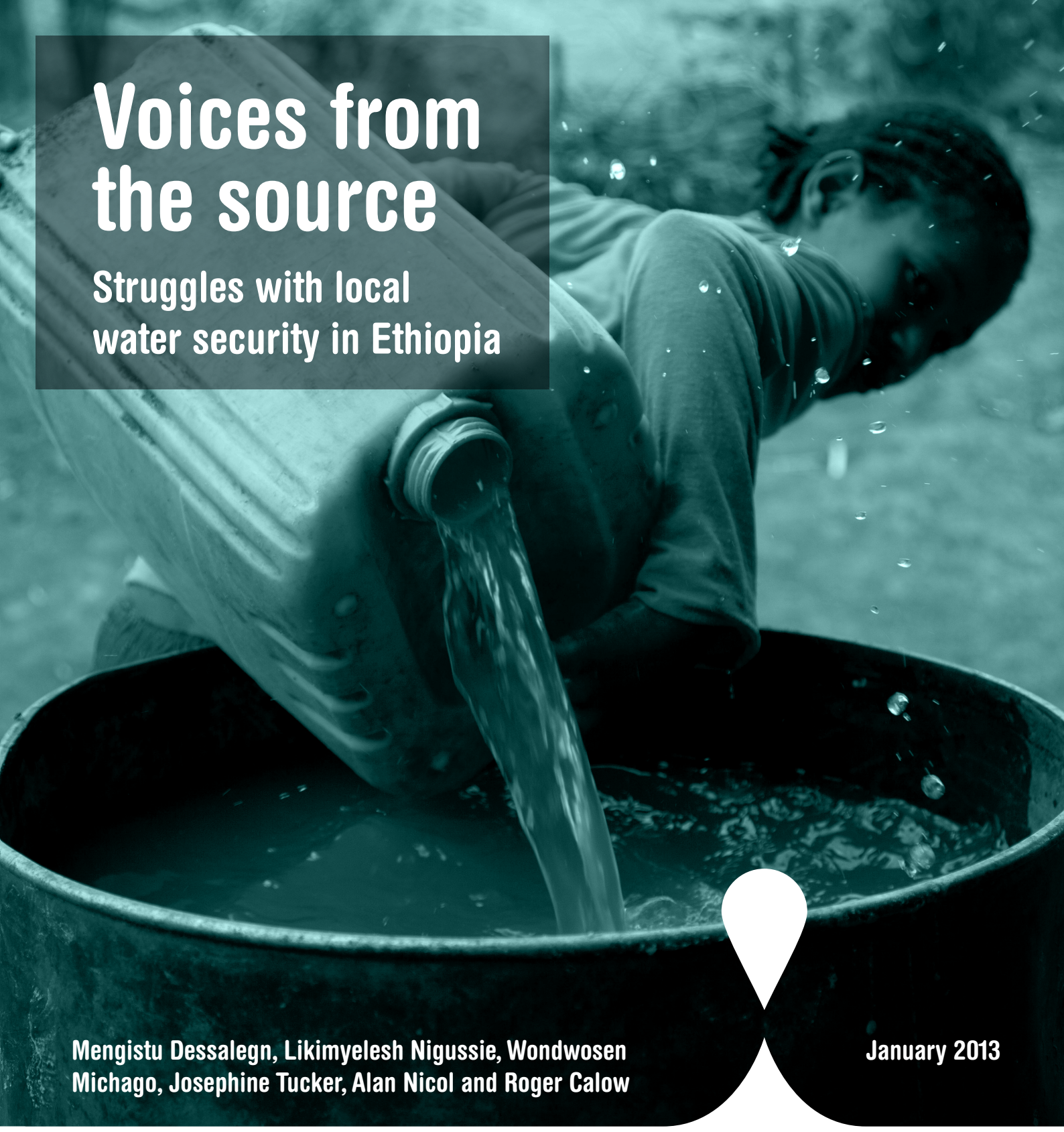

Voices from the source

Struggles with local water security in Ethiopia

Mengistu Dessalegn, Likimyelesh Nigussie, Wondwosen Michago, Josephine Tucker, Alan Nicol and Roger Calow

January 2013

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‘I am telling you, I am torn between my work and water.’

‘I cannot save water for myself while knowing that my neighbour has no water. I should give it to my neighbour.’

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Acknowledgements

The authors would like to thank WaterAid for their sponsorship of this work and for their contributions to the methodology and analysis. The staff of WaterAid Ethiopia and Hararghe Catholic Secretariat (HCS) gave vital support to the fieldwork. Lyla Mehta and Jeremy Allouche of the Institute of Development Studies contributed to early development of the research concept. Most importantly, thanks are due to the communities and local government staff in Shinile and Konso who gave time to share their views and experiences with us.

About WaterAid

WaterAid is an international non-governmental organisation (NGO) working in 27 countries in Africa, Asia, Latin America and the Pacific region dedicated to the provision of safe domestic water, sanitation and hygiene education to the world's poorest people. Our mission is to transform lives by improving access to safe water, hygiene and sanitation in the world's poorest communities.

WaterAid's Policy and Campaigns Department commissioned this study as part of its work to improve understanding of the reality of water in people's lives. It contributes to WaterAid's advocacy efforts to promote the equitable distribution of water resources and protect the rights of the poor to access safe and affordable water and sanitation.

Contact Daniel Yeo (danielyeo@wateraid.org) for more information about WaterAid's work on water security and climate change.

Cover photo: Lahyte, Konso, Ethiopia (WaterAid/Anna Kari, July 2012)

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Abbreviations

BoWR	(Regional) Bureau of Water Resources
DA	Development Agent
ETB	Ethiopian Birr (USD 1 = ETB 17.93 on 23 October, 2012)
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GoE	Government of Ethiopia
HH	Household
MoA	Ministry of Agriculture
MoWE	Ministry of Water and Energy
MUS	Multiple use (water) services
NMA	National Meteorology Agency
PSNP	Productive Safety Net Programme
UAP	Universal Access Plan
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WASH	Water, sanitation and hygiene
WELS	Water Economy for Livelihoods
WIF	WASH Implementation Framework

Glossary of Ethiopian terms

Belg	Short rainy season, important for crop production in Konso (March to May)
Birka	Water storage tank
Bona	Long dry season in Konso (November to February)
Chaka	Local alcoholic drink
Dira	Rainy season in Shinile (March to May), also known as *Gu*
Fededa	Agricultural labour group
Gu	Rainy season in Shinile (March to May), also known as *Dira*
Hais	Brief December/January rains in Shinile
Jilaal	Long dry season in Shinile (October to March)
Karan	Rainy season in Shinile (July to September)
Kebele	Lowest administrative unit in Ethiopia, composed of several villages
Kiremt	Rainy season in Konso (September to October), and main rainy season in most of the country occurring between June and October
Meher	Crops grown during the *kiremt* rainy season
Shikela	Wage labour
Woreda	Administrative area equivalent to a district

Executive summary

This assessment explored local water security in two very different sites in rural Ethiopia – a pastoral district in the eastern Somali region (Shinile), and a somewhat remote agricultural district in the south (Konso). The following questions were addressed using a combination of field research and analysis of available secondary data and literature:

- What are the physical, social, economic and political drivers of water insecurity in different locations in Ethiopia?
- How have different communities responded to situations of water stress?
- What should be the public policy and institutional priorities to improve resilience to water stress at a local level, and reduce the negative impacts on communities?

The findings clearly reveal that water security, from the perspective of communities, cannot be reduced to a single diagnostic. Neither volumetric measures of water use, nor the presence of an improved source within a certain distance (1.5 km is the official standard for coverage in rural Ethiopia), adequately capture the way in which households in these environments achieve – or struggle to achieve - a basic level of water security. People use water for different purposes from multiple sources with different profiles in terms of convenience, quality, reliability, cost and access rights, across different seasons and years, according to their wider livelihood priorities and pressures. Wealth status, access to labour, transport and storage assets, particular livelihood or health needs, household composition, and intra-household relations all come into play in determining which sources to use, and how much water to use for which purposes. Convenient unimproved sources are consistently preferred over more distant improved sources, unless sources are specifically known to be contaminated or unpleasant to drink. Motorised boreholes present in some sites are expensive - in some cases similar to the cost of piped water in the UK - partly due to the high costs of fuel but also due to the need for adequate funds for maintenance and repairs. Financial and institutional models to ensure reliable, affordable supply in these conditions remain elusive.

Social relations emerge as critical for ensuring water security in a context where many face long and difficult journeys (and long queues) to access water, exacerbated by frequent drying and/or breakdown of sources. Possibilities to share or borrow either water itself, transport assets (principally donkeys) and labour for water collection (and other activities e.g. farmwork) provide vital flexibility for households in managing the allocation of their assets. These enable them to to avoid the worst effects of poor access and, to some degree, to control the opportunity costs of lengthy water collection times. These arrangements also provide a social buffer for households who may face a sudden access difficulty either due to source failure or to non water-related factors such as sickness of household members, or loss of a donkey. They do have their limits however, and extremes of poor water access are seen to drive outmigration from the worst affected locations.

In spite of the social buffer, water insecurity remains a significant challenge. In both sites communities face difficult water access in the dry season, and have struggled with successive years of rainfall failure in recent years. They report having to sacrifice agricultural work and paid labour as a result, as well as restricting water use for hygiene and in some cases removing children from school. Women bear the brunt of the labour demand for water collection, and may extend their working hours well into the night when water collection times are long and coincide with peak demands for agricultural labour. Missed agricultural labour or domestic tasks can be a cause of domestic conflict. Under extreme shortage, however, men may share the task of water collection. This is just one illustration of the fact that drought responses are not simply an extension of normal dry season coping patterns, but represent a step change once certain thresholds are breached.

The study initially focused on access to water supply (for domestic and productive uses). However, the impact of high rainfall variability on both agricultural and livestock production

emerged as the most important dimension of water insecurity for most communities. People respond to this pressure, where they can, by diversifying livelihoods or migrating to more promising areas. Both of these responses may be temporary or permanent, and may be either a planned accumulation strategy or a survival response. Livelihoods are thus highly dynamic over time in both of the districts studied. Some new activities are non water-dependent – such as wage labour – while in other cases people are exploiting previously untapped water availability to increase irrigation. Survival-type diversification may involve further degradation of the natural environment, for example firewood sales and charcoal production contribute to deforestation.

In the first sections of this report, these pressures on livelihoods and household-level responses are discussed in detail. This is followed by an examination of government responses at local and national level, and discussion of possible ways forward. It emerges that local government is highly constrained in terms of its ability to respond to the complex water security situation in an integrated, livelihoods-based fashion. National policy makes some interesting and ambitious proposals, and is increasingly paying attention to ensuring the sustainability of water schemes and exploring possibilities to better support households' own water investments by enabling and regulating self-supply. Outstanding gaps include linkage of water service provision with resource management for buffering of groundwater supply, and greater clarity on the various water- and livelihood-related thresholds of water security which would inform more locally-responsive planning and drought response

1 Introduction

This study seeks to understand the dynamics and lived experience of water (in)security at the local level in Ethiopia, in particular the critical pressures on water access, how households and communities respond, the impacts of constrained access and gaps in existing local-level responses. It was commissioned by and co-developed with WaterAid. WaterAid's recent Water Security Framework (WaterAid 2012:5) defines water security as 'reliable access to water of sufficient quantity and quality for basic human needs, small-scale livelihoods and local ecosystem services, coupled with a well managed risk of water-related disasters'. For the purposes of this study the focus was primarily on access to water services (for both domestic and small-scale productive purposes such as livestock watering, small-scale irrigation and household brewing). However, the ability to cope with water-related shocks and stresses emerged as critical, reflecting the rain-dependent nature of livelihoods in the study areas, whether agricultural, pastoral or agropastoral.

The study was carried out in two *woredas* (districts) of Ethiopia: Shinile in Somali Regional State, and Konso in Southern Nations, Nationalities and Peoples Region (SNNPR). Six *kebeles* (wards) were purposively selected in each *woreda* to capture a range of circumstances in terms of water availability, livelihoods represented, and distance from the *woreda* centre. Box 1 gives a brief overview of livelihoods in the two study *woredas*.

The study employed a combination of data collection methods at the local level, including: key informant interviews with local government officers, focus group discussions using elements of a Water Economy for Livelihoods (WELS) methodology which is used to quantify water use, participatory community mapping, and household interviews (data collection formats are annexed to the online version of this report). Available secondary data on water availability and access (hydrogeology, rainfall and coverage estimates), population growth and livelihoods were used to triangulate, validate and contextualize the information.

The central questions posed were:

- What are the physical, social, economic and political drivers of water insecurity in different locations in Ethiopia?
- How have different communities responded to situations of water stress?
- What should be the public policy and institutional priorities to improve resilience to water stress at a local level, and reduce the negative impacts on communities?

For analytical purposes, this translated into a focus on (i) pressures, and (ii) responses, which are discussed in sections 2 and 3 of this report respectively. Section 3 primarily focuses on household and community responses but also includes a brief review of local and national government responses. Section 4 outlines some of the gaps in current responses and possible ways forward from a policy perspective.

Box 1: Livelihoods and environments in the study sites

Shinile

Shinile is predominantly pastoral. In 2002 approximately 90% of the population was engaged in pastoralism and 10% in agro-pastoralism. Pastoralists occupy central and northern parts of the *woreda*, with agropastoralists largely in the foothills at its southernmost tip. Annual rainfall is 500-700mm, with two main rainy seasons - the *dira* or *gu* (late March to late May) and *karan* (late July to late September) - of more or less equal importance for livestock production. A brief *hais* rain falls in December or January but this is unreliable. Both pastoral and agropastoral communities are highly vulnerable to rain failures, and several *kebeles* in Shinile are reliant on the Productive Safety Net Progamme (PSNP) to ensure household food security. As in all rural areas of Somali region, extended families form important social networks among which resources are freely shared.

In pastoralist households, milk and milk products are important sources of food and most income is derived from livestock sales (both domestic and for export through Somaliland and Djibouti). Renting of camels for pack is also an important income source for some households. Within the household, men are largely responsible for herding cattle and camels (which takes place over long distances) while women look after small stock – sheep and goats – closer to the home, as well as milking and taking care of other domestic tasks. During the long dry *jilaal* season of a normal year (October to March), men migrate with larger livestock to find pasture and water. This migration may cross *woreda* boundaries but generally remains within the wider Shinile zone. During the rains, family members and herds congregate around the homestead. However in a drought year migration patterns typically associated with the dry season may continue into the failed (or poor) rainy season, and distances travelled may be far longer – with attendant changes in the social composition of households over time.

Agropastoralists have shifted away from pastoral livelihoods in recent decades for various reasons. These include: reduced herd size due to recurrent droughts; an attempt to stop perceived encroachment by agricultural communities from neighbouring Oromo areas; and government encouragement of more settled agriculture. The main crop is sorghum with some maize production. Crops are particularly vulnerable to failure if the *dira* (March to May) rains are poor. In normal years agropastoralists do not migrate with their livestock, but in a bad rainfall year they may move over large distances.

Konso

Konso includes both highland and lowland areas, with intense settled cultivation (primarily of cereals) and a history of deforestation. Maize and sorghum are the main food crops, and teff is an important cash crop. Better-off households earn income from agriculture and fattening of oxen for sale. Poorer households also sell grass and firewood, and/or brew *chaka* (a local alcoholic drink) for sale. Agricultural labour is also important for poorer households and in bad years some long-distance labour migration takes place, for example to Moyale and Arba Minch. In the former there is flourishing cross-border trade, including in foodstuffs. Women play a significant role in agricultural labour in Konso, as well as carrying out domestic tasks. As in Shinile, many households rely on the PSNP.

Konso is far from the regional capital (Hawassa) and other large towns in the zone. It also lies in a 'severe moisture stress area' which experiences frequent droughts and erratic rainfall, varying between 300mm and 900mm per year and often occurring in intense storm events. Steep topography and high erodible soil create challenges in maintaining soil fertility. The most important rainy season (*belg)* occurs in March to May and is responsible for 70 – 80% of grain production. A second rainy season (the *kiremt*) in September and October brings less rainfall and a smaller share of land is typically planted during this season. Crops grown during this period are referred to as *meher*. Some forms of traditional irrigation are practised in Konso (mostly by capturing excess runoff at times of rainfall or diversion of seasonal rivers), but the majority of agricultural production is rainfed.

A unique and important feature of Konso is the use of traditional terraces for management of soil moisture and fertility. These terraces have been maintained for centuries using traditional collective labour, and have recently led to Konso's designation as a World Heritage Site by UNESCO. Due to the fragility and topography of these terraces, cultivation on steeper slopes is mostly done by hand, although ox-plough methods are used in some areas. In addition to terracing, farmers practise a complex array of other soil and water conservation techniques such as mulching, multiple cropping, and integrated management of crops, livestock and trees.

Sources: Save the Children (2001 and 2002), MoARD (2009), Förch (2003).

2 Water access: status and pressures

2.1 Overview

Communities in these *woredas* use water from both protected and unprotected sources. They are discerning in which sources are used for different purposes, and at different times. Established patterns depend on several factors including seasonal availability of different sources, and household preferences in terms of trade-offs between proximity, quality, and affordability. A key distinction which emerged during the research is between the water sources available in the *kebele* centre (used by people living there, and sometimes people travelling from surrounding 'sub-*kebeles'*; these often, but not always, include an improved source) and sources available in the sub-*kebeles* themselves, where improved sources have rarely been developed.

Table 1: Water sources used in wet and dry seasons of a 'normal' year

Woreda	*Kebeles* visited	Wet season			Dry season		
		Domestic use	**Livestock**	**Irrigation**	**Domestic use**	**Livestock**	**Irrigation**
Shinile	**Tome**	borehole; open sources in sub-*kebeles*	borehole; open sources in sub-*kebeles*	n/a	borehole, & other open source	borehole, & other open source	n/a
	Baraag	developed spring (through pipe)	improved & un-improved spring; hand pump	spring	developed spring (through pipe)	improved & un-improved spring; hand pump	spring
	Gaad	borehole; hand dug well	rainwater, Borehole-cattle troughs; open sources-pond, small river, springs	n/a	borehole; hand dug well	borehole-cattle troughs; using the diminishing open sources-pond, small river, springs	n/a
	Bisile	rain water (scheme),	rain water (scheme),	n/a	borehole at other *kebele;* hand dug well	N/A (outmigration)	n/a
	Meeto	borehole; traditional wells at HH level; hand pump; pond	traditional well; pond	boreholes (new)	borehole only	open sources	borehole
	Mermersa	borehole	borehole, rainwater collection, pond	n/a	borehole	borehole, rainwater collection, pond	n/a
Konso	**Gacha**	protected springs	open sources-pond.	n/a	protected springs	protected springs	n/a
	Mecheka	open sources-streams and ponds	open sources-streams and ponds	n/a	open sources-small river;	open sources-small rivers;	n/a
	Gelgelana Kolmele	borehole; open sources (HH water well; springs and streams	open sources (HH well; springs and streams	traditional	borehole; open sources (HH well; springs and streams	open sources (HH well; springs and streams	n/a
	Fuchucha	borehole	small river	traditional	borehole	small river	n/a
	Nalaya Segen	small river; streams	small river	n/a	small river; to the nearby town, Konso	small river; to the nearby town, Konso	n/a
	Buso	springs and streams	springs and streams	n/a	streams and springs	streams and springs	n/a

Livestock are major water users in both areas, and play an important role in livelihoods in agricultural Konso as well as in Shinile. In Shinile, cattle and people often use water from the same source, but with separate troughs for animals in the case of improved sources. The exception is donkeys, which play a crucial role in water transportation and are given water from jerrycans while they are near the water points (Figure 1). In Konso, farmers more often collect water for their livestock from different sources than those used for drinking.

Figure 1: Cattle and donkey watering in Shinile

Photos by Mengistu Dessalegn and Likimyelesh Nigussie

For the purposes of this research we defined water security pragmatically as safe and reliable access to 'enough' water for all household needs (domestic and productive) at all times. The Government of Ethiopia defines coverage as having access to 15 litres of improved water supply per capita per day within 1.5km of a homestead in rural areas (MoWR 2009). This is a minimum standard for domestic needs. According to government estimates, coverage rates of improved water supply in Konso and Shinile were 38.7% and 20.2%, respectively, in 2008 (unpublished data from SNNPR Bureau of Water Resources (BOWR), Kene 2008). Although coverage rates for Konso are around average for SNNPR, the high population density of this *woreda* means that the unserved population per km^2 is one of the highest in the region (BOWR unpublished data, Macdonald, D. pers. comm.).

However these coverage figures are estimates based on an assumed number of people served per scheme. They do not measure distances from schemes or quantities of water accessed, nor is there an official standard for access to water for productive uses. The concept of 'enough' is difficult to quantify in such circumstances – and in absolute terms – when considering the livelihood strategies, individual needs and preferences of different households. A pilot Water Economy for Livelihoods (WELS) analysis conducted in three livelihood zones of Ethiopia in 2009 reveals the complexity involved in quantifying livelihood water requirements and the extent to which these vary, both within and between communities, as well as over time (Coulter et al. 2010).

Given this complex reality, the starting point for the research was simply to ask whether people felt that they could access 'enough' water for all their needs, year round, and whether they faced any problems in doing so. Although this is inevitably subjective, its value lay in enabling researchers to understand water security in terms of impact on human wellbeing and people's real lived experiences, both of which are only imperfectly measurable.

Almost across the board (with the exception of Meeto *kebele* in Shinile, which has recently been supplied with new boreholes), people indicated in focus group discussions and interviews that they did not have enough water to meet all their needs year-round. This was said to be a

longstanding constraint; as one elder in Konso put it, 'the problem of water has existed with us for a long time'.

While most communities agreed that water access was better in the wet season, as more seasonal groundwater sources and streams are available and rainwater harvesting provides a supplementary option, even wet season access was widely felt to be inadequate, irrespective of the presence of an improved source, partly due to the ever-present possibility of rain failure. This vulnerability of wet season access to rainfall variation was felt particularly keenly in Konso, where there is high dependence on springs and surface water sources, many of which dry up readily in the absence of rain. Those relying principally or solely on rainwater collection also indicated that they felt water access to be highly insecure, unsurprisingly, given very high rainfall variability (see Figure 2). However, those using rainwater to supplement other sources benefitted from the additional supply it offered when available.

In terms of groundwater availability, hydrogeological maps confirm the assertion by *woreda* officials in Konso that 'it is difficult to find underground water', as the *woreda* is underlain by low productivity fractured basement rocks (Chernet 1988). Shinile is underlain by a mixture of high and moderate productivity strata (ibid.), but officials reported that it is hard to find groundwater in some *kebeles*.

It is evident that perceptions of water security are subjective, shaped by comparisons in time and space: either with the past, which was in some cases worse than the present (as in Meeto which had recently received six new boreholes), and in some cases better (as in Gelgelana Kolmele where previously-available water points had recently fallen into disrepair); or with neighbouring geographical areas. Some people facing objectively difficult water access still feel lucky in comparison with others, as this quote from a 60-year-old man in Baraag, Shinile, indicates:

> 'My village is around Hadmle. It is far from [the water point in the *kebele* centre]. The water pipe does not reach our area. Yet, this is not a big problem. There are people who suffer more than we do. So, I do not want to talk about problems in detail. Thanks to God. There are places where there is no water. Although the water is far from our area, I can travel and fetch water.'

2.2 Collection times and seasonality

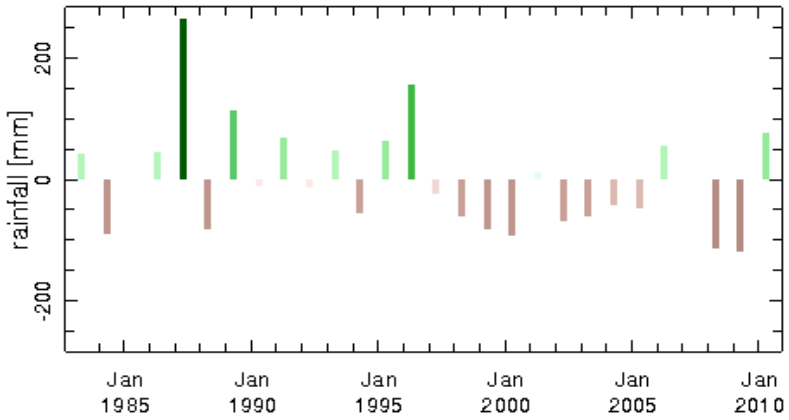
The seasonality of changing water access is borne out by seasonal calendars at most sites which show how water collection times vary across the year (Figure 3). In the wet season, a greater variety and number of sources are typically available (see Table 1). Even so, round trip collection times for water are still over an hour at some sites in Konso, and up to four hours at one in particular. During the dry season, many springs, seasonal streams, shallow wells and even boreholes tend to dry up and households are forced to look for alternative sources. This can mean travel beyond the immediate village or *kebele*. Gaad *kebele* typifies the situation in much of Shinile where one borehole in the *kebele* is used year-round by those living close to it. In the wet season, households living further away tend to use ponds or other open sources around their village. In the dry season these dry up, leaving the entire population dependent on the single borehole. This means not only longer distances to fetch water for many households, but longer queues at the water point. That most households use the more convenient but unprotected ponds when available, rather than travel to a more distant but improved source, reflects a widely expressed preference for convenience over water quality.

The water collection calendars also confirm that – with the exception of one site in Shinile (Bisile), where absence of available groundwater sources forces people to travel beyond the *kebele* for water during the dry season – seasonality is more keenly felt in Konso where water collection takes between two and five hours longer in the dry season.

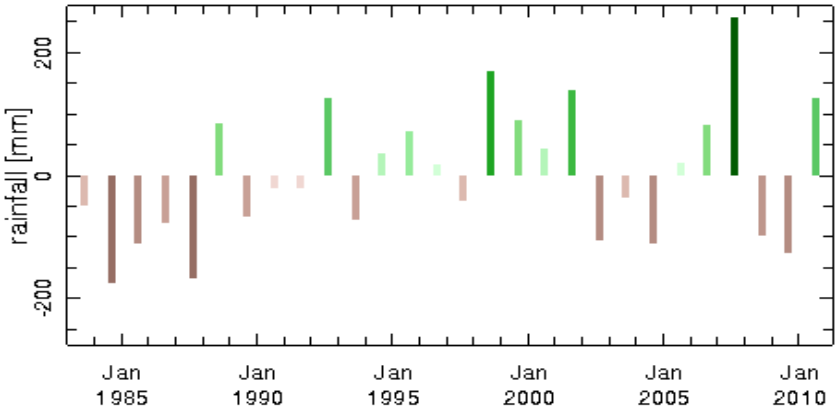
Figure 2: Wet season rainfall variation deviation from the mean

a. Shinile

(i) March – May (*dira / gu*) total rainfall

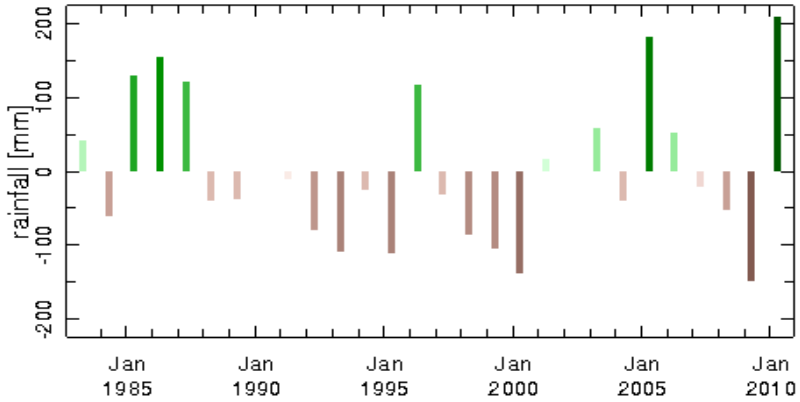


(ii) July – September (*karan*) total rainfall.

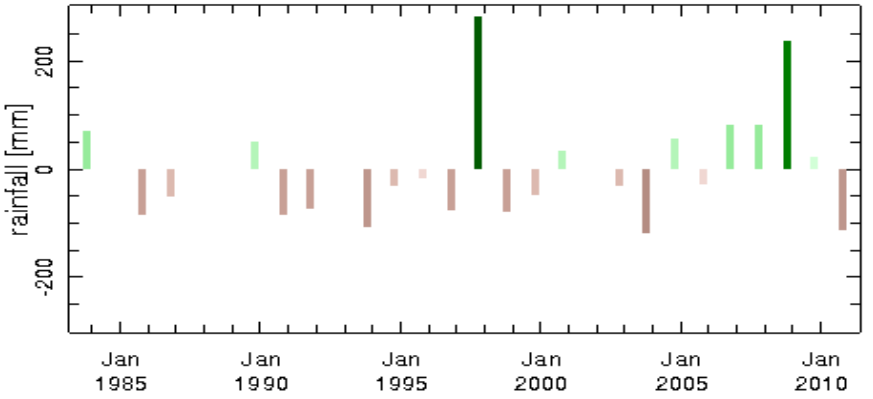


b.Konso

(i) March – May (*belg*) total rainfall



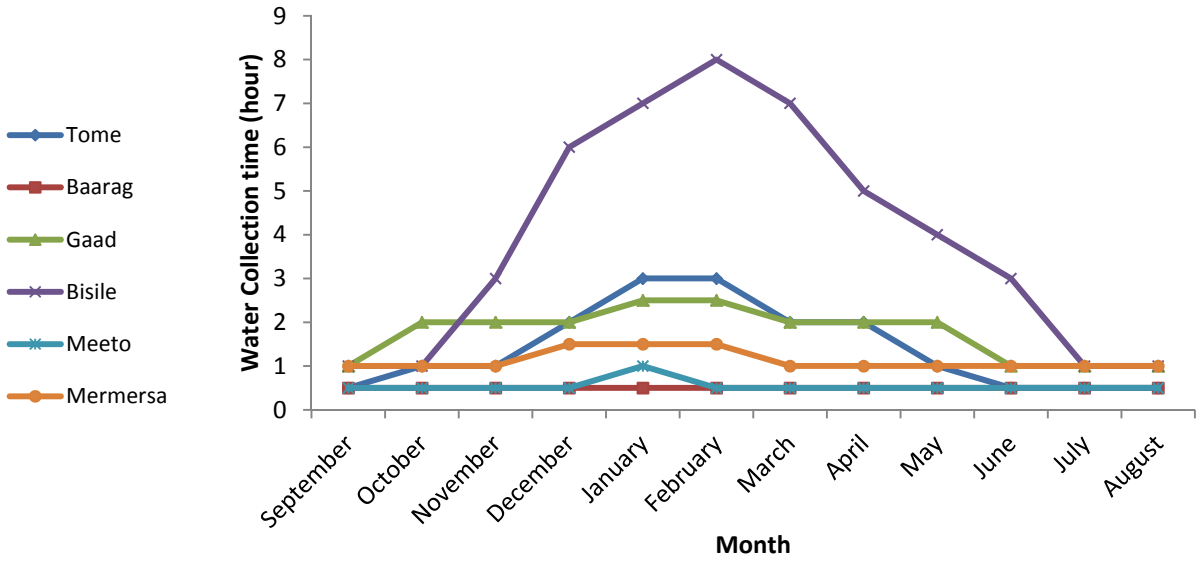
(ii) September - November (*kiremt*) total rainfall



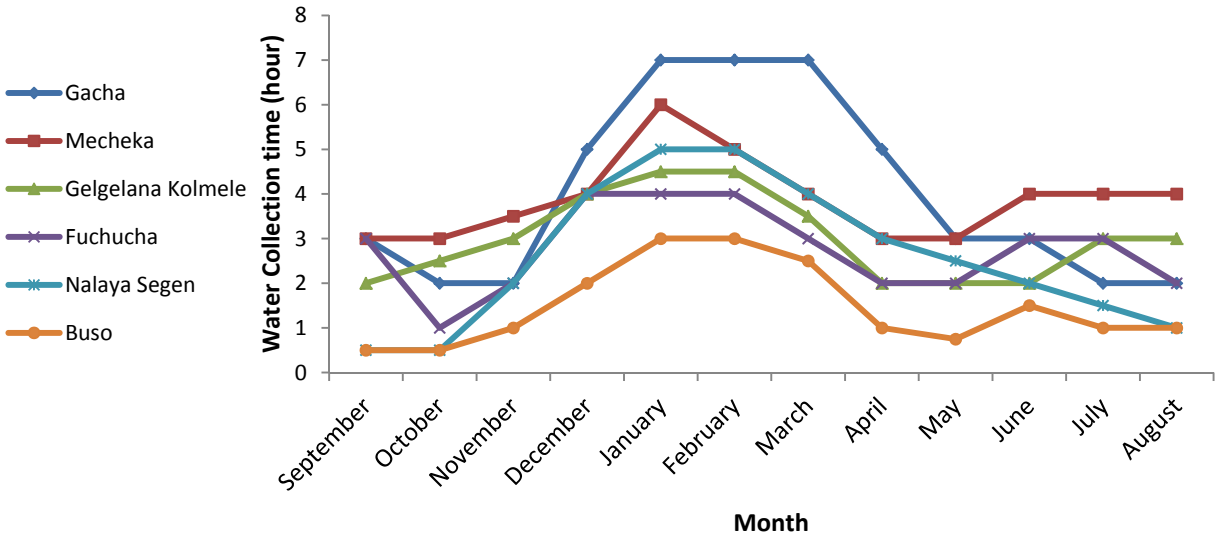
Source: NMA (2012)

Figure 3: Seasonal calendars of reported water collection times

a. Shinile



b. Konso



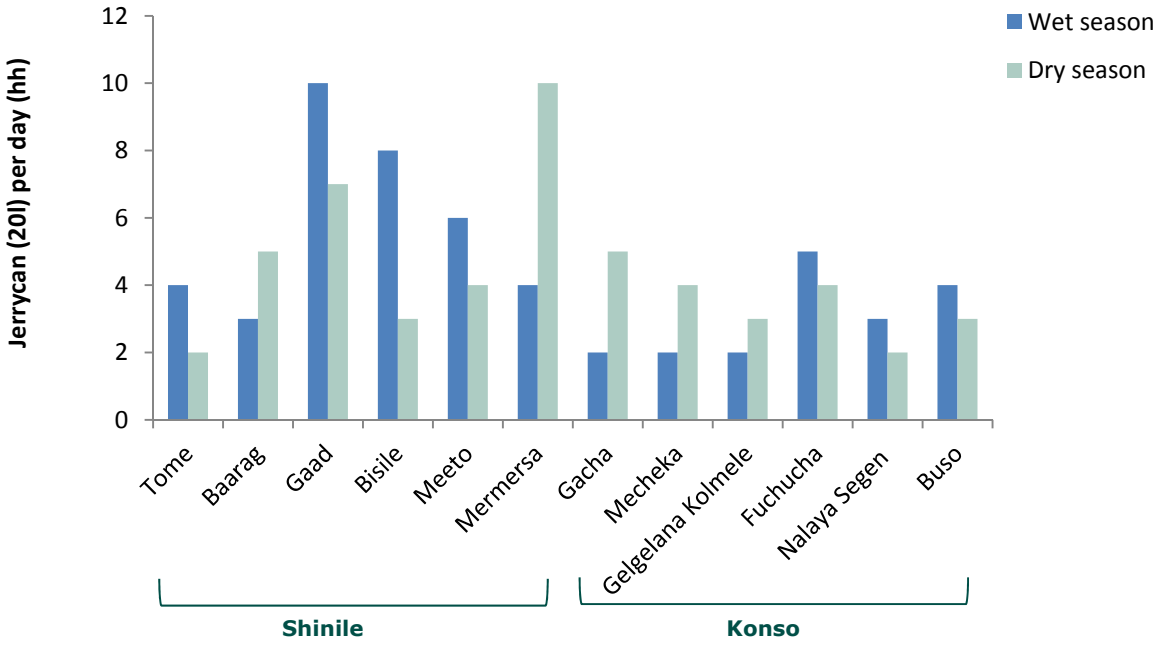
Source: Focus group discussions

These charts are illustrative only. In reality people often use a range of sources for different purposes, and different people within a *kebele* use different sources in different locations. The collection times illustrated are what focus group respondents reported as an 'average' or 'typical' round trip collection time for people in the *kebele* each month to and from their main domestic water source. The figures are therefore likely to hide extremes of both good and poor access, but nonetheless reveal important patterns. High collection times exact a range of costs including other productive activities forgone (including agricultural work, wage labour and the work of public employees providing services), individual physical exhaustion and risk, and overall reductions in water use with attendant impacts at the household level (see section 3.1).

Looking at volumes of water collected, however, does not reveal a uniform seasonal pattern (Figure 4). In seven of the *kebeles* water collection increased in the dry season. This was reportedly to meet increased demands for consumption by both humans and livestock, due to higher temperatures and the lower water content of livestock fodder, and in some cases to provide for livestock watering, and domestic bathing and laundry, which in the wet season could be practised at open sources. However, in five sites the number of jerrycans collected decreased in the dry season, suggesting that increasing collection times may be negatively affecting household water security, where either labour or other key assets required to increase collection did not exist. In these sites households report a limit on the availability of human labour (and time) to collect water, and even when donkeys are used to carry more water these eventually become exhausted after travelling long distances day after day.

It might be expected that sites with dramatic increases in collection times in the dry season show a corresponding decline in water use, but this is not necessarily the case. In Bisile, where water collection time is said to increase by 7.5 hours in the dry season, the number of jerrycans collected does fall (although this also relates in part to outmigration of some family members during the dry season). In Gacha, though, collection times reportedly increase by 5 hours but households still increase their water collection in response to greater needs. In some household cases, therefore, demand is inelastic, in spite of the rapidly rising costs.

Figure 4: Reported daily water collection (in 20l jerrycans) in wet and dry seasons of a normal year



Source: Focus group discussions

2.3 Drought years

Although people often have to travel further to collect water during the dry season, in most cases the focus group participants felt that water could be found with relative ease in 'nearby' areas, almost always within the *kebele*. At times of severe drought this changes and people are often forced to move beyond their *kebele* to collect water. This should be understood as a major water security threshold, where the usual coping mechanisms are insufficient and

demand sufficiently inelastic to require additional actions at a household level. Often this can involve decisions about dividing the household, moving in the longer-term and making use of other key resources, including urban centres, to achieve water security (see section 3).

The challenge is, however, defining the notion of a 'drought' response. There are examples of responses that are non-rainfall related, where sudden loss in labour availability through morbidity or mortality creates a 'social drought' effect, or the loss of other assets – a donkey for example – which may precipitate a sudden loss of access to a normally accessible source, or income with which to purchase access through other means. A flexible notion of drought is therefore useful, and one that understands the range of views and effects that may exist within a community – one person's drought may not be another's. In some typical drought events (defined meteorologically), indeed, some households may in fact benefit if their resources or assets (e.g. transport) are called upon by others.

Figure 5: Relatively short queue at a waterpoint in Konso

Photo by Mengistu Dessalegn

2.4 Source proximity and quality

Proximity is a key factor determining which water source to use. Convenience usually – though not always – overrides any preference for improved over unimproved sources, which indicates the value of time and effort to a household's wider livelihood security. Eight of the twelve selected *kebeles* in both *woredas* have their own protected water sources (see Table 1). But even within these *kebeles*, households living in sub-*kebeles* far from a protected water source generally prefer to use nearby unprotected water sources, if available, rather than travel and divert labour from other activities to water collection. This is perhaps unsurprising given the amount of time which can be involved. An extension worker (Development Agent in Ethiopian terminology) in Meeto, for example, indicated that even though there is a borehole in the *kebele*, people from Bura-Adad and Belembele villages have to spend seven hours collecting water from the *kebele* centre if they use it. (Note again that the 'typical' collection times illustrated in Figure 3 are averages only and mask such extremes of poor (and good) access).

However, sources which are perceived as particularly contaminated are more likely to be avoided in favour of more distant sources perceived to be safe or clean. For example, the residents of Gelgelana-Kolmele reported that their village spring can become 'contaminated' (by which they mean bad smells) during the wet season and when this happens they resort to sources outside their village. It is worth noting that local perceptions of water quality do not necessarily correspond with source type (unimproved versus improved sources, or surface water versus groundwater). As these perceptions are key determinants of which sources people actually use, this suggests that there is a disjunction between the views, opinions and understandings of interveners – whether government, NGO or private sector – and communities. In Mecheke (Konso), for example, two springs perceived to be contaminated in the wet season, due to a bad smell, are avoided in favour of a river which is felt to provide better water quality for domestic use. In the dry season when river flow drops off, households often revert to using the springs.

In some instances, women reported using water treatment provided by the government to improve water quality from more convenient but unimproved sources:

> 'There is one river around the valley over there from where I get water. I use it for drinking and cooking. Since it is a river, we take a bath somewhere here, we wash clothes a bit further along, and we collect drinking water somewhere there too. Consequently, we have been susceptible to disease. It brings illness. However, the government provides us wuha agar (water purification), and we put this in a jerrycan of water and use the water that way. It is good that the government has taught us about hygiene and water use accordingly.'
>
> (47-year-old woman, Mecheka)

> 'During the dry time we spend lots of time looking for water. When there is rain, we collect water from a running river. We use it with wuha agar (water purification).'
>
> (40-year-old woman, Nalaya Segen)

For the most part, though, water quality did not emerge as nearly such a significant concern as shortages and the time required for collection. A participant in a men's focus group discussion in Gaad captured what seemed to be the prevailing view, that access and quantity were the main concerns, saying 'You die through lacking water. But you don't die from drinking water.'

2.5 Affordability

Water from improved sources is invariably paid for. Fees provide funds for maintenance and, in the case of motorised boreholes, for fuel. In the study sites payment for borehole water ranges from ETB 0.25 to ETB 0.50 per 20 litre jerrycan. This is equivalent to US $0.70 to $1.40 per cubic metre (by comparison, the latter is roughly the same amount that UK consumers pay, but in a country where annual per capita GDP is some 36 times higher). At these rates purchasing just 15 litres per person per day for a relatively small household of five would cost ETB 340-680 per year. Current data on typical annual income in the study sites were not available, but in the early 2000s these were just ETB 800 – 2400 for agricultural households in Konso (FEG n.d.) and ETB 2000 – 7000 for pastoralist households in Shinile (Save The Children 2002).

High water prices mainly reflect the high cost of fuel required for the diesel generators often used in association with electrical submersible pumps. Interviews indicated that rising fuel costs had driven water prices up from ETB 0.20 to ETB 0.50 in one instance. The fact that those living near the boreholes continue to use them over unimproved sources indicates that the price is affordable for many, though the trade-offs involved in terms of other expenditure possibly forgone will be a crucial longer-term determinant of net livelihood benefits to households. However, there is clear concern about cost for some households – and probably amongst the poorest and most vulnerable. In Shinile some households indicated that they

found it hard to pay the 0.25 ETB price, but they also recognised the high quality of borehole water and so tried to either obtain water via the borehole from their neighbours or persuade the respective water committees to allow them access to free water. Where the price per jerrycan was highest (0.5 ETB, in Gelgelana-Kolmele in Konso), some households reported that they had started to collect water from unimproved sources instead as this is unaffordable.

2.6 Underlying drivers: supply, reliability and demand

Interviewees and focus group members in the different sites frequently referred to increased rainfall failure in recent years as a cause of livelihood deterioration. The perception of a declining rainfall trend over the long term is not borne out either by available rainfall data from the study *woredas* (available from 1982 – Figure 2) or national level analysis dating back to 1960 (Cheung et al. 2008), which both show high variability rather an overall downward trend. The latter analysis did find that *kiremt* rainfall has shown a downward trend in parts of southern Ethiopia (ibid.), though conclusions are complicated by patchy data availability. What is clear, however, is that both sites encounter frequent rain failures, sometimes for many years in succession, with a substantial effect on livelihoods and well-being.

Regardless of rainfall trends and events, it is evident that infrastructure is insufficient – and itself insufficiently reliable – to ensure access even in a good year, to nationally-determined standards of water supply. As noted above, improved water points are located mainly in *kebele* centres. This does not necessarily encourage use by the population of more peripheral sub-*kebeles*, which can be five or more kilometres distant. Informants in several *kebeles* reported that infrastructure was either ageing leading to more and more frequent breakdown (e.g. pipes in Meeto were reportedly weak and easily broken by monkeys), poorly maintained (e.g. a dirty water storage facility in Fuchucha which reportedly contaminated supplies), or built for a design population which has since been exceeded (the population across Ethiopia is rising by over 1.5 million people a year (World Bank, 2012). In Fuchucha, for example, a borehole with two water points was constructed in 2004, when the *kebele* population was 1,304 (FDRE, 2008). According to *kebele* officials the population has since increased by over a third to 1,772, placing pressure on the scheme:

> 'When the water scheme was initiated, the population of the kebele was small. It has now increased, and the existing water points do not match with the number of people'.
>
> (Kebele official, Fuchucha)

At *woreda* level in Konso, population growth has been less rapid but is still significant, rising from 158,000 in 1994 (FDRE 1996) to 235,000 in 2006 (FDRE 2008), an increase of almost 50% in 13 years which is said to have outstripped investment in water services. Where people move between *kebeles* to access water, population growth in surrounding *kebeles* may also increase pressure on water points. Moreover, with larger numbers of people come larger livestock populations, particularly in pastoral and agro-pastoral communities, adding design stress to what are frequently 'multiple use' water systems.

Infrastructure breakdown can in part be attributed to age and increasing pressure on water schemes, but also to the institutional and financial arrangements for maintenance. Under Ethiopia's existing community managed model for rural water supply, infrastructure constructed by NGOs (HCS and Oxfam in Shinile, and WaterAid in Konso) is handed over to community water committees which are then responsible for operation and maintenance. In two *kebeles* (Fuchucha and Gelgelana Kolmele) committee members reported that their fund for basic day-to-day maintenance was running low. In turn this has pushed up user charges (also due to increases in the cost of fuel) to 0.40 and 0.50 ETB per 20l jerry can, respectively. The fact that some users reported that they find this cost unaffordable, and so resort to unprotected sources, risks a vicious cycle of declining collections, inability to maintain service from the borehole, and use of poorer-quality sources. Finding an institutional-financing model

that accommodates affordability, promotes sufficient levels of service across different user types, and relies on low-cost and readily accessible technologies, remains largely elusive.

2.7 Livelihood vulnerability to rainfall variations: the greatest pressure?

Any understanding of local water security must consider that in these two *woredas* – as in most of rural Ethiopia – livelihoods are directly dependent on a combination of rainfed crop production and grazing for livestock. While the initial focus of the study was on water supply (often from groundwater), according to respondents to the impact of rainfall variability on their livelihoods, mediated by impacts on crop and livestock production, is probably the most important form of water insecurity they face.

In Shinile, ten of the last 15 years have seen below average rainfall in the *dira* season and five in the *karan* (Figure 2). Communities report that this series of events has led to a decline in cattle holdings. The Government of Ethiopia has indeed documented a wider decline in livestock production in the Somali region over the last two years and attributes this to the poor performance of the last two rainy seasons (MoA 2012). A middle-aged man in Meeto revealed the devastating impact of this form of water insecurity on a pastoral livelihood in a case study interview:

> 'I have lost my livestock. I am empty. Everything is finished. I lost 30 goats and sheep. I had 10 cattle. But I lost all of them. We are now begging Allah. We are making dua (a prayer) so that this problem goes away.'

Such extreme losses do not usually occur due to a single bad year, but are the cumulative effect of successive or chronic drought years preventing restocking. Rain failures and resulting poor pasture conditions were also reported to have affected the market value of cattle, reducing household capacity to raise funds through livestock sales and ensure their food security. As a *kebele* official in Gaad explained:

> 'If livestock do not eat anything, they cannot be sold. Now one goat does not cost even ETB 500. People are living on government handouts. The government is distributing wheat.'

ETB 500 is towards the low end of the range of goat prices experienced in Shinile over the year preceding the fieldwork, which varied from approximately ETB 400 to 900 per head (FEWS-NET 2012). In pastoral areas of Ethiopia, livelihoods – and hence patterns of land and water access - are also changing rapidly. Crop production in Shinile increased almost five-fold between 1995 and 2008 (Kene 2008) and farmers report growing interest in small-scale irrigation to improve food security in response to uncertain rainfall (see section 3.8).

In Konso, rainfall was again the most frequently mentioned dimension of water insecurity during fieldwork, which coincided with a good season when people expected a successful harvest. However, both interviews and focus groups revealed that lack of rain has repeatedly jeopardised crop production in the past. This has happened regardless of efforts to maintain traditional soil and water conservation practices (see Box 1 above). Participants in focus groups in all *kebeles* in Konso confirmed the severe effect of consecutive *belg* rainfall failures experienced from 2007 – 2009 (see Figure 2). People in Fuchucha, Nalaya Segen and Buso reported that 2008/2009 was a particularly hard year. On top of failed crop production the price of grains from the market sharply increased. One participant of the focus group discussion in Fuchucha recalled that:

> 'The situation was very worrying. Food grain was expensive. There was no grain at home. In the market the price was expensive.'

Indeed, extremely high food prices compounded by *belg* failure were officially reported in 2008 in the south, while Konso and surrounding belg-dependent woredas were characterised as highly food-insecure in 2009 following a second near-failure of the *belg* crop in 2009 (FEWS-NET 2008, 2010).

Even here, where soil and water conservation practices are established and maintained (unlike in much of Ethiopia), there is an emerging sense of livelihoods in decline, confirmed by high recent incidence of food insecurity. Some studies have reported increasing pressure on land as populations and numbers of livestock increase (visible in the form of decreased vegetation cover and reductions in fallowing of land), leading to degradation and declining crop production (Förch 2003, Beshah 2003, DiGiovanni 2011). Recent population increase is in part due to the decline of the traditional generation grading systems which controlled population growth by restricting marriage and reproduction until a certain age (Beshah 2003). However others suggest that the undermining of local institutions for resource management is a more important factor than population pressure (e.g. Watson 2009). Probably as a result of a combination of all these factors, as well as the rain failures and food price shocks encountered in the last five years, people are increasingly seizing new livelihood opportunities, which are discussed below in section 3.8.

In the context of high climate variability, with most people engaged in rain-dependent subsistence production, many chronically-reliant on food aid, and ever-increasing pressure on the soils and pasture on which production depend, there is no clear distinction between 'emergency' and 'normal' situations in either *woreda*. Rain failures may be a leading proximate cause of food and livelihood insecurity, but it is clear that underlying structural factors are critical in the long term and are the major source of vulnerability amongst poor households, whether involved in rainfed farming, pastoralism or a combination of the two. Local water security must be understood in the context of these wider natural resource- and market-related effects, including the rising costs of farm inputs, transport and food staples. As argued by Blaikie et al. (1994) and many since, while natural systems may create hazards and pressures, the extent of vulnerability to these is a function of human-driven social, economic and political factors, both underlying structures and dynamic processes of change.

3 Responses

3.1 Travel for water

Section 2 illustrated how lack of availability of preferred sources may force people to travel greater distances to collect water. However, individuals differ in their capacities to undertake such journeys. During a household interview, a 45-year-old woman in Mecheke *kebele*, Konso said*:*

> 'I am ok during the wet season. I can go and collect water. However, during the dry season I feel tired when I go and fetch water. I also feel sick. It is a lot of work considering my age. At times I may have no water at all, as I don't have the capacity to collect more water.'

Similarly, a 35-year old woman in Bisile, Shinile described the difficulty of travelling for water, saying:

> 'I do not often get enough water. My big problem is exhaustion. I feel like a sick person when collecting water from far away.'

Bisile *kebele* represents an extreme case of water insecurity, having no other source of water except rainwater which is harvested and stored in open concrete-lined tanks (*birka*). Uniquely among the *kebeles* studied, in years when rain fails the need for water drives not just daily movements to collect water but mass out-migration to areas with better supplies. This was evident at the time of fieldwork when only the better-off households, who have donkeys enabling them to carry water over large distances and to collect larger volumes in one journey, remained in the village. Focus group participants in Bisile explained that in previous years they had received emergency water trucked in to the area which helped to prevent migration, but that at the time of the research visit no water trucking had taken place.

For those for whom travelling to a distant source is impossible, social relations and the ability to share the burden of travel or beg, buy or borrow water from others become critical (see section 3.5 below). Alternatively, people may invest in developing their own supplies (if they have the resources to do so) or resort to unsafe sources in place of improved or trusted sources, risking health and well-being. For those who do make the long journeys and spend long periods of time engaged in water collection, there can be a significant cost in terms of other activities sacrificed. The following section discusses the labour trade-offs made by adults. In Konso, it was also reported that children sometimes miss school to collect water, and that their parents are penalized as a result.

3.2 'Torn between my work and water'

The time and labour requirements to access water often compete with those of other household activities and in particular agricultural labour, especially in Konso where people are predominantly sedentary farmers. There, people frequently respond by reducing farm work in favour of water collection. Women are primarily responsible for water collection and in Konso also play significant roles in farm activities, including ploughing/digging land, sowing, planting, weeding and harvesting (Tadesse 2010). Indeed, in Konso women carry out more farm tasks than men, even though they are also expected to undertake the majority of domestic tasks. During a focus group discussion conducted with women in Golcha, participants stated that:

> 'When a husband and a wife live together, they do farm work together. When the woman goes to collect water, only the husband stays in the farm. Then, it is only one person's labour that will be available for farm work.'

Some households emphasised that they miss their farm work repeatedly, and the constant demands of water collection leave little opportunity to compensate for lost labour inputs at a later date. As a result, the cumulative impacts can be serious. As women in Mecheka explained during a focus group:

> 'The need to have access to water is so great that we postpone the farm work we intend to do today for tomorrow. When tomorrow comes, we again defer the farm work for another day. Since time won't be enough to do the skipped farm work, it will be ignored completely.'

Men seem to appreciate that the household has to forgo some basic activities in return for water access, but often insist that missing their partners' farm labour inputs can cause significant livelihood impacts. One of the participants of a focus group discussion with farmers in Nalaya Segen emphasised that:

> 'The problem of water is what prevented us from growing. Mother goes in search of water. Father stays alone in the farm. He does not do anything until she comes. When she comes, the time of work is already gone. She cannot also do much after she is back from water collection. The time will be short. There is shortage of labour. Life is better with two people working.'

Others echoed this view, and in particular confirmed the tendency to abandon farm work completely in the absence of women, although no clear explanation was given for why they could not continue working:

> 'When there is high shortage of water, my wife goes out in search of water. When it takes her too long to come and aid me in the farm, I cannot do the work alone. Instead, I go back home, abandoning farm work.'

Such opinions confirm evidence from the literature on the imbalanced expectations place on women to provide farm labour in Konso. As well as being responsible for domestic duties, women are also expected to contribute at least half the farm labour, and men appear – at least in some cases – to abandon even their share in the face of women's absence. Men also reported that water collection prevents their wives preparing meals and bringing food to them on the farm, which makes it hard to continue physical work.

The competition between water collection and farm work becomes particularly intense when a household is pressed by high labour demand for water collection as well as farm work. Seasonal calendars are a useful tool for investigating these pinch points. Women in Gelgelana Kolmele pointed out that:

> 'The high season of work and shortage of water join together. We lose two days of farm work for the purpose of travelling and collecting water.'

Water collection time peaks during the last two months of the *bona* (dry) season (January and February – see Figure 3) which coincides with the labour-intensive agricultural activities of land preparation and planting (Figure 6). Withdrawing labour from agriculture at key times has an effect on the household's future food security, by risking insufficiently prepared land that may encourage weed infestation and soil loss.

To meet multiple demands on their time, many women reported that they extend working hours late into the night to collect water, even though travelling at night is considered dangerous, as a 32-year-old woman in Buso explained:

> 'When I return home after staying in the farm, doing farm work, there will be no water. Then I will be worried about the lack of water and the long queue in case I decide to go and collect water. Sometimes it gets dark when I go out to collect water. Sometimes the darkness presents a good opportunity for collecting water. There will be a small queue, as many people will have finished collecting water and returned home. On the other hand, I fear travelling at night. Yet, it is such a problem that I somehow compose myself and go out to collect water.'

When water collection times peak in Konso, girls may also be withdrawn from school to help with water collection, particularly for *chaka* making, although this was said to be occasional. When mothers lack the time to prepare food, it was also reported that children were sometimes too hungry to go to school and so stayed at home.

The labour and time required for water collection also compete with other income-generating activities in Shinile. People from Tome and Mermersa reported that firewood sales provide an income source, but collection is reduced, if not abandoned completely, when water collection demands more time. Respondents in Tome, which is close to the *woreda* centre (Shinile town), also indicated that high water collection times impinge on their wage labour provision (*shikela*) in the town. As a 32-year-old man in Tome explained:

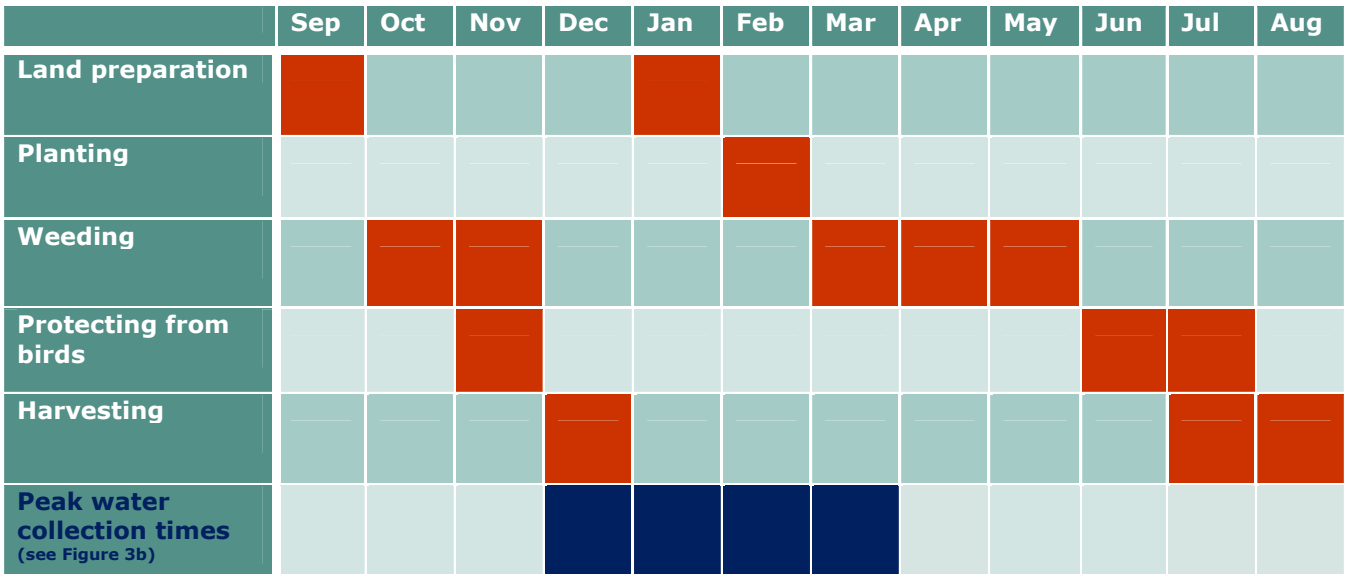
> 'Water collection from a far-off place challenges wage-labour. This was particularly true 5 years ago when there was no borehole in our area. We had to go to other far-off places including Dire Dawa to collect water. During such circumstances, I would stop doing paid labour work. I had to give priority to the household water needs.'

Although it is usually men who migrate for wage labour, while women are responsible for water collection, in this *kebele* men reportedly abandon other activities to help collect water when access becomes particularly challenging. This statement indicates that recent investment in a borehole in the *kebele* has not only improved water access but also wider livelihood and income security.

There are also indications that water collection is compromising the work of some government employees performing important public functions. One agricultural extension agent indicated that water collection sometimes takes time away from pilot projects on cropping practices, while elsewhere a health worker explained that she feels unable to exercise her right to jump the queue for water and so misses vital hours of work:

> 'Every morning I have to line up for water, even if I have the privilege of getting it first, as I am government staff working for the clinic at the *kebele*. The reason why I line up is I feel guilty getting ahead of all the women who came before dawn. So I queue for two or three hours. During this time the pregnant women line up waiting for me at the clinic. I am telling you, I am torn between my work and water.'

Figure 6: Agricultural labour calendar and peak water collection times, Konso



Source: Focus group discussions

3.3 Store water and restrict its use

As well as having to compromise livelihood activities to spend time collecting water, people may also economise on water use in situations of shortage. In both *woredas*, people mentioned restricting water use so that they do not have to collect water every day. As a 40-year-old informant in Nalaya Segen said:

> 'If three jerrycans of water are collected in one day, we use it for two days. It is not enough though.'

Households respond by a combination of water storage and restricting use:

> 'During the dry season it is necessary to store water. We collect two jerrycans of water. We boil the first one and keep it. We use the other one for the household. Those who have the capacity, store water in a barrel. However, I just store it in a jerrycan.'
>
> (an elder, again in Nalaya Segen)

The availability of larger containers for household water storage container is a mark of wealth differentiation. The relatively better-off households can store more water and therefore have more flexibility in deciding when to collect water. For example, some allocate one whole day every so often to the task, as a 27-year-old woman interviewed explained:

> 'When I have to bring water, I ignore the farm work that day and go to collect water. I have a small roto (water container) that contains 9 jerrycans of water. I use this to store water.'

Increased storage of water at the household level is known to increase the risk of contamination, however (Wright et al. 2004).

Even with some storage at the household level, shortages of water often mean restricting quantities used and prioritising uses. In both *woredas*, people indicated that they restricted water use for some purposes, particularly bathing. During a household interview in Bisile, Shinile, a 35-year-old woman emphatically stated that she often minimized her water usage, saying:

> 'You can tell this looking at my boy. You see how unclean he is? It is because of lack of water that he is dirty like this. Otherwise, I would clean him. But now I use the water for making food.'

Women in Fuchucha also indicated that they restricted water use for bathing, particularly during the dry season. Men in Nalaya Segen also stated:

> 'We wash our hands. Taking shower is unthinkable. This happens during the dry season.'

Whilst both men and women reported restricting water use for bathing in Buso men emphasised that uneconomical use of water could be a source of dispute within the household, with women being more conscious of the need to save water. As one explained:

> 'Due to shortage of water, we economize on use, particularly for bathing. When we come home from the fields, we want to take a shower. If the water available at home is small, our wives get angry when we take a shower. They say "Why are you taking a shower? We only have a little water!"'

Although water shortage may force restrictions on use of water for bathing, some parts of the body seem to deserve special treatment in cultural terms, regardless of shortages of water. In the case of Konso, the face is given special treatment. During a focus group discussion with men in Gacha, several participants confirmed one participant's description:

> 'Since we do not have enough water, we economise on the use of water for bathing. We skip taking a shower while we should do so. This kind of problem happens. However, it is embarrassing to wake up from bed and go out without washing our face. It is under such circumstances that we go to our neighbours to seek water.'
>
> (Male FGD participant, Gacha)

People also reduce productive uses of water at times of shortage. In Konso, brewing of *chaka* is the main income-generating activity, practised particularly by women. Local explanations indicate that *chaka* preparation requires a great deal of water, and therefore labour for water collection. A middle-aged woman in Mecheka explained:

> 'I don't have the capacity to collect more water. That is why I do not make chaka. It is a household that has enough young women that makes chaka. Or those who have donkeys to collect more water from another *kebele*.'

Challenges around *chaka* preparation and its labour requirements intensify during times of high water stress. *Chaka* makers respond by reducing production, as women in Gelgelana Kolmele described:

> 'A woman who makes *chaka* twice per week will be forced to make *chaka* only once per week, while a woman who makes *chaka* once per week will stop doing it.'

3.4 Invest in new supply

At different sites, people have also invested in 'self-supply': building their own private wells and pipelines in order to secure water. In Meeto, Shinile, although there is a public borehole people have been widely engaged in digging wells privately. Several interview respondents confirmed that almost every household now has its own hand-dug well, most of which are unprotected, and, therefore, according to a *kebele* official, forbidden for domestic use. However, the reality as indicated by focus groups is that these wells are used for all purposes, in spite of their potential health risks. There are also unresolved questions around the

sustainability of the community borehole, as usage has significantly declined resulting in a drop in fee collection by the water committee. As a committee member said:

> 'Now the strength of the water committee has declined because people have their own hand dug wells. In the past they would buy water. Now there is water around every house and people infrequently buy water. Since people use these hand dug wells for free, the number of people who buy water has decreased.'

As an alternative to self-supply from wells, some households prefer to pay ETB 100 per month for a pipeline from the borehole to their homestead. However community members reported that this is only an option for the better-off. Typical annual income of such households in Shinile (who comprise around 20% of the population) was estimated at just over ETB 9,600 in 2008, compared with around ETB 3,500 for the 35% classed as 'poor', using Household Economy Analysis data (Kene 2008).

In Gelgelana Kolmele, Konso, some households have dug their own wells around rivers (e.g. the Arbosh). During fieldwork it was revealed that such households were able to find shallow groundwater in this manner and now control access to these wells. Others can use the wells without charge but must seek permission from the owner first, and priority is given to use by the owner. Another study in Konso documented a community-wide collaborative investment of labour by hundreds of people from three villages to restore a large rainwater storage pond, which was then made available for use by all the participating families (DiGiovanni 2011).

In Fuchucha, groups of five to six farmers have invested in motor pumps for irrigation, in response to declining yields and the vulnerability of rainfed agriculture. In Meeto, Shinile, where lack of rain has resulted in loss of livestock, some households have dug wells for home gardening. In both cases, availability of groundwater is going some way to compensate for the livelihood difficulties resulting from unpredictable or inadequate rainfall (see below).

Finally, households may supplement their water supply through rainwater harvesting. Wealth indirectly affects households' ability to harvest rain water, as it is dependent on having a house with a tin roof. Rainwater harvesting provides a buffer against problems with other sources, as farmers in Mecheka explained. When spring sources are contaminated and smell bad during the wet season, people who built houses with tin roofs can harvest rain water, while those living in huts with thatched roofs either have to travel to another village to collect water, or continue to use the dirty water source.

3.5 Pay for water or transport

As well as – or instead of – investing more time in water collection, households may spend additional money to access water more conveniently at time of shortage, by buying from vendors. In Gelgelana Kolmele, for example, *chaka* makers often buy water from vendors (at a very high ETB 4 per 20 litre jerry can) in order to maintain production. These markets operate during the dry season, which is extended in drought years, and vendors may come either from the local community or from neighbouring *kebeles*, depending on where they can source water and find a market. In the case of Mermersa, which is close to Dire Dawa, vendors bring water from the city, exploiting its superior infrastructure. *Chaka* makers also hire horse-drawn carts to collect bulk water from distant sources, during all seasons. Participants in a women's focus group in Fuchucha explained that this costs ETB 50 per trip to hire, and transports up to 20 jerrycans. In Shinile, hiring of donkeys for water collection is common in the dry season.

3.6 Cooperative responses

The above discussion has indicated that households make trade-offs between the allocation of different assets (labour, financial capital, transport assets, water) for water collection, and the costs and risks associated with different responses (health risks, physical danger/fear, food

production, income-generation and domestic conflict). The trade-offs depend on household preferences, and wealth confers significant advantages. Household decisions may also have wider effects, if self-supply reduces the financial viability of the main communal source, for example.

However, households do not make these decisions as isolated units. This study found that social relations between households also play an important role in bridging gaps in access to water, enabling people to cope at times of difficulty, and providing greater flexibility in the allocation of labour, transport and storage assets, and money. The social capital of households may thus be as important in ensuring water security as an ability to mobilise labour or financial resources.

Water sharing is often practised between households in times of need, particularly between neighbours. This was reported in Shinile, where local people often stated that whenever a household collects water it shares it with another household if there is need. A 35-year-old woman in Bisile emphasized this understanding, saying:

> 'I cannot save water for myself while knowing that my neighbour has no water. I should give it to my neighbour.'

In Konso, water sharing takes the form of more formal lending/borrowing arrangements. Households often lend each other a 10 litre jerrycan of water, which has to be repaid. Focus group participants in Gacha indicated that failure to repay the borrowed water affects the household's future options to borrow, even if in dire need, which indicates how seriously households take the concept and practice of reciprocity. Failure to pay back borrowed water can lead to conflicts, as a middle-aged woman in Nalaya Segen explained:

> 'If water is taken from someone, it has to be given back. Not doing so can even lead to physical confrontations. How could someone refuse to pay back the water which was collected by travelling a long distance? If this happens, it leads to fighting.'

The resolution of disputes that arise over borrowed water can also involve local dispute resolution practices, indicating the significance of the issue. The greater emphasis on the importance of repayment in Konso may reflect the generally higher collection times than in Konso (see Figure 3) and the greater investment therefore made by the lender.

People's social relations around water also extend to sharing transport. In Konso donkeys are not frequently used, probably due to difficult topography, but in Shinile donkey ownership confers a clear advantage when it comes to water collection, especially when water has to be collected from distance. As a result, various arrangements have developed by which households share donkeys in times of water shortage. The simplest is simply borrowing, as one woman in Gaad explained:

> 'The construction of water points around the village has helped me sell tea and spaghetti. However, when the water scheme becomes non-functional, I experience a big problem to collect water from distant places. I cannot transport water on my own, as I cannot carry it. My husband is also old. However, I can rely on others who have donkeys. I can share a donkey with those owning or using a donkey in the neighbourhood. So, I can bring water with the help of a donkey.'

When distances to water are very high, limits on the number of journeys which donkeys can make before becoming exhausted (or before the day is over) mean that simple sharing arrangements evolve into a form of shared water collection. The household borrowing the donkey collects water for the borrowing and lending household at once, bringing mutual benefit. In Table 2 below this has been termed 'share-collecting', reflecting the similarity of the arrangement to share-cropping of land. But such arrangements have their limits too, as seen in Bisile where those without donkeys are forced to leave the *kebele* under conditions of

shortage to be nearer a water source. As a focus group participant commented, when water sources are very distant and the entire community faces a severe struggle to access enough water, 'It is impossible to beg [for a donkey] every time'.

The use of labour groups is another form of social relation which enables households to manage demands on their labour with some flexibility. This particularly relates to the use of various agricultural labour group systems (e.g. *fededa)* practised by farmers in Konso, where there is a long tradition of collective agricultural labour (further detailed in Beshah 2003). These are used more intensively during high water collection times and peak agricultural activities. It mediates the challenges of water collection and the labour demand for farm work, rendering jobs which may require three days by an individual to be accomplished in one day with the help of a labour group.

Similarly, *chaka* makers in Konso may share the task of water collection when shortages become intense, on a rotational basis. A 40-year-old woman in Nalaya Segen explained that:

> 'I will tell women in the neighbourhood that I have *chaka* preparation, and I need support. I will ask 6 people to support me. Then, we go together and collect water for me. During this "water day", we won't be able to accomplish other activities but collecting water.'

Overall, many cooperative institutions exist which improve water security. However, when water access becomes difficult this can also create tension. Disputes among those waiting at water points were also widely reported, occurring particularly when queues are long in the dry season as people are conscious of the opportunity cost of waiting for water. These disputes are usually triggered when somebody tries – or is seen to try - to 'jump the queue'. These arguments were generally felt to be of relatively minor importance, although male focus groups cited a few instances when men stepped in to help resolve arguments between women collecting water. Disputes were also reported with other communities, when people had to travel to other *kebeles* to collect water.

Table 2 summarises the local social institutions that support water security, both market-based and cooperative.

Table 2: Local institutions that support water security

	Reciprocal	Market-based
Water	**Water sharing and lending** In both *woredas*, households with water share with those in need, especially neighbours. In Konso, water is considered to have been lent and repayment (in kind) is strictly expected.	**Water vending** In some *kebeles* in Konso, *chaka* makers buy water from vendors at a price of ETB 4 per 20 litre jerrycan.
Transport	**Donkey lending and 'share-collecting'** Households without donkeys in Shinile can sometimes borrow a donkey to collect water. Where distances to water are high, 'share-collecting' is undertaken, whereby the borrower collects water for both herself and the donkey owner.	**Horse-drawn cart hire** In Konso, *chaka* makers sometimes hire horse-drawn carts to transport water in bulk (up to 20 jerrycans).
Labour	**Labour sharing** Women in Konso frequently share the task of water collection for *chaka* production with neighbours, on a rotational basis. Arrangements for sharing agricultural labour (*fededa* and various other mechanisms) also provide flexibility and intensify at times of peak water collection and agricultural activity. At times of drought, men in Shinile sometimes cooperate to dig for new supply.	**Labour hire** The use of hired labour provides flexibility for households in allocation of their own labour and can prevent the sacrifice of productive activities when water collection times are at their peak.

3.7 Inter- and intra-household relations under extreme shortages

Water collection under normal circumstances is almost wholly associated with women. However, in Shinile under severe drought a husband and a wife may rotate responsibility for water collection. A 40-year-old woman in Bisile said

> 'It is this year that I have experienced a big water problem. I go out for water collection early in the morning. I have one donkey, which goes with me to fetch water. My husband also collects water. If he collects water once, I will in turn go out another day. It is impossible to go out and back again every day.'

Some women even insist that men take responsibility for water collection when it requires long journeys. For instance, during a household interview in Bisile, a 35-year-old woman said

> 'I have faced a big problem, particularly this year. I live with my husband. He has gone out for water collection. Most of the time he is the one who goes for water collection. When it is a big problem it is men who go to distant places.'

Data from Konso also revealed that at times of severe shortage, rather than competing over water, households are likely to collaborate to help secure access. For example, men in Buso explained that during drought they would work together to dig down to reach groundwater. Although only small amounts of water are found this way, which then have to be shared, the very fact of pooling labour makes digging these deep excavations possible.

The opportunity costs associated with water collection may also be reduced in a severe drought, reducing tension over water. Women in Fuchucha explained that disputes among those queuing for water points are in fact rarer at times of drought, because there is no farm work to be done (lack of rainfall having already destroyed crops) and so there is less pressure on their time. Thus responses to severe drought are not necessarily intensified versions of normal dry season responses. Again, the emphasis is on specific thresholds in water security, beyond which normal responses and behaviours cease.

3.8 Migration and diversification of livelihoods

Informants in both *woredas* indicated that rain failure and the high vulnerability of rain-dependent livelihoods induce a variety of responses, in particular migration and livelihood diversification. These may be temporary or permanent, and driven by the desire to improve livelihoods over the long term (so-called 'accumulation'-type diversification) or the failure of other options (leading to 'survival'-type diversification, in which circumstance new activities are frequently risky, low-return or both). A picture emerges of a highly dynamic pattern of local livelihood activities, including short-term adjustments and longer-term change.

In Shinile, rain failure is said to be forcing migration in order to seek pasture. As a 35-year-old woman from Meeto explained:

> 'I have lived here for fifteen years. I have not seen people migrating in search of water… People migrate to access grass. They do this when they face lack of grass due to rain failure. They do this when they face the kind of situation we now have. Let alone cattle, even goats do not have anything to eat.'

Meeto is well endowed with groundwater and supply infrastructure, but this implies that local livelihoods cannot be considered secure in the absence of other key assets. Only those who have already lost their livestock remain behind. However, some of these people are now attempting to develop new livelihoods based on irrigation development from groundwater. Some women are practising vegetable cultivation with hand dug wells, while some men are embarking on borehole-based irrigation in farmland some distance from the village (Figure 9).

The availability of ample water sources in the *kebele* gives people more livelihood options, and more potential to overcome shocks and stresses associated with rain failure, with the right support and capacity to exploit this advantage. One woman expressed the downward trend in pastoral livelihoods following successive droughts, and her high hopes for irrigation to provide a way out:

> 'I used to live in a place where there was no water. I came here 15 years ago. I get water here as I want. I do not worry about having no water. But this place used to be full of people who live on livestock. They used to bring livestock and goats and milk. I would buy from them and sell them on in Shinile and Dire Dawa. I used to sell goats, sheep and butter. I had a good life, and I would support my family by working like this. Now there is nothing. All those things I have told you are not there any more. I am just sitting now. They have stopped bringing goats and sheep due to the drought. If farming is done in this area, there will be a good change. I am trying it now, though I am troubled by my capacity. I have five children, taking care of them without a husband. If I can farm, I will have a good life. It will be good if there is agriculture. I am ready to do farming when this irrigation project is finished.'

In Baraag, some of the better-off households already benefit from more secure livelihoods based on spring-based irrigation of both staple crops and cash crops (mainly fruits). However, it is not clear whether less wealthy households will be in a position to invest in and capitalise on irrigation opportunities. Other households in Shinile unable to irrigate are engaging in survival-type diversification in response to declining cattle holdings, migrating to nearby towns either temporarily or permanently for wage labour provision or engaging in the sale of firewood and charcoal on a seasonal basis. In the longer term, these latter activities may exacerbate risks to the natural resource base and further undermine pastoral livelihoods.

In Konso, rain failure also drives the movement of farmers. Some migrate in a bad year to undertake wage labour or work in gold mining areas. Others move from their homes in the hills to cultivate lands closer to rivers which they can irrigate using traditional river diversions, again temporarily. Such temporary strategies may, however, persist over several years under

conditions of successive rain failure. Diversification initially practised as a short term coping mechanism may also become a more regular part of livelihood strategies if it continues to bring clear benefits, which was reportedly the case with gold mining around Gelgelana Kolmele.

Figure 7: Borehole-based irrigation in Meeto

Photo by Mengistu Dessalegn

3.9 Household responses summarised

People in Shinile and Konso have adopted a variety of strategies in response to changing water availability and access conditions. Some are last-resort coping strategies, for example reducing water use for bathing or *chaka* production (in effect managing household demand), travelling longer distances to collect water, collecting water at night, or - in the extreme case of Bisile – undertaking seasonal migration to areas where there is more water availability. These strategies are adopted when people have little choice, and are often costly or high-risk in terms of health, personal safety and/or time and money. To enable households to better balance and manage these risks and costs, various local institutions have emerged in both *woredas* to support the sharing of both the resource itself and the means to acquire it – labour and/or transport assets. Markets are also active to support donkey hire, and in some cases water vending, which can turn access difficulties for some into opportunities for others.

These strategies enable people to get by, to greater or lesser degrees, but not without incurring additional costs and risks. Much of the burden falls on women and tensions over the allocation of water and labour can trigger domestic conflict. Household-level water security depends both on ability to access social institutions – which often rely on reciprocity and in some cases at least create very serious obligations – and own wealth. Wealth creates water security in numerous ways. Wealthier households are: more likely to own donkeys, making water collection easier and enabling them to benefit from donkey hire or 'share-collecting' arrangements; better able to purchase water from vendors if needed, or to invest in self-supply; able to store more water in the household, reducing the need for frequent trips; and better able to supplement supply with rainwater harvesting.

Water access difficulties – and the costs and risks incurred by different responses – are not occasional; they are part of daily life. In some places in Konso, households are making significant investments in hand dug wells and even irrigation boreholes, to improve their own water security. However this is relatively uncommon, which begs the question why people remain primarily in coping mode when it comes to water access rather than investing in longer-term solutions, given the frequency with which shortages occur. The answer may lie in

the high vulnerability of livelihoods overall, particularly to rain failure, which provides severe disincentives to making substantial investments. In the absence of these, the fall-back option is to rely on self-supply and complex social structures (or community 'software'). Some, however, may be unable to afford or access these alternatives, particularly where there are measurable declines in yields and/or livestock holdings, which, coupled with increasingly erratic rainfall and a limited set of livelihood alternatives, leads to forced migration. Short term movement is most common, but some people are diversifying and migrating on a longer-term basis to escape rainfall-dependency. Where water resources allow, investment in securing water for productive use (e.g. irrigation from groundwater) can help overcome vulnerability to rainfall variations, but the initial costs are high.

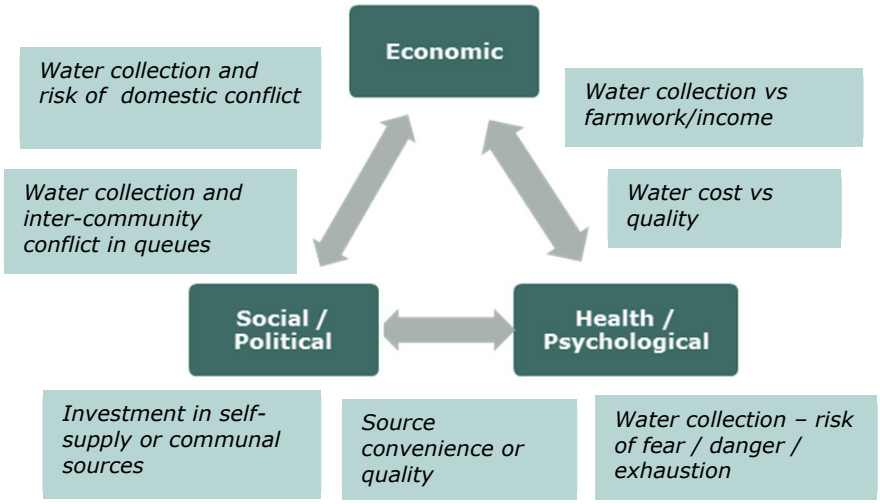
The context in which people make their trade-offs and decisions around water access is also affected by other exogenous factors, including the value of their time in the wage-labour market. Time is a precious commodity as livelihoods are precarious and the opportunity costs of water collection high, and given the alternatives that may be available by way of labour provision, time seems to be valued over the health benefits of using improved sources, except where nearby sources are understood to be specifically contaminated.

Figure 8 summarises some of the many trade-offs households face in determining water access strategies. The way in which households make these decisions relate to a number of factors, notably:

- **Household assets**: cash, donkeys, labour, water containers
- **Social capital**: possibilities to buy, beg or borrow water or share labour/transport to improve access
- **Intra-household relations**: likelihood of domestic conflict or cooperation
- **Range of available water sources**: distance, quality, cost, accessibility

Both experiences of, and responses to, water insecurity are also highly gendered. These gender effects are summarised in box 2.

Figure 8: Trade-offs involved in water access decisions



Source: authors' own elaboration

Box 2: Gender dimensions of water (in)security

As is well known, women and girls are generally responsible for water collection and therefore bear many of the costs of poor access: arduous and sometimes dangerous journeys; and loss of time for schooling, caring for family members and productive work. But the gender aspects of water security go beyond this:

1. Women are not only considered responsible for domestic tasks, but often provide a large proportion of agricultural labour too.

This means that women not only bear a high workload when water access is good, but when collection times are high they may be forced to extend their working hours well into the night, undertaking risky journeys in the dark, or abandon farmwork or other tasks completely (such as preparing meals for their husbands). As a result they may face domestic conflict and/or a loss of agricultural production. In Konso women bear a disproportionate share of the household workload, and this is not a unique situation: FAO report that worldwide, 'overall the labour burden of rural women exceeds that of men' (FAO, 2011:1), while in rural Ethiopia others have observed that 'women work from dawn to dusk and, in contrast with men, have little time for leisure… Women are not only the major source of labour in the agricultural sector, they are also responsible for… [the] household' (Aregu et al. 2010:5).

2. Water access challenges may trigger cooperation or conflict within the household.

Intra-household dynamics are necessarily highly varied. A mixed picture emerged in which some households showed a high degree of mutual understanding and cooperation over the need to spend more time collecting water and/or reduce water use during periods of difficult access, while in other cases this triggered disputes and criticism of women by male household members, or vice versa.

3. Most inter-household conflicts over water collection which take place between women are minor, but when serious, these are arbitrated by men.

Women reported occasional minor conflicts in queues for water points, mainly occurring when somebody is seen to jump the queue. These were mostly not said to be serious, but in the rare event of escalation it is regarded as the role of men in the community to resolve them.

4. Under extreme water shortage, men may take on the task of water collection.

Although women are primarily responsible for water collection, it was sometimes reported that when the journeys become excessively long and arduous – e.g. during severe droughts – men do in some cases take on this task or share responsibility with women. It is incorrect to assume that the burden of water insecurity will always fall on women and their workload necessarily increases proportionately as access worsens.

3.10 Government responses

Kebele and *woreda* water offices are key institutions responsible for providing water services. The challenges identified by officials at these levels in Shinile and Konso were broadly similar to those mentioned by communities, but capacity to respond seems limited. *Kebeles* report that the main response they can give is to pass information on local needs to higher levels. But they also organise communities for public works related to water, such as making ponds and clearing obstructions around springs, from time to time.

The *kebele* and *woreda* are responsible for supporting local water committees with repairs to schemes which the committee cannot manage, because of lack of technical knowledge, parts or resources. The *woreda* office is usually called upon to support the repair of motorised schemes, which is usually beyond the capacity of *kebele* offices. Key informants in both *woredas* emphasised that the *woreda* works together with the regional administration and NGOs to facilitate access to water and the improvement of water sources. *Woreda* offices also play a role in stepping in to tackle serious water supply problems and to provide emergency supplies, possessing greater capacity to do this than *kebeles*. For example, in Nalaya Segen, Konso *woreda* intervened and provided occasional piped supplies connected to the Konso Town's water supply system.

At national level, water sector policies do seek to address some of the pressures identified in this study. The Universal Access Plan (UAP) sets an ambitious target of 98.5% coverage (defined as having access to 15 litres per capita per day (lpcd) within 1.5 km of the homestead for rural areas) by 2015, and both government and donor funds have been successfully mobilised around this plan, though a financing gap remains (Ludi et al. 2013). Self-supply is recognised in the UAP as a low-cost service delivery model which could contribute to coverage increases, and the associated WASH Implementation Framework (WIF) provides some guidance to local governments on enabling self-supply (discussed further in section 4), although to date the promotion of self-supply has often been in campaign mode with limited evidence of sustainability (see Adank et al. 2013).

The UAP and WIF also pay some attention to the sustainability of infrastructure, although many of the ideas discussed have not yet been realised on a widespread basis. Management support units are proposed as a mechanism to improve maintenance and repairs of rural water schemes (initially on a public basis but with a view to developing a market for private support arrangements in the future, although how this transition will be achieved is not clear). A highly devolved service delivery model – 'community managed projects', which has shown a high level of sustainability so far under a programme funded by the Government of Finland – is also slated for wider roll-out. Under this model the community takes on full responsibility for scheme design, installation and management, including procurement. However this approach requires a high level of capacity at community level and is unlikely to be successful everywhere.

The recently initiated National WASH Inventory (NWI) will capture full information on service levels at the household level for the first time, including from self-supply and unimproved sources, and will also collect data on scheme functionality. This has the potential to strengthen local service delivery, although it will necessarily provide only a snapshot view. How exactly this information will be made available to *woreda* offices, however, remains unclear, and it appears to be more geared towards national level monitoring than local planning and management (Butterworth et al. 2013).

However, there remain some gaps in policy. There is currently limited integration between those responsible for domestic water services and irrigation supply (in spite of the mention of multiple use water services (MUS) as a recommended service delivery model in one version of the UAP), while water for livestock is a largely neglected area of policy, particularly in agricultural areas (Tucker et al. 2013). There is also a broader disconnect between the planning of water services and the management of local natural resources which could provide a buffer against rainfall variation (see 4.1 below).

There are also substantial shortfalls in capacity, finance and downward accountability at the local level (Aboma 2009) which hinder local government in putting these policies fully into practice and in developing strong, locally tailored *woreda*-level (or *kebele*-level) plans. With some exceptions local government is largely playing the role of 'passive provider', often lacking the capacity, resources and decision-making power to plan investments strategically or to develop innovative mechanisms (e.g. cross-subsidy arrangements) to meet local service needs. Budgets for capital investment are limited, but even so are not always fully spent (Wube et al. 2009). In some cases local *woreda* officials rarely even have the chance to visit schemes after construction, while *kebele* officials report that their role is largely limited to reporting issues upward.

4 Ways forward

Table 3 summarises gaps in existing responses. Below, ways forward to address the most pressing gaps are proposed, along with suggestions for further enquiry where needed.

Table 3: Summary of pressures, responses and gaps

Pressure	Local Responses	Gaps
High collection times	Water sharing Labour sharing Collection at night Use of unsafe sources Sacrifice farm or paid work Reduced hygiene practices Reduced *chaka* making Self-supply (family wells)	Density of improved water points Reliability of improved water points Buffering rainfall variability / back-up supplies for dry season / drought Policies to ensure water quality and equity under self-supply
Affordability	Pay excessive fees for borehole Resort to unsafe sources Begging from neighbours / water committee	Subsidy / any means to control cost or support users (e.g. subsidy to water committee to purchase fuel; subsidy to users) Clear policy on who gets free water and how the additional cost of providing free water for the poorest can be managed.
Availability	Migration (Bisile) Self-supply (for irrigation)	Enhancing local (natural) storage. Solutions for the driest areas such as Bisile. Official support for self-supply; control of abstraction for irrigation. Support where self-supply is not an option because of hydrogeology Timely responses to emergencies
Gender expectations	Collection at night Abandoning of farmwork In extreme cases, men collect water	Address imbalance of labour expectations affecting women Women's empowerment
Lack of storage/transport assets	'Share'-collecting Donkey / horse-drawn cart hire Begging to borrow donkeys [limited]	Provision / subsidy / support / extend hire arrangements for donkeys, jerry cans, carts, storage containers Official hire schemes / subsidised vendors
Rainfall dependence of livelihoods	Self-supply (for irrigation and home gardening) Move to irrigation from livestock Seek non-water-dependent livelihood options (e.g. wage labour, mining) Migrate (long / short term)	Alternative livelihood options Support for productive water development where possible

4.1 Ensuring continuous access: buffered supply and sustainable schemes

In four of the twelve studied *kebeles*, there is no improved water source. In the eight which have improved sources, there remain many people living in peripheral sub-*kebeles* who consider the water point too far away to be useful, except when no other sources are available (when they may face round trips of several hours to and from the source). Furthermore, there were many reports of infrastructure ageing and breakdown. The scale of the challenge of bringing improved water infrastructure to all households in Ethiopia is huge. The Government

of Ethiopia has made substantial progress in recent years in increasing coverage, and works to an ambitious Universal Access Plan. However, it is imperative that this remain a focus and that a corresponding level of attention is now giving to sustaining services from infrastructure already in place (see Mason et al. 2013). Population growth also demands that services are planned with a view to increasing future demand, and groundwater sources should be developed with an awareness of seasonal water table changes (e.g. drilling of boreholes should take place in the dry season).

Ensuring sustainability of improved schemes is to an extent a matter of ensuring adequate technical and financial capacity for timely maintenance and repairs, at both community and local government level. But there is also a clear gap in terms of managing (or buffering) rainfall variations to ensure continuity of supply. Rainfall variations have a significant effect on local water availability and access, mirroring national level trends which show coincidence of dry years with a fall in GDP and an increase in numbers of people requiring food aid (Conway and Schipper 2011; Funk 2005). Households often make use of several different sources when these are available, but the reduction in available sources to one (or even none) in the dry season or when rains fail creates unsustainable pressure on both the sources themselves (leading to increased breakdown) and on people's time (spent in travelling and queuing).

Better buffering of local water availability can mean several things. The reliability of local water supply may be enhanced by increasing storage of rainwater or capturing runoff to enhance groundwater recharge, using check dams or other simple technologies. Intensive rainwater harvesting may even yield enough water to enable small-scale irrigation (or other productive uses) - see for example the experiences of the MERET programme, documented in Omamo et al. (2010). Another dimension of ensuring year-round supply is to ensure that provision of services includes redundancy or back up options for times of shortage, and/or that technologies are screened for risk of climate-related failure and designs selected accordingly. Various efforts have been made to categorise technology types for water supply in terms of vulnerability to climate variability and change (for example Bartram and Howard 2011), but others caution against generalising about technology types which may fare very differently in different hydrological and hydrogeological conditions, and with different approaches to design and use (e.g. Calow et al. 2011).

4.2 Household water storage and transport assets

In some sites, one dimension of water insecurity was the inability of poorer households to transport and store larger volumes of water. Bulk transport and storage would enable them to travel less frequently to collect water. Support for the purchase of jerry cans, storage containers, donkeys and carts (horse or hand-drawn) could be of value in helping poorer households improve their water access. Provision of donkeys would require consideration of upkeep costs and effect on local grazing, however, while provision of containers should be accompanied by education and support on safe water storage.

4.3 Appropriate regulation and support for self-supply

The dynamics of self-supply also merit further examination, to understand the drivers and risk profile of this trend, especially given its national policy focus.

Self-supply is an emerging policy priority in Ethiopia, because of the potential it holds to expand water access rapidly and at low cost to the government (MoWR 2009; MoWE 2011). Self-supply certainly has the potential to bring many benefits, principally convenient water supply within the homestead or close to it, which is known to be associated with greater use of water for hygiene (see for example: Thompson et al. 2001; Tucker et al. 2013), and greater possibilities of using water for small-scale gardening or other productive activities that will improve food security and income. Self-supply for irrigation was also encountered in some

study sites, and may represent a significant opportunity for farmers to increase yields and buffer the high risks associated with rainfed agriculture. For these reasons, developing appropriate support mechanisms to enable self-supply could strengthen local water security.

Important roles of government which could be put in place include: provision of guidance on technology and design; promotion and support to low-cost quality improvements and/or household water treatment; provision of (or encouraging markets for) parts and technical support; formalizing access arrangements for those without their own wells, including possible provision of incentives for shared supply through subsidy and capitalizing existing cooperative institutions; and monitoring water quality from wells (Sutton 2010). Ethiopian policy provides for some of these in theory, proposing that local government should mandate standards, assess self-supply proposals from households or groups, and provide training and technical assistance on design (MoWE 2011), and the government is developing a Self-Supply Acceleration Programme aimed at putting the policy into practice (Adank et al. 2013). Challenges to be overcome include ensuring both budgetary and political support for local government to invest in the 'software' activities required to support self-supply; currently the main focus of budgets and monitoring/reporting of progress is on infrastructure ('hardware'), creating limited incentive for supporting self-supply (ibid.).

Self-supply also carries risks, both for adopting households and the wider community, and needs to be supported with care to ensure safety, sustainability and equity. The first risk is that of water quality – household wells were reported to be mainly unprotected, yet households repeatedly use them for drinking in spite of a local ban, including in areas where a borehole is available. This again illustrates the primacy given to convenience, and support for low-cost improvements to increase quality is more likely to be more effective than a ban on using them for drinking. However, institutional responsibility for monitoring and ensuring the quality of water from self-supply remains rather unclear.

The second set of risks relate to the balance between self-supply and communal supply, the latter of which relies on user contributions to pay for operations and maintenance and ensure sustainability. If demand for communal supply falls as more and more households engage in self-supply, there is a risk to the sustainability of the communal source and to the water access of those households which remain dependent on it. On the other hand, the presence of alternative sources in the form of household wells may reduce pressure on over-used communal sources, with sustainability benefits. These dynamics, as well as the opportunities for water sharing among neighbours with self-supply as a means of ensuring equity, require further exploration. Interestingly, research in two other *woredas* in SNNPR found that household wells were not developed only by wealthier households - almost 60% of wells were found to belong to the lowest two wealth quintiles - and that water was typically shared with neighbours without charge. These wells were unprotected or at best semi-protected in design, however, and protected wells would have higher costs (Adank et al. 2013).

4.4 Affordability guarantees

In many areas boreholes are, and will be, the only viable improved source of water. However, the rising costs of fuel are rendering borehole water very costly – in some cases at similar prices to water in the UK – and unaffordable for some households. There is a clear need for some means to guarantee that water from improved sources is not priced beyond the means of local households, driving them back to unimproved supplies. The best means to deliver on affordability would need to be developed locally, but possibilities include subsidies for fuel purchase for use in water supply, or purchasing subsidies for the poorest households (either provided to households, or in-kind in the form of free/cheap water for which the water committee is reimbursed). Insistence on full recovery of operating costs at current fuel prices is likely to undermine – indeed in some cases already is undermining – equity of access. Alternative energy sources such as solar power may offer long term prospects for improving affordability. For example, Oxfam report good early results from a trial of solar-powered pumps in Turkana, northern Kenya (McSorley 2012).

4.5 Solutions for severely water-stressed areas

Bisile *kebele* is illustrative of the problems faced in solving the water problem in situations where physical availability is said to be severely constrained. Such extreme scenarios are relatively uncommon, but are serious: mass outmigration is a regular occurrence from Bisile in response to water shortage and the access challenges faced, in particular, by poorer households. There is no easy answer, but places like Bisile risk facing a double difficulty, in that they have few natural/open sources to rely on but are also the places where providing improved water is most costly and difficult, so are seldom prioritised for investment. There may be a case for prioritising water investments – even if costly – in severely affected areas such as this, rather than seeking to provide access for as many people as possible for the available budget, when this may mean serving people who already have fairly reliable (albeit unimproved) access to water. Any technical solution to serve an area like Bisile is likely to be costly, whether a deep borehole drilled in challenging terrain, a pipeline from a neighbouring area or the provision of tankers.

Intermediate solutions may, however, exist in the form of maximising rainwater harvesting and storage in the wet season, and having adequate back-up supplies available (e.g. from tankering) to bridge the gap in a dry year. However, given the frequency of rain failure this may not be a viable long-term option.

4.6 Emergency water provision

In all areas facing high vulnerability to drought, the timeliness of emergency water provision when existing supplies fail is critical to protect livelihoods, especially to prevent livestock losses and protect food security in pastoral areas (livestock condition and milk production are affected much more quickly than crops by water shortage). The study suggests that provision is not always received early enough, a finding borne out by other research and evaluations of emergency responses in Ethiopia. The current early warning system does include assessment of water shortage, but it has been argued that the timing and methodology of assessments could be strengthened. Better sharing of information between the WASH and food security sectors would be a valuable first step, enabling early identification of communities particularly vulnerable to water shortage or source failures at times of drought (for more discussion see Tucker and Yirgu 2011). National WASH Inventory data on scheme functionality rates would be one useful input, although it is important to note that drying of *unimproved* sources is also an important indicator of vulnerability, especially in pastoral areas.

4.7 Support for water (transport) markets

Many of the gaps identified above presuppose that government (or NGO) investment in infrastructure is the way to bring improved, reliable water supply to areas where it is lacking. This remains essential, but alternatives may also be possible in the form of supporting local markets for water (e.g. providing incentives for, and regulating, vending to areas facing water shortage) and water transport (e.g. support to entrepreneurs to sell or hire donkeys, carts or water containers, or direct hire of these by government offices). The viability of such markets, and possible mechanisms to ensure affordability would require further exploration. There is also a risk, however, that if government steps in to support and regulate local vending and rental arrangements where these already exist, providers become burdened with bureaucracy.

4.8 Holistic, livelihood-based support and multiple use services

Implicit in several of the gaps outlined above is another, namely that water services are not always being delivered in ways which respond to people's real livelihood priorities. People piece together their water security – to the extent that they can be said to have achieved this – by combining different sources, at different times, for a range of domestic and productive purposes which also vary in time and space. This creates a challenge for planners (who are often accustomed to a clear divide between domestic/WASH provision, irrigation and livestock provision for example) but also an opportunity to create highly beneficial synergies. Providing services in more integrated, livelihood-based ways (for example through multiple use water services (MUS)) may require a shift in current top-down planning processes and the empowering and capacity development of local government offices to identify local needs and respond strategically.

Going beyond delivery of water services, it is also clear that the top priority of most households when it comes to water is reducing their vulnerability to variation in rainfall. This could include a wide variety of strategies such as: promoting soil and water conservation techniques and alternative crops/fodder species through the extension system (though these have their limits, as seen in Konso, and incentives and sustainability need to be given thorough consideration); development of new water sources/infrastructure for irrigation, including potentially irrigated fodder, where water is available; and supporting alternative non-agricultural livelihoods (a huge and complex task, but involving investment in other essential infrastructure, particularly roads, and in education).

5 Conclusions

The findings of this study further our understanding of local water security in Ethiopia and related environments in several important ways.

First, it is impossible to reduce water security to a single diagnostic, or to a volumetric standard of water use. Water security encompasses use of water from multiple sources with different quality, reliability and access rights profiles, for multiple purposes, all of which vary in time and space, according to wider livelihood priorities and pressures. Water security must be understood in relation to livelihoods and the wider human security context in often 'hard' rural development environments. The achievement of water security in terms of access to quantities necessary for survival and basic domestic use is, in these communities, inextricably linked to the role of social relations in binding households and communities together. This creates challenges in relation to developing standardised water security measures, which is of concern to those interested in target-setting and monitoring progress. A recent review of water security metrics highlights some of these difficulties and argues that any measure must go beyond physical availability and include a human focus (Mason and Calow 2012). The findings of this study support this assessment, while also revealing the likely limitations of any standardised measures and the need for these to be complemented with locally-grounded analysis.

Access cannot be defined one-dimensionally, and having an improved source within a certain distance does not translate into routine use of water from that source to the exclusion of others. Assumptions about coverage levels provided by improved sources are shown to be gross oversimplifications, with households choosing to use a wide variety of sources and not necessarily having reliable, safe or convenient access to improved sources even when present in the *kebele*. Nor, indeed, do people necessarily prefer to use improved sources when these are available. Convenience is consistently prioritised over using a more distant improved source, while local perceptions of water quality do not necessarily correspond with the level of protection of the source. The local 'mental map' of choice between sources is complex, constantly evolving and part of a range of calculations about costs (and opportunity costs), the distance-time continuum and perceptions (and knowledge of) specific risks and rights. A simple continuum from water security to insecurity defined in terms of physical availability and provision of infrastructure for improved services probably does not exist, although these are of course important determinants of water (in)security.

Access is constrained in various ways, in both normal and drought conditions. Particular 'pinch points' arise when water collection times are extended in the dry season, conflicting with peak labour demands in agriculture for activities critical to future food security. In more extreme drought conditions, the opportunity costs of water collection may in fact be lower, if lack of rain prohibits agricultural production. This suggests that easy assumptions about drought impacts and responses should be avoided; they are not necessarily an intensification of normal dry season coping strategies, but are a step change for the worse. That said, the distinction between 'normal' and 'drought' years is itself a gross generalisation given huge levels of variability (and differences in felt impact and perceptions within a community) and the increasingly chronic nature of drought and food insecurity. More important than classifying years into 'drought' and 'non-drought' is to understand critical vulnerabilities (times of year, water sources, populations most at risk and thresholds such as livestock survival periods following rain failure), monitoring these and being ready to respond appropriately.

The better-off tend to have better water access under normal conditions and are more able to cope under shortage. This may be through mobilising a range of assets which poor households may not be able to obtain, in order to create a wider range of access choices and reduce the time and drudgery involved in water collection (e.g. donkeys and water storage containers, tin roofs for rainwater harvesting, labour to collect water for *chaka* production in Konso, and financial capital to pay water user fees and/or invest in self-supply). Water storage and transport assets repeatedly emerge as important, suggesting that those investing in water

infrastructure should perhaps look beyond the water point to jerrycans, storage containers, carts or even donkeys as intervention areas with very significant potential to increase access capacity within communities and households. Affordability of water from motorised sources must also be tackled.

A range of local institutions enable people to bridge the access gap. Water security under conditions of limited or uncertain access (as in much of rural sub-Saharan Africa) appears to be socially contextual; 'security' may depend upon access to social and political capital as much as material wealth. (This echoes findings from low-income urban communities, where water sharing among neighbours and water markets are commonplace.) These local institutions include markets (for labour and in some cases water) and a wide range of cooperative and reciprocal arrangements. Some of these have their roots in long traditions of cooperative agricultural labour, and some strict systems exist for preventing free-riding. It may be possible to support and build on these existing coping systems, although formalisation always carries the risk of removing flexibility and undermining delicate social networks. Further exploration of these networks, including probing questions about local political economies, equity and social inclusion, is suggested.

These social institutions have their limits, however. Where availability and access are most severely constrained (as in Bisile in the dry season), such arrangements are not sufficient to provide water security and livelihoods simply become non-viable for many (poorer) members of the community, forcing them to migrate.

Water-related pressures and responses are highly gendered, and this study revealed that this extends not only to the demands placed on women by water collection, but also to domestic disputes and unequal divisions of labour within the household. The findings also challenge some often-held assumptions about division of labour, with women playing a vital role in agricultural work in Konso, and men in Shinile taking responsibility for water collection under situations of extreme shortage or very long journeys for collection.

Finally, rainfall is centre stage in perceptions of water insecurity. Livelihoods are almost entirely rain-dependent (with the exception of a relatively small number of households engaged in irrigation) and the impact of rainfall variability for the most part dwarfs that of poor access to water supply. The two are inextricably connected; rain failure drives migration, for example, which affects patterns of water source use, while development of available water sources (where these exist) for irrigation or other activities can buffer rainfall variability and provide more livelihood options, if the right support and capacity are in place to exploit this advantage. This argues for a broader understanding of water security, in which not only access and supply, but the rainfall-dependence of livelihoods and vulnerability to water-related shocks and stresses, are given focus. This demands sound understanding of local livelihoods, and greater integration of strategies aimed at enhancing water access, food security and rural development.

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‘I cannot transport water on my own. However, I can rely on others who have donkeys.’

‘We lose two days of farm work for travelling and collecting water.’

‘I fear travelling at night. Yet, it is such a problem that I compose myself and go out to collect water.’

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