Drought and community water supplies

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In many countries drought management focuses almost exclusively on the question of food – despite growing evidence that access to secure water can also be a major problem. Drought can be planned for in rural water supply projects – especially by developing an understanding of the relationship between water availability, access and use.

The development of groundwater for community water supplies has underpinned efforts to reduce poverty and promote sustainable livelihoods in many poor countries. One of the key advantages of groundwater is its reliability: when surface rivers and streams have dried up, groundwater can still be accessed through wells, springs and boreholes. However this ability to buffer drought has limits. In certain areas, and under some conditions, groundwater sources can fail, and the search for water becomes long and arduous.

Water resources and supplies will come under increasing pressure as climate change takes its toll. Historically, approximately 20% of the land surface of the earth was under drought conditions at any one time. Now, this total has risen to 28% and is set to rise to 35% by 2020. Areas affected by the severest droughts have risen from 1% to 3% in the past 10 years; models predict that this trend will continue until 8% of the land surface will be in severe drought at any time.[1]

Responses of water sources during drought

During a prolonged dry season or drought, surface water, shallow wells and small spring sources often fail, leaving only water points which tap larger bodies of groundwater. Therefore it is often the larger springs, deep wells or boreholes that are reliable across seasons, and in drought years. However, even these larger sources can fail in drought conditions. There may be several reasons for this (see Figure 1):

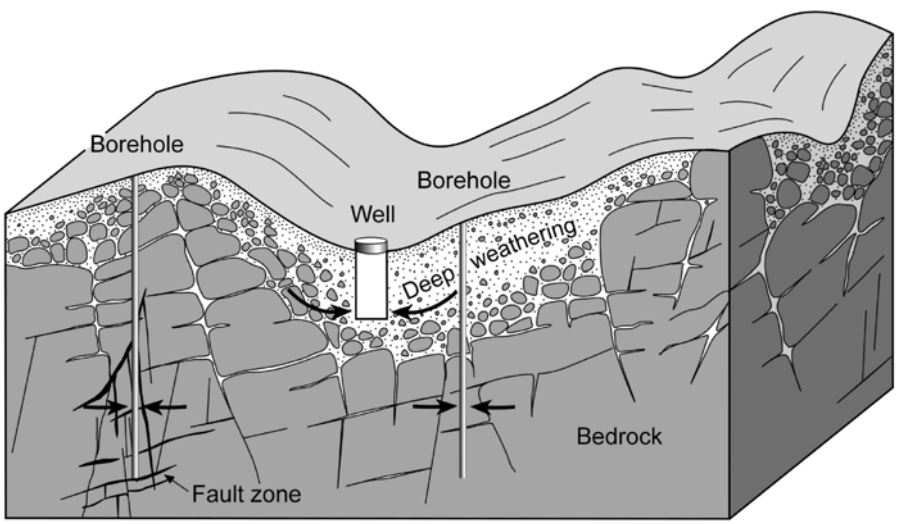


Figure 1. Groundwater sources may fail during drought if they tap only shallow groundwater, or if there is such high demand on an individual source that the pump fails, or the groundwater is locally depleted. The well shown will only be sustainable during extended drought if the weathered zone is sufficiently permeable and thick.

Increased demand on individual sources as other sources run dry. Prolonged pumping throughout the day can put considerable strain on the pump mechanism leading to breakdowns, especially if water levels are falling and pumping lifts increasing. The result may be increased demand on a neighbouring source, and thus increased stress (and probability of failure) on that source as well. The problem may be exacerbated by the cessation of maintenance activities as relief drilling programmes take priority.

Localized depletion results in falling groundwater levels in the immediate vicinity of a well or borehole, or group of sources. This is most likely to occur where the demands being placed on a groundwater source are high, and where the permeability of the aquifer is low.

Regional and widespread depletion of an aquifer is rarely a problem in rural Africa, as abstraction from individual sources is low (10–15 m^3/day), and sources are sufficiently few in number. However, as long-term rainfall continues to decline in many areas, and demand for groundwater increases, regional depletion may become a reality.

A wider view: water security

Water security is a broader issue, and is affected by people's ability to find and use water for different livelihood activities. A useful interdisciplinary framework for analysing the determinants of water security was developed by the authors and applied to the area of South Wollo in Ethiopia. This framework highlighted three main factors, an understanding of which can

During drought, as other sources dry up, long queues may develop at sources that are still working.

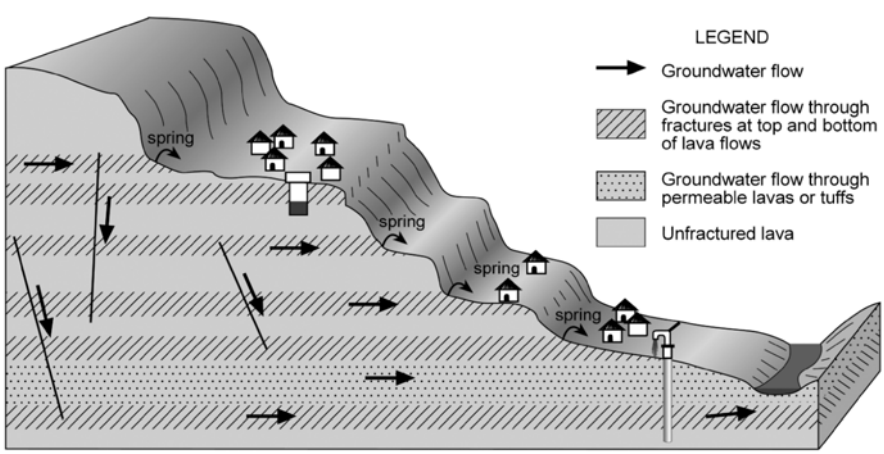
help people develop policies and projects that are more drought resistant.

1. *The absolute availability and quality of water resources*, for example the presence of large aquifers, or perennial springs and rivers, of acceptable (for the intended purpose) quality. High availability can still be associated with water insecurity if quality is poor, or if access to the resource is constrained (see below).
2. *The ability of households to access this water* through springs, boreholes and wells. In a broad sense, this is influenced by (related) technical and socio-economic factors: (a) technical factors such as coverage and the state of repair of infrastructure; and (b) the rights and abilities of individuals, households and communities to reach a source, withdraw water and transport it. For example, payment may be required, or a working source may take many hours to reach in difficult conditions.
3. *Patterns of water use and demand*. Particularly the returns to different livelihood activities through increased access to water at a household level. For example, livelihoods may be affected by the ability to water livestock or use water in household production activities, as well as the ability to meet domestic needs.

Applying this interdisciplinary approach to Ethiopia revealed much about the nature of water security in communities, and how people cope (see Figure 2). One of the key messages is that drought is an extension and intensification of seasonal water shortages in most communities, rather than an event with its own pattern of shortage. It is, in effect, an acute version of the chronic water insecurity felt by households during dry season periods. Indicators of water *insecurity* include longer time taken to collect water (due to reduced yield combined with increased demand), the use of poorer quality sources (due to the failure of 'good' sources or the time needed to reach them), and reduced consumption of water within the household. Water insecurity can have a serious impact on the livelihoods of households, and may be a contributing factor to food insecurity.

Preparing for drought

Drought can, and should, be planned for within 'normal' development activities. There are ways of identifying vulnerable areas or groups without sophisticated early warning systems. In Figure 2, for example, in Kolla and Weyna Dega areas, increasing the number of boreholes may be the best way to protect against drought, and to ensure that the sources are in good working order when drought occurs. However, in Dega areas, the absolute resource is significantly reduced in times of drought, so additional sources may not help (although some deeper boreholes or wells may be more sustain-



	Dega (mountain)	Weyna Dega (intermontane)	Kolla (plain)
Availability	Small resource base but high recharge	Moderate resource base but less recharge than Dega. More surface water (fed by groundwater)	Large resource base but low rainfall. Fewer surface sources (all groundwater fed)
Access	High: multiple access through springs	Moderate: multiple access through springs, wells and boreholes (often widely spaced)	Low: few boreholes, no springs
Demand	Low: mainly household consumption	High demand from people and livestock (most populated)	Human population less dense, but greater demand from livestock

Figure 2. An analysis of water security in the highlands of Ethiopia. The framework was developed in 2001 by BGS, ODI and the Amhara Regional Water Bureau[3]

Planning for drought can ensure that, when drought strikes, water is still secure.

able). Therefore care must be taken not to introduce activities that depend heavily on large reliable quantities of groundwater. With an understanding of which are the vulnerable areas, simple measures can be taken to help drought-proof water supplies.

Water-security mapping. Mapping of water availability, access and demand/use can be a powerful tool for informing decisions and preparing for drought. For example, maps can be used to highlight vulnerable areas, and to help target drought-proofing measures. At this scale maps are more useful for generating discussions at a national level – focusing minds on water issues. Regional or district mapping provides a much more powerful tool for identifying insecure areas and targeting development or relief measures.

Early warning systems – moving beyond just food security. Since the 1980s, there has been a huge increase in the number and quality of early warning information systems in Africa. However, while second-generation systems have moved towards multi-indicator approaches, including demand-side as well as supply-side variables, their remit is still narrowly food focused. By widening the scope of existing local-level assessments to include simple indicators of water security, a clearer picture of livelihood security, and of the interventions needed to support it, could be gained at little extra cost.

This information could help generate more flexible and more appropriate responses for drought interventions. For example, in order to protect the livelihood assets of households in the early stages of drought, or rebuilding them in the aftermath of a bad year, improving access to water may be vital. This could be achieved through targeted, timely water supply interventions including: water point rehabilitation and repairs, well deepening, and help with water transport.

Improving selection, design and siting of water points. Much can be done to improve the selection process through which water supply choices are made. In particular, the knowledge base that influences the particular 'menu' of service options offered to communities needs to be strengthened, so that the likely effects of drought on the availability of water, and on access to and use of water at times of peak demand, is factored into decisions. Here are some simple measures:

1. Ensuring that wells or boreholes are located in the most productive parts of the aquifer. Modest investment in resource assessment and siting techniques can pay dividends in terms of higher drilling success rates and higher yielding, more reliable, sources.[2]
2. Constructing sufficient sources in a village to meet peak demand. In the longer term, this is more cost-effective than attempting to develop extra capacity when additional water is required.
3. Sinking deep relief boreholes in the most favourable hydrogeological locations – perhaps away from villages – which can be uncapped and used in emergency situations.

By understanding and mapping patterns of water security, we can go some way towards predicting the effect that drought may have on livelihoods. In drought-prone areas, community water supplies must be developed to withstand drought. If not, when a severe drought comes, experience indicates that the response is often expensive and late.

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