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81a. FRAGMENTS AND SENTIMENTS: WHY IS 'THE COMMUNITY' THE FOCUS OF DEVELOPMENT?

Roger Blench

81b. GROUNDWATER RESOURCE DEVELOPMENT IN THE CONTEXT OF FARMING SYSTEMS INTENSIFICATION AND CHANGING RAINFALL REGIMES: A CASE STUDY FROM SOUTH EAST ZIMBABWE

P.B. Moriarty and C.J. Lovell

edited by Roger Blench

The two papers in this volume (together with those in the accompanying Network paper 81) were originally presented at a conference held at ODI in June 1997. The objective of the conference – which was entitled 'Ghana and Zimbabwe: options for change' – was to bring together and discuss various of the studies of aspects of rural livelihoods which are currently in progress in these countries. The papers dealing with Ghana will be published in book format in 1998.

At the conference a particular emphasis was placed on semi-arid areas; in Zimbabwe many of these are only now beginning to recover from the prolonged drought of the early 1990s. Paper 81a takes on a conceptual point in the debate over community-based development. It reviews the definition of community and the often unexamined assumption that such a 'community' must be the focus for social action. The argument is illustrated with material from field research in the Rwenya basin in north east Zimbabwe. Paper 81b describes an approach to water-point development in Zimbabwe, arguing for the need to develop both community and individual access points to patchy water resources.

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Acronyms

AGRITEX	Agricultural Technical and Extension Services Department
BUN-Zimbabwe	Biomass Users' Network - Zimbabwe
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
CEO	Chief Executive Officer
CSO	Central Statistical Office
DDF	District Development Fund
GIS	geographical information system
GMB	Grain Marketing Board
IRWSS	Integrated Rural Water Supply and Sanitation
ITDG	Intermediate Technology Development Group
MRDC	Mudzi Rural District Council
NGO	non-governmental organisation
NRDC	Nyanga Rural District Council
PRA	participatory rural appraisal
RDC	Rural District Council
RWMA	Rwenya Wildlife Management Area
UDI	Unilateral Declaration of Independence
VIDCO	Village Development Council
WADCO	Ward Development Council

GROUNDWATER RESOURCE DEVELOPMENT IN THE CONTEXT OF FARMING SYSTEMS INTENSIFICATION AND CHANGING RAINFALL REGIMES: A CASE STUDY FROM SOUTH EAST ZIMBABWE

P.B. Moriarty and C.J. Lovell

1 INTRODUCTION

The Romwe catchment in south east Zimbabwe is a small (4.5km²) headwater catchment located in an area of crystalline basement geology typified by shallow soils, rocky outcrops and shallow, low potential groundwater aquifers. It lies at an altitude of 760 m and has a long-term average annual rainfall of about between 600 and 700 mm. In socio-economic terms it is representative of Zimbabwe's communal lands, which are typified by small-scale subsistence farming supported by income remitted by family members working away from home.

In 1991 an initial collector well and a 0.4 ha irrigated vegetable garden was established to serve 103 local families. Since then a multidisciplinary study, the 'Romwe Catchment Study', has been underway to investigate the scheme's physical and institutional sustainability, as well as its effects on farming systems and livelihood strategies in the surrounding area (Lovell *et al*, 1995; Butterworth *et al*, 1995; Waughray *et al*, 1997). The study is working with local residents to monitor both the physical environment of the catchment and the human environment in a wider area, centred on the catchment. Day to day monitoring of the physical environment is carried out by a resident researcher assisted by local people who have been trained to carry out a variety of technical jobs such as monitoring groundwater levels, surface runoff and soil moisture as well as basic data entry and quality control. The employment and training of local people, rather than 'outsiders', as technicians has been a major factor in the projects success.

Villages are the smallest legislative land division recognised in Zimbabwe. They form the basis for all resource allocation in communal areas. Typically they consist of a number of *kraals* which are loose associations of families under the leadership of a *sabhuku*; they are the fundamental unit of the traditional hierarchy. The water resource survey reported in this paper was carried out in Village D of Ward 23, Chivi district. Village D consists of six kraals, two of which have land inside the Romwe catchment.

The main aims of the water resource survey were: to obtain baseline data on the extent of current water resource development in the area; to identify the main factors influencing the development of water resources, and their use for productive purposes; and to take a first step towards developing community based management structures for the area's water resources. While the survey was concerned with all water resources, the presence of a single dam for the entire village meant that the principal focus was on groundwater.

Village mapping

Village mapping is widely accepted as an efficient and time-conserving method for establishing a rapport with communities and eliciting reliable data. It has been used extensively in watershed management programmes in India and elsewhere (Shah, 1993; Chambers, 1994) but to date it has been employed only to a limited extent in Zimbabwe (a simplified form is used in some Integrated Rural Water Supply and Sanitation (IRWSS) projects). The present mapping exercise is a first step in a programme investigating the potential for and practicalities of implementing communal water resource management systems in semi-arid areas.

Methodology

The mapping work in Village D was carried out over a one month period at the end of the 1996/97 rainy season. The exercise took a 'long morning' at each kraal, and was carried out by a four-person facilitation team, consisting of the first author, the local agricultural extension worker (male) and the ward community worker (female) (both of whom are government employees) and a local Romwe project employee who acted as interpreter. A week before the start of the mapping exercise an explanatory meeting was held with the *sabhukus* of the six kraals, during which the purpose of the mapping exercise was explained and dates for visits to each kraal were agreed. The *sabhukus* were asked to convene as many people as possible on the given day, and in particular to ensure a good turnout of women and youth.

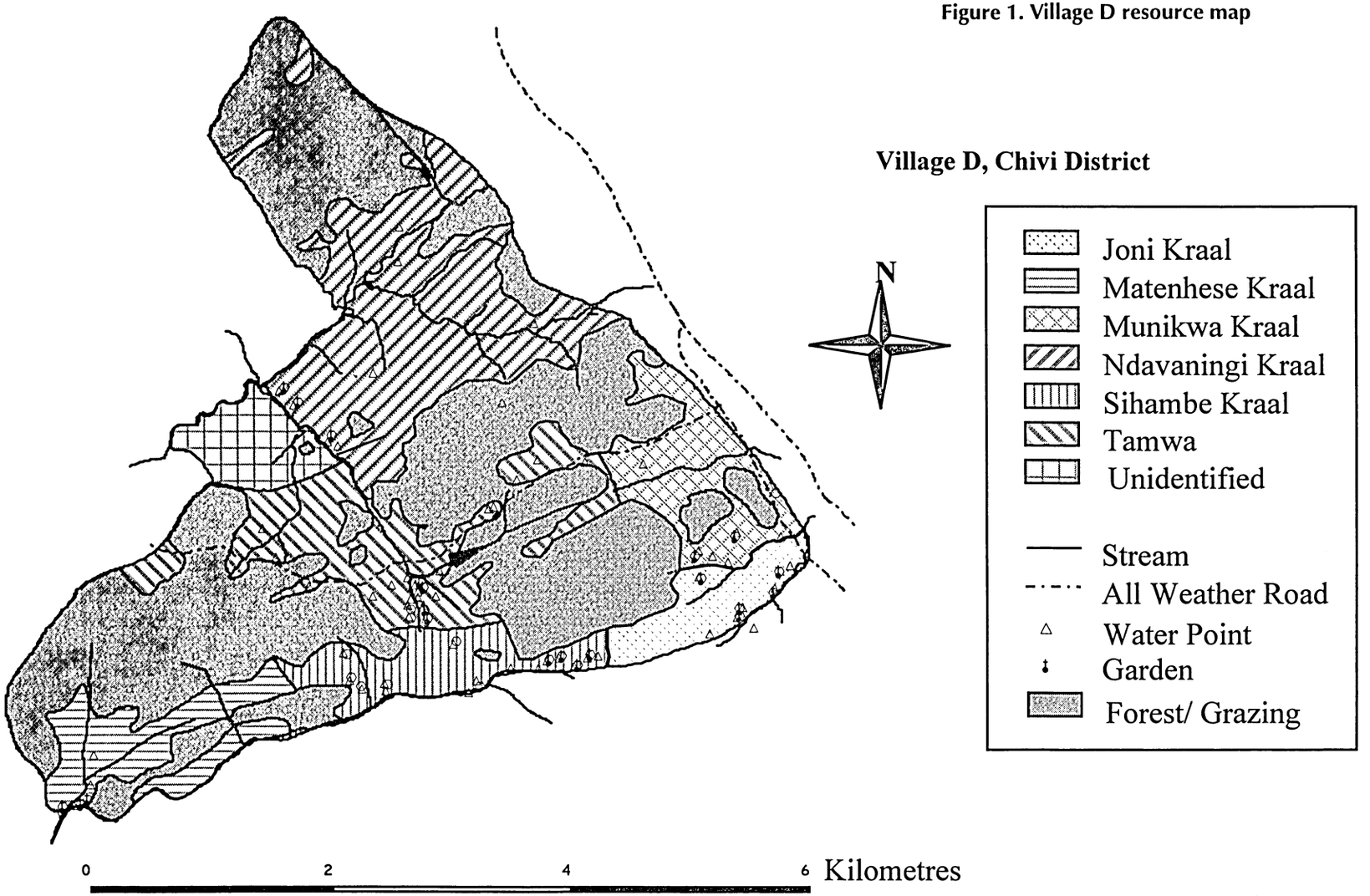
The mapping was done by separate men's and women's groups to help ensure that no one felt intimidated in any way when airing their views. The

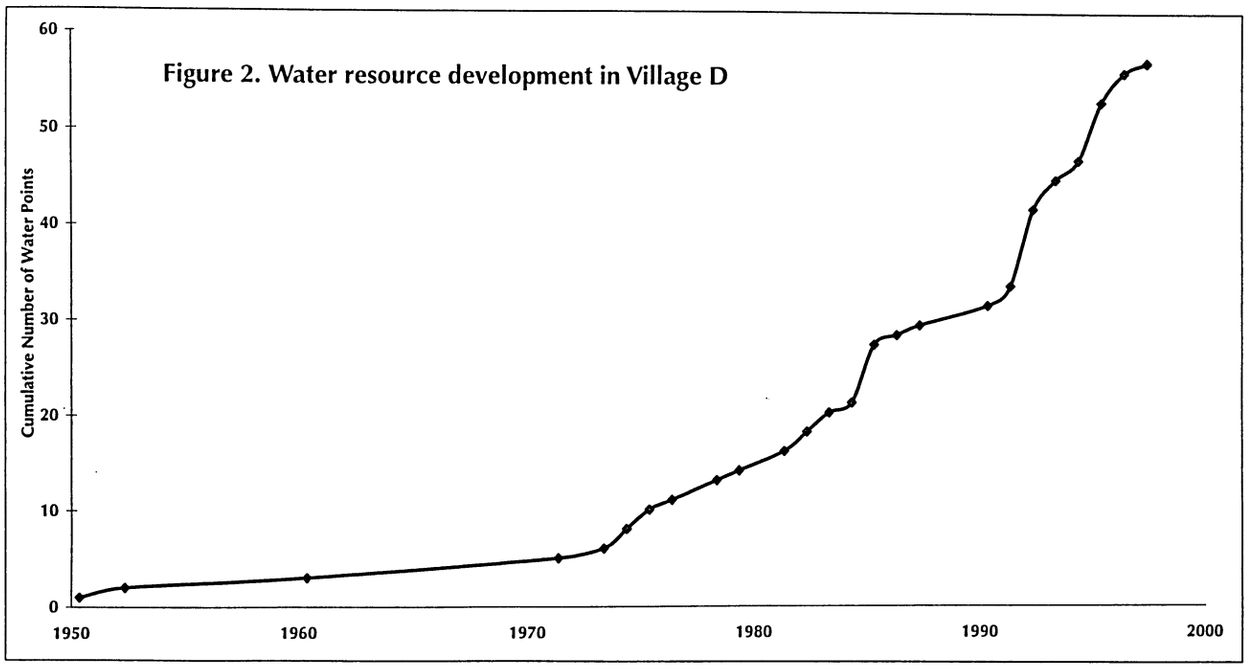
Acknowledgements

This paper presents results from a participatory resource inventory, carried out through village mapping, in Chivi District, Zimbabwe. The survey results are analysed with particular reference to other recent findings on the 'patchy' nature of basement aquifers in Zimbabwe and the cyclical nature of regional rainfall. From the results, policy implications are drawn for management of groundwater resources in communal areas of Zimbabwe.

The authors would like to thank: Mr A. Mahlekete, Agritex extension worker for Ward 23; Mrs Mandebhvu, WCW for Ward 23; and Mr C. Mhlanga, Romwe project, as well as the village D community without whose help this work could not have been completed. The research is part funded by the UK Department for International Development, through the British Development Division in Central Africa, Harare. The first author's work is partly financed by a NERC CASE studentship, No. GT25/96/3/C.

Figure 1. Village D resource map





maps were drawn on paper (two A3 sheets taped together) using felt-tip pens, as previous experiences had indicated that people were happier using this method than mapping using natural materials. Each group was asked to draw a map of their kraal, showing arable and grazing/forestry areas, streams, roads, houses (with number of occupants) and water points, with any associated vegetable gardens. Data was then entered into a geographical information system (GIS) database for analysis. Each water point identified on the map was given a unique number, and had a 'water-point data sheet' drawn up for it that included date of construction, number of users, depth, principle uses of water, and so on. For further details of the mapping exercise see Moriarty (1997).

2 RESULTS

Figure 1 shows the map of Village D developed within the GIS by cross-referencing between the village maps and existing topographic maps of the area. The map shows the division between arable and grazing areas, as well as the boundaries between the six kraals within the grazing areas. In addition to major features such as streams and roads it also shows the positions of all reported water points and gardens. Individual homesteads are not indicated as there were too many (216) to be shown clearly. Houses are typically located along the interface between arable and grazing/forestry land at the base of hill-slopes.

Principal reported uses of water were: domestic (washing and drinking); irrigation (vegetable gardening); livestock watering; and brick making. Interestingly no mention was made of beer brewing, although beer is often reported in the literature as being used to pay for traditional work parties that help with jobs on individually owned land.

Historical development of water points

Of significance for water resource management in this area is the rapid increase in the rate of water point development, shown in Figure 2. Until the 1970s, there was little development of the groundwater resource, and most water requirements were satisfied by access to streams and springs (Price, 1993). Since then, there has been a sharp increase in the number of water points developed, and there is no indication that the rate of development will fall in the near future.

Access to land

Data collected at a broader range of water point projects throughout Masvingo Province indicates a strong correlation between age and access to land. Older people have significantly larger farms and younger people particularly feel the squeeze as land becomes short. Table 1 shows the age-classes of household heads against family size and landholding.

Table 1. Access to farming land by age group

Age Group	<30	30–60	>60
No. in Family	4.8	15.6	19.5
Land (ha)	1.3	3.0	3.9

The current population of the study area derived from the village maps is 1553, giving an average density of 71 persons per square kilometre. Since five of the six kraals have only been settled here since the 1950s, this suggests a very rapid increase in population (which is common to most of Zimbabwe's communal lands). It is suggested that rising demand for water is driven by intensification of the farming system as households attempt to maintain production from decreasing land holdings. This hypothesis is supported by the fact that the two kraals with the greatest access to land per

individual also have the lowest rate of water point development (see figure 3 below).

Figure 3 illustrates inter-kraal differences in access to land, water and gardens. The two kraals with the greatest access to arable land also have the lowest rate of water point development. In other words, households are compelled to intensify agricultural production when land is short. The Tamwa and Sihambe kraals, which share access to the Romwe collector well garden, have access to greater volumes of water and are thus under-represented in terms of overall water points.

Heterogeneous nature of the groundwater resource

Perhaps the most striking result of the mapping exercise is the marked spatial variability in the development of water resources both within and between kraals. Figure 1 shows a number of clusters of water point development adjacent to large areas with no water points at all. Individual access to water points ranges from 19 to >50 people per well in the least developed areas. The domestic water requirements of a large section of the community are provided by a handful of community water points (boreholes or deep wells with hand pumps), and this is particularly the case during dry periods when family wells dry up. Interestingly, slightly more water points were reported to be used for irrigation than domestic use. This strongly suggests that the priority of householders is switching increasingly towards the use of water for productive purposes.

Crystalline basement aquifers are noted for their spatial variability, which helps to explain the clusters of wells identified by mapping. The 'patchy' nature of the groundwater resource, combined with poorly matched pump capacity, means that many wells are prone to failure in dry cycles. At the same time others, in favourable sites, which are fitted with only a single hand pump tap only a small part of what is potentially available.

Attitudes to water

After each mapping exercise a general discussion of attitudes to water resources, and ground water points in particular, was held. From these discussions it became clear that groundwater is seen as the property of the family that owns the land where it is found and has typically developed the well. While it is generally considered wrong to refuse neighbours access to drinking water from these family wells, particularly in times of crisis, any productive use of the water, be it for irrigation, brick making or livestock, is seen as the prerogative of the well owner.

Community wells developed in common areas are considered as common resources for the community or kraal, as are temporary wells dug in river beds and ephemeral springs. Boreholes and deep wells implemented by Government were described as belonging either to the community or the District Development Fund. There appeared to be little or no concept of groundwater as a common or shared resource, and little understanding of the nature of aquifers, or groundwater in general. Although there was general consensus that 'planting trees can help conserve water and soil', when questioned about how this might happen, few clear ideas were expressed.

A ranking exercise conducted in the Romwe catchment found a marked difference in the preference expressed for potential development projects between age groups. Younger men and women (who own little land) are primarily interested in labour-intensive, market-oriented projects such as piggeries, nurseries

Figure 3. Access to arable land, water points and gardens in the kraals of Village D

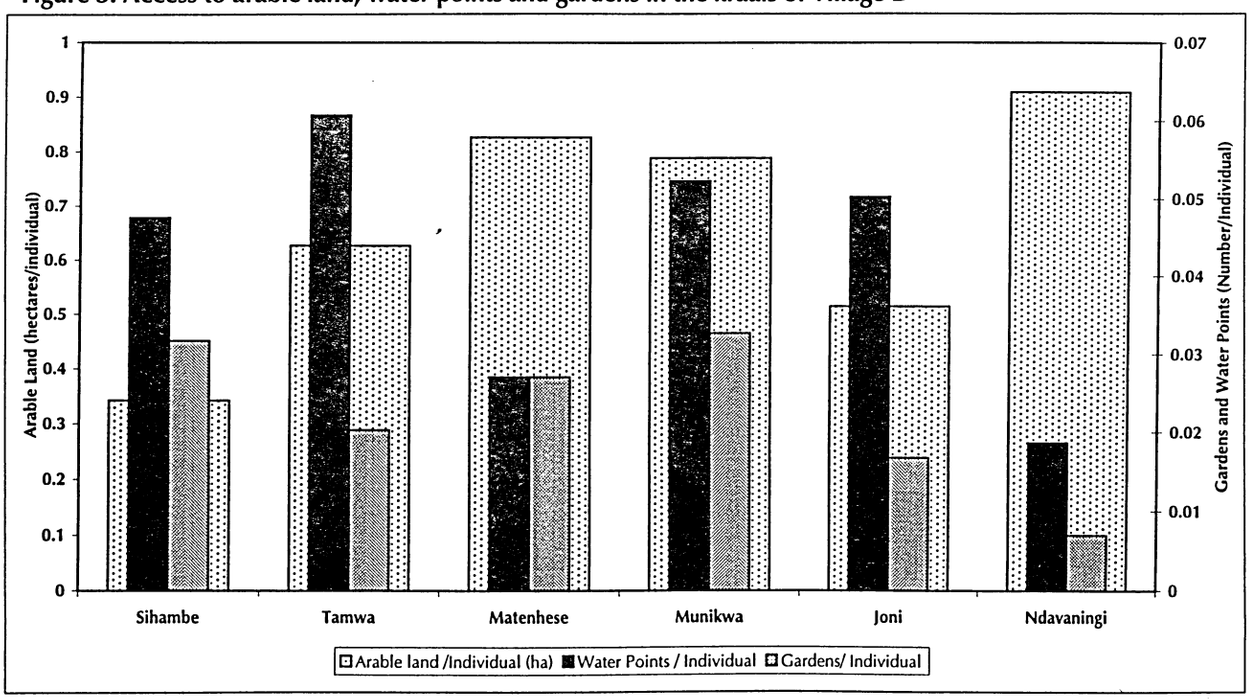
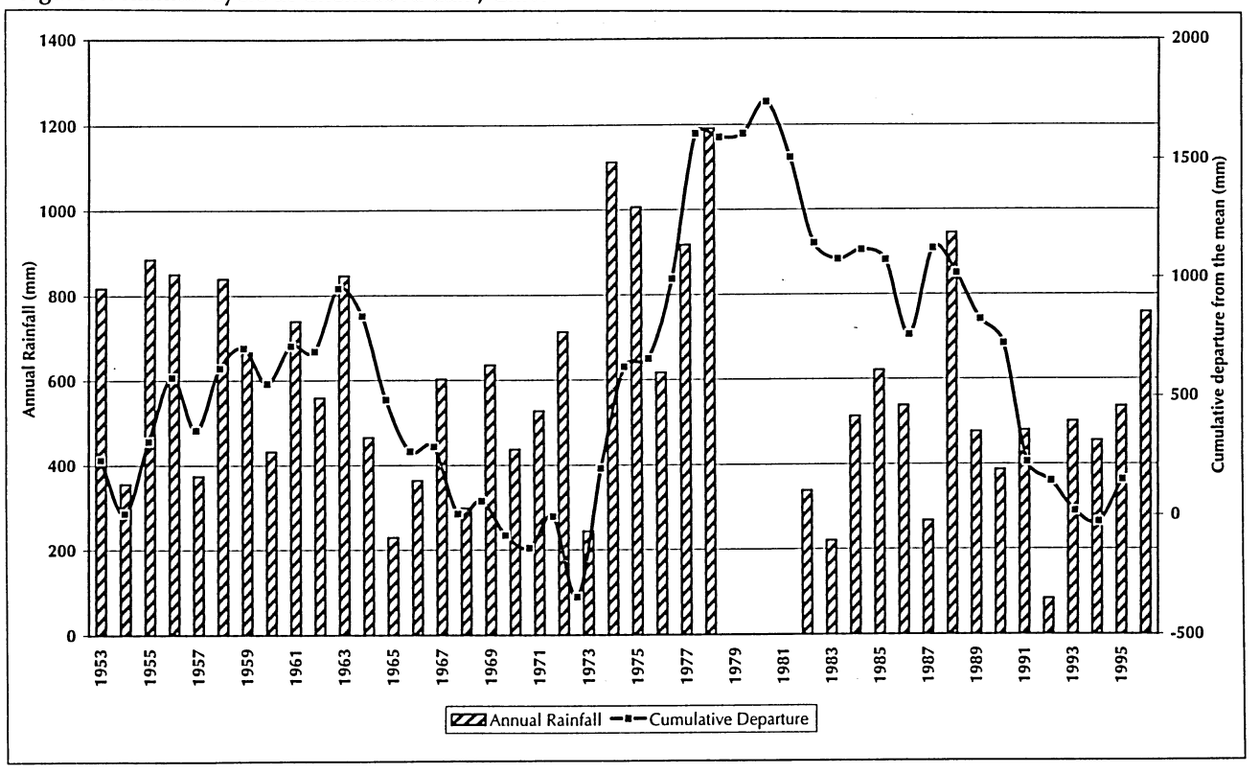


Figure 4. Rainfall cycle at Chendebvu dam, Chivi



and gardens, all of which maximise the utility which can be gained from small areas of land. All also require an adequate and reliable water supply. In contrast, older community members favour farm improvement projects including, for example, the provision of loans for the purchase of cattle and inputs for their relatively large dryland farms.

Physical constraints to water use

A reconnaissance survey of the Romwe catchment identified falling groundwater levels and the failure of springs and streams amongst other environmental problems (Price, 1993). It was hypothesised that these were due to changes in land use and perhaps inappropriate farming practices. However, Butterworth (1997) suggests that the observed water table fluctuations are more likely the result of a series of low rainfall years. There appears to be a 20-year rainfall cycle, with alternate 10–15 year periods of above and below long-term average rainfall (figure 4, above). These cycles can be seen by examining the graph of rainfall cumulative departure from the mean, a rising line indicating a wet period, and a falling one a dry period. Groundwater levels in recent years have shown signs of recovery in the current wetter period, indicating that present levels of abstraction are sustainable in the long term.

This cyclical nature of rainfall needs to be considered when planning groundwater resource development. Crystalline basement aquifers are noted for their low storage potential and the groundwater reservoir is vulnerable to changes in rainfall (Macdonald *et al*, 1995). While there is generally sufficient storage to smooth inter-annual variability (for example, a low rainfall year during an otherwise wet cycle) there may not be sufficient storage to cope with longer dry periods. Evidence of this was provided by the 1992–93 drought when, after a number of dry years, many traditional family wells in Zimbabwe failed.

3 IMPLICATIONS FOR WATER RESOURCE MANAGEMENT

The water resource survey showed a rapid increase in overall groundwater resource development, the preponderance of water points being used for 'productive' purposes. It also illustrated the 'patchy' nature of the resource development.

That farming systems intensify in the face of population increases, and that irrigation is one of the common facets of such intensification, is not contentious (see, for example, Boserup, 1965 and Tiffen *et al*, 1994). Nonetheless, the shift in the use of groundwater from purely domestic to productive uses is important and should be recognised in planning water supply programmes.

With increasing reliance on groundwater for domestic use and production, the section of population at risk during dry cycles is growing. Unfortunately, areas of groundwater concentration are frequently under land already owned by one or two individuals. Unless there is major land reallocation to ensure that each family has a plot in a reliable water bearing zone, development of private wells alone cannot lead to equitable resource allocation. It will become increasingly important in water resource development to ensure equity of access to these water resources during dry cycles. This raises the question of whether the groundwater resource is

best developed through many individual family wells (cheap and simple but prone to failure) or through carefully sited communal wells ('more expensive'; 'more difficult to initiate' but reliable). There is at present a preference among NGOs to develop the former, often in the light of community members' preferences. It is suggested that some mix of the two would be a better policy given the nature of the crystalline basement aquifer and the cyclical rainfall pattern. While development of family wells in appropriate locations adds considerably to general security and wellbeing in times of plentiful rain, there is an equal need to develop communal schemes as a 'backstop' in times of low rainfall and for those families whose homestead and fields are unsuitable for the development of private water points.

4 FUTURE WORK ON WATER RESOURCE MANAGEMENT

The results discussed above clearly point to the need for further research into the role of water resources, particularly those of the shallow crystalline basement aquifers, within the context of changes to farming systems and livelihood strategies in communal areas. In particular, a fuller understanding of the capacity of crystalline basement aquifers to sustain substantial localised abstraction for productive purposes, and to match the type of development to that capacity is essential if any meaningful management of the resource is to be achieved.

To date, the role of water (and particularly ground water) has been under-emphasised or ignored by much of the systems-oriented research in Zimbabwe, which has tended to concentrate on more traditional soil and water conservation techniques and livestock management issues within the framework of rainfed farming systems. While such work is important, with increasing reliance on groundwater and irrigation, an analysis which omits these issues is incomplete. The drastic reduction in the size of family land holdings may be alleviated to some extent by macro-economic development and subsequent migration to the cities, or perhaps in the short term by resettlement programmes. Nonetheless, more attention should be paid to finding ways to increase yields on landholdings declining in size, and to ensuring that such developments are sustainable in the long term.

5 SUMMARY

- Village mapping is a useful and suitable tool for water resource surveying in Zimbabwe and there is a role for village mapping within the framework of rural water and sanitation supply projects.
- A rapid increase in the number of water points being developed was identified in the survey area. This reflects intensification of farming systems due to population pressure.
- Physical and climatic factors combine to give a water resource base which is heterogeneous in both space and time; this has important implications for the equitable development of the resource. An approach which develops a mix of individual family wells and more reliable communal water points and irrigation schemes is recommended.
- The optimal balance between individual and communal approaches to water resource development will be further investigated with the communities in the survey area as a first step towards the development of appropriate community water resource management systems.

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