Simplest is not always best - physical and climatic constraints to community water supply in Zimbabwe

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All photos have been taken by **Patrick Moriarty**.

This article gives a brief overview of findings from nearly ten years of interdisciplinary research in south-eastern Zimbabwe. It outlines some of the major findings, and their relevance in terms of water resource development, rural livelihoods, and environmental sustainability.

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An uncertain climate, rapid population growth, and equally rapid social and economic change are putting rural livelihoods in semi-arid regions under great strain. In many areas people are responding to this strain by intensifying their farming systems; moving from extensive to intensive forms of production, often relying on increased water use.

The focus for the study is the Romwe catchment, a small headwater catchment of the Runde river in south-eastern Zimbabwe, it has an area of approximately 4.5 sq km, and roughly 250 inhabitants. It is an area of hard rock (crystalline basement) geology, where shallow soils overlie fractured metamorphic rock. It is a famously difficult landscape in which to develop water resources, yet people are increasingly turning to groundwater in an effort to wrest more productive potential from their land. Like many of the more agriculturally marginal regions of Zimbabwe, it was settled relatively recently – mainly since 1953, and has since then experienced rapid population growth. Livelihoods are centred around, but not limited to, small-scale rainfed agriculture.

The Romwe catchment was the focus of the new pilot project

In 1991 the catchment community became involved in a pilot project to test a new type of water supply project, based around the provision of a mixed use water source; that is, a source that gives water for both domestic and productive use, in the form of a 0.4 hectare fenced vegetable garden with plots for 50 people. The results were startling and unexpected. The garden, originally seen as adding a 'food security' component to a water and sanitation project was a great success. It provided a steady stream of income from sales to all those involved; an income stream that was used among other things for the O&M costs of the well itself. The new design and careful siting of the well meant that it continued to provide water as surrounding areas went dry during the devastating drought of 1991/92.

The initial success of the well, coupled with worries at the time regarding its hydrological sustainability against a background of widespread groundwater drought led to a research programme to look at the land management practices of the community, and their effect on groundwater. Ten years later and much widened in its scope the project continues, now under the leadership of the University of Zimbabwe's Institute of Environmental Studies[1] (http://www.uz.ac.zw/ies/mcm/).

The long term nature of the study has allowed a number important insights to be developed into the highly complex web or relationships between physical and human aspects of the semi-arid environment. A short article such as this can only outline in the broadest sense some of the more important findings of such a long process – those interested in further detail are urged to contact either of the authors.

Flood irrigation methods were used in collector well gardens

Key findings

Findings are grouped under three main headings relating to livelihoods, the geology of the area (crucial to deciding how water resources are developed) and climate, primarily rainfall and its variability.

Livelihoods

Livelihoods in the study area are centred around mixed farming, based on rainfed cropping and raising cattle. Since the area was initially settled the population has doubled. During this time livelihoods have not remained static; new crops have been introduced, particularly cash crops such as cotton, while traditional small grains have almost ceased to be used. The main crop continues to be hybrid maize which is grown primarily for consumption. Perhaps the most striking change in livelihoods has been the rapid development since the early 1970s of hand dug wells. Between 1950 and 1970 two or three wells sufficed to provide drinking water for the whole community. By the late 1990s there were over fifty wells, the majority of which were used for irrigating vegetable plots.

'Young people in particular suffer from low and insecure access to land (relying on the goodwill of older relatives), linked to greatly expanded expectations due to their higher level of education'.

Using a number of participatory tools to explore the reasons for this rapid change it became clear that it was driven by a mixture of causes, prime among which was the lack of land for rainfed farming, and hence a need to intensify farming activities. A further important driver to change is the degree to which the community is now part of a wider cash economy; in the 1950s it was still possible to get most of life's necessities through bartering, now people must find cash for school fees, travel, health care and so on.

Geology

Key to the success of developing groundwater for production is the nature of the crystalline basement itself. The shallow soils (where most water storage takes place) with differing storage potential, and heavily deformed, underlying bedrock mean that water resources are not spread evenly across the landscape, but rather exist in pockets and sumps of deeper weathering, as well as within fracture zones in the rock. The water table reacts quickly to both recharge and abstraction with the result that a well or borehole developed just after the wet season, or during a wet period when water tables are generally higher, often fail due to natural water table recession.

Rainfall

Much is made of the 'unpredictable' and 'extreme' nature of rainfall (often with a subtext of global warming and impending crisis) of the region. The reality is that this is only extreme relative to the 'regularity' of weather in temperate zones. Climate in southern Africa has been irregular for millennia – and neither the droughts of the early 1990s or the inundations seen today, are in any way out of the ordinary when viewed in their historical context. The work at the Romwe catchment suggests the need for a change in emphasis on understanding variability. It is not the year to year variability, but the cumulative effect that is important. Southern African rainfall has been observed to follow a pattern of above and below average rainfall (on a roughly 18 year cycle) – this doesn't mean that it is always dry in a dry part of the cycle, just that it is more likely to be so than during a wet cycle. The environment acts as a buffer to the inter-annual variability: in a wet period water tables are high, there's lots of browse for livestock and so on, in a dry period water tables fall, browse dies or is eaten. The result is that while a single low rainfall year in a wet period can be coped with, when an extended period of generally below average rainfall is capped by a total drought (as happened in 1991/92), the results are catastrophic.

Policy implications

The findings have a number of important implications for addressing water supply projects in semi-arid hard rock areas. Some of these are briefly discussed below.

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Support for a livelihoods based approach

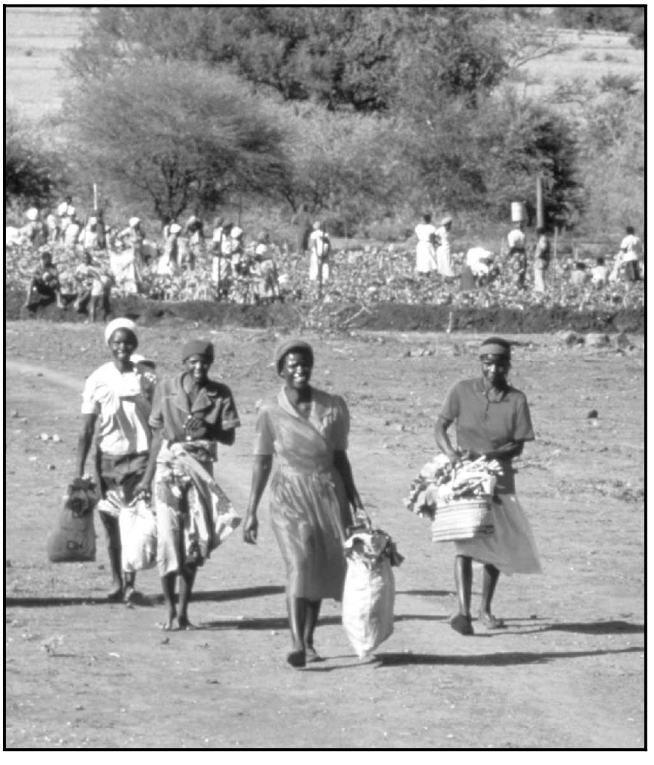
The pilot productive water point was not implemented based on an analysis of livelihoods: this came later. However, what seems clear is that the success of the project (nine years on and still functioning well without outside intervention) is due to its having met a clear need of the community. The pilot scheme was a success because it responded to this need and in addition overcame a number of technical difficulties associated with family wells.

Dangers of over reliance on privateor family wells

Due to the nature of the hard-rock geology groundwater is not distributed evenly. Poorly sited wells can and do fail as the water table recedes during the dry season, or extended periods of low recharge. Family well programmes, popular because they are seen as being cheap and 'appropriate' do not always take this problem into account, partly because there is a widely held (but wrong) perception that given the ability to continuously deepen a well water will always be found. Hand-dug wells in inappropriate geological settings run the very real risk of building dependency during wetter periods, only to fail when most needed during droughts.

This is not to say that family well programmes are always inappropriate - they answer a real need. However they should be seen as an addition to, not a replacement for, properly sited, highly reliable community water points.

During the drought of 1991-2 the Rowne collector well gardens proved vital



Potential problems with small dams

The cyclical nature of rainfall in much of southern Africa means that small dams are also highly prone to failure. Their limited depth (and high evaporation rates) means that few are capable of storing more than one to two years supply, and are reliant on being filled every year. However, as experience in the 1990s in Zimbabwe showed this is not the case - dams end up failing just when they are most needed.

Carefully sited communal groundwater points are the best solution

Because the productive water point is carefully sited in the zone of maximum depth of weathering, and hence maximum water availability, it will last longer than poorly sited family wells or boreholes. Only this careful siting brings with it the guarantee of adequate water during the years of gradual water table decline in dry parts of the rainfall cycle.

Mixed use of water must be addressed

What then are the key lessons of the Romwe catchment study? One is that, to come up with sustainable and appropriate development projects, it is necessary to look not just at expressed needs or wish lists, but rather at whole livelihood systems, to see how they work within environmental and climatic systems, and to identify key points at which interventions may take place.

Another lesson is that with the rapid integration of ground water as a cornerstone of peoples, farming livelihoods the degree of exposure to water point failure during times of low rainfall and drought becomes ever greater. Given the rapid increase in use of water for productive purposes, during the current wet spell in southern Africa, this suggests potentially serious problems come the next drier period. The only uncertainty about the next drought is its precise date – that it will come is inevitable.

A more general lesson is that successful development projects are ones that can step outside sectoral or disciplinary boundaries, or take a holistic view not only of existing livelihood strategies, but also of historical and future trends against a background of great uncertainty. Rural communities and their livelihoods are not static. They are part of a wider society, reflecting its trends, and driven by powerful internal dynamics of change and growth.

The Romwe catchment study is participatory, 'off-station', and

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multidisciplinary. However, it remains a research project, based around a case study. For its findings to have a wider impact it is necessary that they are picked up and internalised by the wider 'development community'. Not all the lessons are palatable. Family well programmes are popular, and seen as an exciting alternative to the problems of community management of larger water points; small dams are politically popular as highly visible indicators of 'development'. However the lessons of the research are unequivocal. Costly, boring, difficult to manage communal wells and boreholes continue to be the most cost effective and reliable means of supplying both domestic and productive needs. They are, and should, continue to be the backbone of rural water supply schemes.

Coming up in the January 2001 issue...

It has become apparent that shortage of water supply, conflict over the use of water and flooding are are just a few factors resulting in the displacement of people. How do people cope with their water needs once displaced? It is vital to prevent the negative social and health costs of displacement by providing solutions to this ever-increasing situation. The next issue of Waterlines addresses water and sanitation in emergencies, offering analysis of the situation and innovative solutions.