral resource management and pastoralists' livelihoods: lessons learned from water development in selected areas of Eastern Africa* (Kenya, Ethiopia, Somalia). Livelihood Support Programme (LSP) Working Paper 26. LSP, FAO.
- Grieve, T. (2023) *WASH resilience, conflict sensitivity and peacebuilding, Joint Operational Framework, 2023*. Contribution to the Global Triple Nexus in WASH Initiative (www.ircwash.org/sites/default/files/wash-jof_v8_230904_jr.pdf).
- Healy, A., Upton, K., Bristow, G., et al. (2018) *Resilience in groundwater supply systems: integrating resource based approaches with agency, behaviour and choice*. Working Paper. RIGSS, Cardiff University, UK.
- Hesse, C., Anderson, S., Cotulla, L., et al. (2013) Building Climate Resilience in the Sahel. Paper Presented to the DFID Consultation Workshop on Building Resilience in the Sahel and Planned Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) Programme.
- Howard, G., Nijhawan, A., Flint, A., et al. (2021) 'The how tough is WASH framework for assessing the climate resilience of water and sanitation' *npj Clean Water* 4(1) (<https://doi.org/10.1038/s41545-021-00130-5>).
- IRC and Hywas Consultants (2019) *Sustainability checks for UNICEF supported rural WASH services in Ethiopia*.
- Kioko, E., Wachira, J., Balfour, N., et al. (2025) *Resilience narratives and outcomes of new water supplies in the Horn of Africa drylands: a desk study*. CHC and CRRD (<https://whatworks.co.ke/publications/#70-144-wpfd-2025>).
- Kohlitz, J., Chong, J. and Willetts, J. (2019) 'Analysing the capacity to respond to climate change: a framework for community-managed water services' *Climate and Development* 11(9): 775–785 (<https://doi.org/10.1080/17565529.2018.1562867>).
- MacDonald, A.M., Bell, R.A., Kebede, S., et al. (2019) 'Groundwater and resilience to drought in the Ethiopian Highlands' *Environmental Research Letters* 14 (9): 095003. ISSN 1748-9326 (<https://doi.org/10.1088/1748-9326/ab282f>).
- Mtisi, S. and Nicol, A. (2013) *Good practices in water development for drylands* (December), 104. IUCN.
- Mohamed, T.S., Crane, T.A., Derbyshire, S., et al. (2025) *A review of approaches to the integration of humanitarian and development aid: the case of drought management in the Horn of Africa*. *Pastor. Res. Policy Pract.* 15:14001 (doi: 10.3389/past.2025.14001).

- Muller, M. (2021) *Managing Current Climate Variability Can Ensure Water Security Under Climate Change*. 2311–2337 (doi: 10.1007/978-3-030-45106-6_243).
- Nassef, M. and Belayhun, M. (2012) *Water Development in Ethiopia's Pastoral Areas A synthesis of existing knowledge and experience* (<https://www.celep.info/wp-content/uploads/2016/11/Water-Development-in-Pastoral-Areas-of-Ethiopia2012-2.pdf>).
- Nijhawan, A., Howard, G., Poudel, M., et al. (2022) 'Assessing the climate resilience of community-managed water supplies in Ethiopia and Nepal' *Water (Switzerland)* 14(8): 1–18 (<https://doi.org/10.3390/w14081293>).
- Nori, M. (2022) 'Assessing the policy frame in pastoral areas of sub-Saharan Africa (SSA)', EUI RSC PP, 2022/03, Global Governance Programme (Global Economics) (<https://hdl.handle.net/1814/74314>).
- Opitz-Stapleton, S., Mayhew, L., Alasia, I.J., et al. (2022) *Livelihoods, conflict and mediation: Somalia*. SPARC Report (September) ([www.sparc-knowledge.org/sites/default/files/documents/resources/Livelihoods%2C](http://www.sparc-knowledge.org/sites/default/files/documents/resources/Livelihoods%2C%20conflict%20and%20mediation%20Somalia.pdf)
[conflict and mediation Somalia.pdf](http://www.sparc-knowledge.org/sites/default/files/documents/resources/Livelihoods%2C%20conflict%20and%20mediation%20Somalia.pdf)).
- Paron, P. (2023) *Water Resource Management in Baidoa 2022, and 2023*, FAO (unpublished presentation).
- Piemontese, L., Terzi, S., Di Baldassarre, G., et al. (2024) 'Over-reliance on water infrastructure can hinder climate resilience in pastoral drylands' *Nature Climate Change* (<https://doi.org/10.1038/s41558-024-01929-z>).
- SWIFT Consortium (2018) *SWIFT water ATMs experience and impact in Turkana and Wajir counties of Kenya*. Learning Brief (www.rural-water-supply.net/en/resources/831).
- Timpong-Jones, E.C., Owusu-Bremang, R. and Mopipi, K and Sarkwa, F.O. (2023) *Climate change and variability affect rangeland quality and productivity- how? African Journal of Food, Agriculture, Nutrition and Development (AJFAND)* 23(3): January (<https://ideas.repec.org/a/ags/ajfand/340672.html>).
- USAID (U.S. Agency for International Development) (2020) *End-term Performance Evaluation of The Kenya Resilient Arid Lands Partnership for Integrated Development (KENYA RAPID) Activity*. Washington, DC: USAID Water, Sanitation, and Hygiene Partnerships and Learning for Sustainability (WASHPaLS) Project.
- USAID (2022) *Water and conflict: a toolkit for programming* (November) (<https://reliefweb.int/report/world/water-and-conflict-toolkit-programming>).
- Ward, C. and Ruckstuhl, S. (2017) *Water scarcity, climate change and conflict in the Middle East securing livelihoods, building peace*. Bloomsbury (www.bloomsburycollections.com/monograph?docid=b-9781350989719).

APPENDIX: DETAILED RESEARCH METHODOLOGY

The research followed a series of steps as described below.

Literature review

A light literature review was carried out to explore:

- evidence of resilience impacts of water supply developments, specifically between 2017 and 2023 to allow for comparison of coping strategies between droughts in 2017 and 2021. Earlier water developments (in the last 10 years) were included in the review as necessary
- any documented impacts on specific groups (e.g. women).

A summary of this literature review is presented in Section 2 of the main report.

Formation of expert advisory group

The research team decided to appoint an internal advisory group specifically for this study. The group (four recognised experts, globally and for East Africa) advised on the research protocol as well as contributing to the framing of the conclusions and policy implications. One early recommendation of this group was to conduct an additional desk study to frame resilience concepts clearly at the start of the research.

Desk study

A complementary desk study was designed to add to the literature review, as well as contributing to the research objectives, and specifically to:

- explore narratives around new water supplies and household resilience from the perspective of different stakeholders
- review policy and strategy on climate change adaptation and climate resilience in ASAL areas to understand strengths and weaknesses of conceptual framing around water supplies.

The desk study was carried out by an independent consultant and the report was published as a stand-alone document (Kioko et al., 2025). The results helped to refine the analysis framework (See Figure 2 in main report) and shape the areas of enquiry for the detailed research questions.

Field data collection

The research sites were selected using purposeful sampling for success in two countries, Kenya and Ethiopia, selecting one county/region in each country. Criteria for county/region selection included:

- variety of clans/cultures around water and land
- water supply built in the last 10 years (preferably between the last two droughts)
- an implementing agency willing to collaborate
- security and logistics.

At the end of the selection process, the two resulting sites were: (1) Geshamo district in Somali Region, Ethiopia; and (2) Marsabit County in Kenya. Data was collected in four sites in Marsabit in four different sub-counties and in five sites in two districts (Geshamo and Dagahbur) in Somali Region.

Before embarking on data collection in Marsabit, a pretest was undertaken in two locations: Kambi Nyoka in North Horr Sub County and Jaldesa in Saku Sub County. In-depth data collection was undertaken in three locations across three sub-counties: Kargi, Laisamis Sub County; Jaldesa, Saku Sub County and Ambalo, Moyale Sub County. These locations were selected purposively to reflect wider ecological, hydrogeological, socioeconomic and political dynamics characterising Marsabit County.

For instance, Jaldesa is located within Mount Marsabit, where borehole siting and drilling has been a challenge due to unstable volcanic formations, and deep groundwater levels (of more than 200 m below ground level). The area receives moderate rainfall and some residents practise crop farming. On the other hand, Kargi and Ambalo are located in the lowlands of the county where no form of crop farming is possible due to the little rainfall experienced. Groundwater in the lowlands appears to have a higher potential, as many good-yielding deep boreholes are present, with water strikes generally between 50 m and 150 m and with boreholes with a yield of up to 20 m³/h present.

Local research teams carried out data collection in March and April 2024. Fieldwork included a range of methodologies: study of documentation related to the projects and the project sites; qualitative interviewing; and participatory methodologies with affected population groups (users and non-users) to compare their experiences in the latest drought with those of previous droughts (mainly 2017). Where possible, staff from implementing agencies and local government were contacted and interviewed as key informants to understand the rationale of their various choices and their expectations about coping, and to gather any hydrological evidence that informed the investment and that is being monitored.

Interviews were conducted with the following:

- men and women working within local government
- representatives of the implementing organisation (if not local government)

- men and women from local water, resilience and/or drought risk reduction committees
- water users (at the water point)
- other stakeholders including local community members and families in neighbouring settlements.

A combination of tools was used with research participants, including;

- semi-structured interviews with KIIs and water stakeholders at each site
- focus group discussions (FGDs) with carefully constructed groups, including participatory exercises
- participatory tools to explore seasonal patterns of water use, changes over time (before and after water supply) and perceptions of resilience.

The breakdown of research participants is shown in Table A1.

TABLE A1: RESEARCH PARTICIPANTS

Country	KIIs	FGDs
Kenya	6 community leaders	11 (separate M and F)
	5 county officials	
	3 staff NGOs/international NGOs	
Total participants		109 (85M, 24F)
Ethiopia	4 WASHCO	8 (4M, 4F)
	4 community leaders/elders	
	4 <i>kebele</i> officials	
	3 district officials	
	4 regional water board officials	
	5 development actors	
Total participants		119 (64M, 55F)
Global and Horn of Africa regional	5 experts	5 (4M, 1F)
TOTAL		233 (153M, 80F)

Note: M = male, F = female

Spatial and temporal analysis

In order to triangulate information from KIIs with actors, we also reviewed time series of geo-physical maps and remote sensing data. Specifically, we used open-source data and FAO data on vegetation and water index. This was used to explore around study sites to identify patterns of use and land degradation around water supplies.

Analysis of data

Notes from FGDs and interviews were transcribed by research assistants where necessary then cleaned and compiled for each country. The research team came together for a two-day analysis workshop to share findings and develop the analysis using the framework designed at the start of the research programme. This framework is shown in Figure 2 in the main text.

Findings were compiled across the two sites for each of the main themes working down the framework to the core resilience outcomes of livelihoods and health/well-being . Comprehensive notes were recorded of this analysis process by two separate note-takers and these were used to compile this report. Researchers responsible for the two side studies (the desk study on framing of resilience and narratives, and the analysis of range degradation using remote sensing) attended the analysis workshop to ensure that their findings were incorporated.

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Cover: Camels drinking at a borehole in
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