

## **Valuing water as an economic good in dryland areas - balancing the need for food, environmental and financial security.**

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### **Abstract**

Two watersheds, one in north western Syria and the other in south east Zimbabwe are looked at. Both locations are water scarce and food insecure. In both areas field work has found households making multiple and highly productive uses of small amounts of water. These are usually small-scale, informal systems of water use. Within both watersheds, there are also large-scale irrigation schemes. These large systems are much more formal, and are viewed as the providers of national food and economic security. But, research indicates that water is used more productively in the smaller, more informal systems. These small schemes also create far fewer environmental costs and externalities. They also provide most of the inputs which maintain household food, water and income security on a day to day basis.

Due to various resource constraints, both regions need to develop water management strategies whereby water is treated much more as an economic good. In the Syrian watershed, the problem is to not only improve the supply of potable water, but also to arrest a declining water table. In the Zimbabwean watershed, the problem again is not only to improve the supply of potable water, but also to meet stringent cost recovery targets in the water supply sector. It has been suggested that both regions need to move towards more realistic valuation strategies for water. In both locations, some formal charges for water currently exist, but these prices do not pass on the economic cost of using the water to the consumer.

The challenges inherent in adjusting the management systems of water in these two watersheds to reflect the water's economic value are examined. There are several institutional, cultural and property rights related difficulties. A key issue is striking the balance between ensuring access to water to promote food and income security and valuing the water to incorporate its environmental, opportunity and scarcity costs. The similarities in the difficulties faced and the recommendations suggested for each location are assessed. The paper discusses whether economic systems for water resource management are bound to be unique to each environmental, cultural and political location, or could (and should) economic research and experience on water resource valuation in such locations be generalised?

## 1. Introduction

The purpose of this short paper is to examine whether there are any similarities in the issues and challenges inherent in adjusting the management systems of water in two very different political and hydrological settings in order to better reflect the economic value of water. Allen (1996) rightly suggests that any practical study concerning the economics of water management must recognise that resource allocation decisions take place in open political economies and not in closed hydrological or engineered systems. Taking this important, and often forgotten, observation as our start point we have chosen to examine the challenges facing two very different water resource policy environments, one in north west Syria and the other in south east Zimbabwe.

In terms of political economy, Syria enjoys a traditionally centralised level of state influence whereas Zimbabwe has been experiencing a process of decentralisation under a series of structural adjustment programmes since 1991. In cultural and socio-economic terms the two countries are also very different. Syria is predominantly a Moslem society where the state has the original right on land and water and it can be transferred to individuals whereas Zimbabwe, a mostly Christian society, has a longer tradition of communal resource management and decision making. Both case study regions, however, face similar water resource allocation problems. Both areas are water scarce; both have large-scale/ formal and small-scale/ informal water use systems operating within them and both need management systems that can better ensure water and food security for their populations.

Water managers face a range of challenges in each region: the need to supply potable water in both; the need to arrest groundwater depletion in Syria; and the need to achieve self financing for water supply developments in Zimbabwe. And they are essentially equipped with the same resource management tools - the potential to value water as an economic good. The paper therefore investigates the problems facing water resources managers at each site in depth and analyses, using case studies, whether water pricing or water rights strategies can be adopted to meet these different objectives for different users in different political and socio-economic settings. In essence the paper attempts to explore whether the ability to treat water as an economic good, as has been advocated by many international declarations and agencies (eg ICWE, 1992; World Bank, 1993) is a flexible enough resource management tool to help resolve water resource management problems in two very different case study contexts.

## 2. The Case Study Areas

### 2.1 Syria

The case study area in Syria is located in the south-eastern part of Aleppo City, in the north-western part of the country. It includes the eastern and southern part of the Al Hoss Mountains (AHM), where approximately 150,000 people live over 105,000 ha. The climate is Mediterranean with rainfall occurring during the winter and spring and the area falls within classes 3 and 4 of Syria's defined agricultural zones. Zone 3 receives more than 250 mm annual rainfall and not less than that one year out of two (SMAAR, 1996). Cereals (wheat and barley) and food legumes (chickpea, lentil and faba bean) are typically grown in this zone - vegetables and summer crops are grown only where irrigation is available. Zone 4 receives 250 mm annual rainfall and no less than 200 mm one year out of two (SMAAR, 1996). Barley and rangelands occupy most of the rain-fed area. Limited production of vegetables is present here, even where irrigation is available. Wheat and food legumes are only grown under

supplementary irrigation. Small-ruminant production systems of semi-nomadic flocks are widespread in both stability zones.

The main groundwater resources in the Aleppo area are contained in two systems, the upper and lower aquifer systems (Wagner, 1997). The upper aquifer system is composed of chalks and limestones and it comprises mainly fresh groundwater which is intensively exploited for irrigation and domestic supply. Groundwater recharge depends on rainfall, rock outcrops and morphology. The lower aquifer system is composed of limestones and dolomites. It is a highly productive aquifer in the highlands and mountain ranges of western Syria. The water in the lower aquifer is brackish, saline and sulphide rich.

Groundwater is the common water resource for both irrigation and domestic use in the region. However, as a result of policies in the late 1980s and early 1990s, the increasing density of wells and high demand for water has caused a decline in the water table (FAO, 1993) and in some instances the drying of wells (Rodríguez, 1997). In the drier areas of the AHM region, 70% of the communities do not now have an adequate water supply and 35% have to purchase water to survive (IFAD, 1993). Due to the increased number of wells, the depth of the water table has been declining by up to two metres per year and intra-seasonal fluctuations have also increased (Wagner, 1997). Boreholes with depths of between 400 and 775 metres have been drilled in the area east and south-west of Aleppo mainly by private farmers. The water extracted from these boreholes is used for irrigation water, both as a substitute for irrigation water from the depleting upper aquifer and in newly developed irrigation areas. No adverse effects of brackish water irrigation have been reported so far, but longer-term agricultural use of it may have impacts on soil salinity and the quality of shallow groundwater. Furthermore, there are indications that groundwater in the deeper aquifer is not related to seepage from the upper aquifer but originates from a distant recharge area (Wagner, 1997).

In contrast, on the north-eastern base of the AHM (Sfireh), new areas have been developed with surface irrigation as part of government schemes to divert water from the Euphrates river. This irrigation scheme is part of a major government effort to enhance Syrian food security (Da'oud, 1997).

## ***2.2 Zimbabwe: the case study area***

The case study area in Zimbabwe is in the south east of the country - the region in and around Chivi District in Masvingo Province. Chivi District is a dryland rural area affected by poverty, food and water insecurity, characteristic of much of southern Zimbabwe. The 1992 census for Chivi District showed a total population of 157 428 with a growth rate of 1.98% and a population density of 44.5 people per km<sup>2</sup>. At the time of the survey, 49% of the population was under 15 years old (CSO, 1992,1993). Corbett (1994) estimated that 50% of households in Chivi District in 1990 had annual incomes below US\$166 (1996 prices).

Rainfall in the region is characterised by unpredictable variability (Griffiths, 1972). Average rainfall between 1914 and 1992 was 548 mm. This varied between a maximum of 1160 mm in 1917/18 to a minimum of 143 mm in 1991/92. The overall coefficient of variation of rainfall for the period was 37% (Scoones, 1996). There is no evidence for any decline in annual rainfall, but it does seem to follow a cyclical cycle in southern Africa with a periodicity of between 13-19 years, possibly related to the El Nino Southern Oscillation (Downing, 1992). The periods of good rainfall are important for building up populations of livestock and grain. However, rainfall can also vary immensely within years. The rainy season, when the great majority of the annual rainfall occurs, lasts from around December to March, but the length of the season is very variable. Mid season droughts are frequent - the coefficient of variation for

rainfall about the mean in January is 78% (Scoones, 1996). Such mid season droughts are particularly disastrous for drought vulnerable crops such as maize, the staple crop in the region.

Groundwater is found within the crystalline basement geology which underlies the area. Aquifers tend to be shallow (10 - 15 metres) and are found in the zones of heavily fractured weathered rock which overlie the unaltered parent material. As a result siting boreholes in these regions is often difficult and expensive, given that where deep groundwater does exist in the parent rock it is found in fissures and cracks that are not easy to locate. These factors also combine to provide low yields for boreholes (Lovell et al, 1996). For example in a recent World Bank drought relief programme, of the new boreholes drilled in Masvingo Province, 47% were found to be either dry or low yielding. Consequently groundwater usage is only about 4% of annual average recharge.

As a result of the difficulties of accessing groundwater resources, water harvesting or surface water irrigation remain the most popular forms of water usage for agriculture in the region. For small-scale farmers *dambo* cultivation -residual moisture cultivation on small wetlands - is popular for those whose land is endowed with a patch of wetland. Alternatives for the smallholder consist of building a (usually unreliable) private well or farming a small seasonal garden near to a river for supplemental vegetable cultivation. Livestock can be watered at the river or at community water points, but all cereal produce relies on the rains. Hence yields for many people remain reliant on good rainfall and problems of food insecurity remain high for the majority of communal land small holder farmers in the region, as the drought across southern Africa of 1991/92 painfully illustrated (Cleaver and Schreiber, 1994). During 1992, when the previous wet season had produced only 140 mm of rain, around 250 000 children were being given regular supplementary feeding rations in Masvingo Province and one million people (practically the whole communal area population) were being given food relief. The drought relief programme cost the Government around Z\$30 million per month, or around 4.5% of GDP in 1992-93 (Benson and Clay 1994).

For the private land owners in the region, large-scale irrigation schemes have been constructed where river water is pumped to canals and siphons, such as the scheme at Chisumbanje which covers 2400 hectares. However, the great majority of large-scale agricultural activity in the region is related to the production of sugar cane by commercial estates. There is a complex of dams in the Mutirikwi and Chiredzi systems surrounding Chivi District, all operated by the Government Regional Water Authority, which supply the 36 000 hectares of irrigated development under sugar cane. In 1995/96, 3.85 million tonnes of cane was produced. The sugar export industry continues to grow rapidly within Zimbabwe, with the Government retaining its preferential export markets, and it remains an important employer of people from the surrounding communal lands (Zimconsult, 1996).

### **3. Large and Small-scale Water Users in Each Area.**

#### ***3.1 Syria Case Study Area: The Large-scale Water Users***

The large water use systems in the AHM region are located at the base of the mountains where the bulk of the water has been diverted from the Euphrates river and is then supplied to the farmer via government-operated channels. Deep wells are uncommon, but if present are often associated with pollution grievances (unlined deep wells often result in saline water intrusion in the upper strata mixing with freshwater from shallow wells, which makes the water unsuitable for drinking). Cotton, sugar beet and wheat are grown by the larger scale farmers, as part of

the Agricultural Plan. After wheat harvest, a major part of the land is cultivated with summer potato or other cash crops which may be harvested in the autumn, just before the planting of wheat for the next season.

Wheat under irrigated conditions yields 4.5 tonnes/ha, while under supplementary irrigation (SI) conditions in Zones 3 and 4 it may yield between 2.2 and 2.9 tonnes/ha, depending on the level of SI (ESCWA, 1995a; Ahmad and Rodríguez, 1998). Nine hundred litres of water are required to produce one kilogram of wheat under fully irrigated conditions. Less water is required under SI - under farmers' conditions in the region, five to seven hundred litres of water can produce one kilogram of wheat. The cost of wheat irrigation per hectare is 3000 SL (SMAAR, 1996), or US\$ 65.93 using an exchange rate of US\$1 to SL 45.5 (ESCWA, 1995b). If at least 4000 m<sup>3</sup> are delivered, the cost per cubic meter is US\$0.016. Gross margins per unit of water under the government gravity irrigation system are 0.16 US\$/m<sup>3</sup> for sugar beet (a highly subsidised crop according to ESCWA, 1995b), followed by summer potato and wheat at 0.13 US\$/m<sup>3</sup>. It has been suggested that the maintenance and operation costs of the large system could exceed 110 US\$ per hectare (ESCWA, 1995b).

### **3.2 Syria Case Study Area: The Small-scale Water Users**

Field surveys were undertaken in the region to investigate the existence of small-scale water use systems in the AHM region. Small-scale water use systems were found in the mountains and in the lowlands of the Khanasser valley. They are mostly dependent on groundwater, as the surface irrigation schemes have not extended to these areas. These small-scale systems are also characterized by a very limited amount of water available of drinking quality. Supplementary irrigation of wheat, faba bean or barley is practiced in these areas, using nearby private wells. The water from these shallow wells is of varying quality (drinkable, saline or sulfide-rich) and the depth of the shallow wells varies from 50 to 120 meters. The depth of the deep wells can reach 750 meters.

The financial costs of extracting groundwater from a shallow and deep well are 0.02 and 0.03 US\$ / m<sup>3</sup>, respectively (ESCWA, 1995a). Gross margins for wheat under supplementary irrigation from deep wells, however, can be quite variable. In Zone 4, with only 1500 m<sup>3</sup>, the margin is rather low (0.01 US\$/m<sup>3</sup>) but adding just 500 m<sup>3</sup> can boost the gross margin to 0.07 US\$/m<sup>3</sup> (Ahmad and Rodríguez, 1998). This response is related to the quadratic nature of the wheat production function under SI. Because of lower irrigation costs, with the same yield in Zone 3, the gross margin for wheat plus 1500 m<sup>3</sup> of water is 0.10 US\$/m<sup>3</sup>.

However, the scarce and poor quality water the small-scale farmers are able to extract from the aquifer in this system, is not used solely as supplemental irrigation for cereal crops as in the larger scale system. Instead, as well as for domestic purposes (washing cleaning etc.), the limited groundwater available was *also* found to be used for small-scale vegetable gardening, livestock operations and the supplementary irrigation of food legumes. Small-scale vegetable gardens, of between 50 and 400m<sup>2</sup>, were often found on or near the household premises of small holders in these dry and water insecure areas.

Cucumber, squash, chilli, tomato, eggplant, other vegetables and medicinal plants were found to be produced in these small-scale vegetable gardens. The yields of tomato and eggplant grown in the small-scale gardens in the AHM appeared to be lower than those in the large surface irrigation schemes, but the amounts of water used in their production were also lower, and to a significant extent. After extrapolation, the yield estimates for tomato in the small-scale gardens were between 8 and 27 tonnes/ha and for eggplant between 6 and 17 tonnes/ha. The proportions of water used to produce these yields, with respect to recommended irrigation

levels, were between 10 and 30%. These amounts relate to the short periods of hosing that occur for, say, 20 minute periods three times a week. It is hypothesized that the recycling of domestic waste water (such as laundry and kitchen water) through simple splash irrigation techniques, also occurs each day, although this is not formalised in the household farmers' conception of "irrigation".

The widespread existence of such small-scale, often informal horticultural activities runs contrary to the formal focus of water and agricultural research on wheat production for national food security in Syria. Nevertheless, even if the overall technical efficiency of small-scale vegetable production is questionable to conventional irrigators, household farmers (generally women) are investing small amounts of very scarce water in the area to supplement their diet and income. And this small-scale water use strategy proves to be both a rational and an efficient response to water scarcity.

The use of scarce water to cultivate small plots of vegetables, rather than for the supplementary irrigation of wheat, is rational insofar as the gross margins/ m<sup>3</sup> for wheat are clearly low when water is scarce. Yet vegetables can be sold at a premium price, depending on seasonality and transportation costs. On the basis of the yields/ ha suggested by the household growers when surveyed, and using the average summer prices for legumes in Zone 4, the household gardens surveyed gave a gross financial margin of US\$ 13 360 / ha for tomatoes and US\$ 6 760 for eggplant. US\$ obtained per m<sup>3</sup> of water per hectare by using this strategy (based on average summer prices) ranged from US\$1-16 for tomatoes and from US\$5 -13 for eggplant (compared to 0.07 US\$/ m<sup>3</sup> for wheat). For small-scale, resource poor households in the area this strategic use of scarce water forms the basis of an important source of income and constitutes a critical part of many household budgets and livelihood strategies. It must therefore be seen to play an important role in food and income security for small-scale producers in the region. And of particular interest in these small-scale water use systems was the fact that the income generated from these informal productive activities appears to be spent on the purchase of drinking water from vendors, as well as on other household necessities.

The informal use of scarce water for small-scale vegetable cultivation and sale also results in an efficient allocation of water within the region, as a result of this trade in "virtual water". Due to poorly defined groundwater rights, there is no formal market for water here, but through the agricultural market chain farmers with access to low-quality water grow vegetable crops and use part of the revenue they generate to purchase domestic water. Surveys found that many small-scale (female) farmers rely on this strategy to secure their household domestic water. Payments of 0.2 US\$/m<sup>3</sup> at the source and then a further 0.07 US\$/m<sup>3</sup>/km for transportation was found to be widespread. Indeed, vendors selling water 15 km from its source in the region were found to be getting paid up to 1.5 US\$/ m<sup>3</sup> for water of drinking quality from small holder households. On average, household payments for water in the potable-water scarce areas of ALM were found to be 0.9 US\$ per m<sup>3</sup>.

### ***3.3 Zimbabwe Case Study Area: The Large-scale Water Users***

As a result of the 1991/92 drought across Southern Africa, where severe water shortages meant that much of the sugar cane had to be ploughed out and replanted, the large-scale estates in Masvingo Province, where Chivi District lies, have responded with a limited investigation into water use efficiency improvements such as drip irrigation pilot schemes. However, much more focus has been put on improving the supply of water to their production systems. A number of new dams are being constructed in the region, such as the Mteri Dam (capacity 66 000 ML) and the Tokwe-Mukorsi Dam, to be Zimbabwe's largest internal dam (capacity 1.73 million ML), part financed by the private sugar estates. A recent report on water pricing options for

the Zimbabwean Ministry of Lands and Water Resources suggested, however, that the motivation for these developments is not to increase the productive capacity of the sugar industry, as much as to improve the *security* of supply for existing plantations (Zimconsult, 1996). The new dams are to be owned by the Government, and access to water from them by the sugar estates is to be based on an agreement of “mutual trust” with the Ministry - the companies’ capital contributions assuring them of access to a defined share of the dam water for the first 40 years at operation and maintenance price only. The report estimates that, after making reasonable assumptions about the cost to the companies of putting up their capital contribution, the implied price of water from the Tokwe-Mukorsi Dam that the producers will face will be approximately Z\$225, or US\$ 22.3, per ML for an expansion of 8400 hectares (Zimconsult, 1996). This is equivalent to US\$1 per 44 843 litres (at 1996 prices).

### ***3.4 Zimbabwe Case Study Area: The Small-scale Water Users***

Since 1993 a series of pilot small-scale “productive” water points have been implemented in the communal lands of Chivi and Zaka Districts in Masvingo Province, supported by the UK DFID and the Government of Zimbabwe. The schemes consist of a water point, designed to exploit the complex aquifer and give a reliable yield of more than 15 000 litres of water per day, and an associated half hectare community vegetable garden managed and run by local participants, mostly women (Lovell et al, 1996). It is this case study project that is used to illustrate the productivity gains to be had from designing self managed, small-scale irrigation schemes which complement the rainfed farming system in the dryland area (Waughray et al 1996, 1997b)

Seven pilot schemes were implemented (Lovell et al, 1996). It was envisaged that the gardens would improve the dry season nutrition intake for participating households and would be used particularly by women. By 1996, 545 families were members of the seven scheme gardens, and 80% of members surveyed said that the main decision makers for the garden plots were women. Each of the gardens were typically subdivided into small plots, averaging 6 m<sup>2</sup> per plot. During the 1995 growing season, vegetables (such as cabbage, onions and tomatoes) yielded an average 386 kg of produce per member (Mazhangara et al, 1995). This is equivalent to almost 58 tonnes/hectare.

During this period, the gardens had internal financial rates of return ranging from 11-15% and an average gross financial margin at farm gate prices of US\$38 (assuming zero dry season opportunity costs of labour). By 1996, 77% of garden members surveyed were obtaining a seasonal income from the pilot project schemes. Average gross income per member obtained from selling vegetable produce during the 1996 growing season was US\$28 (Waughray et al, 1998).

During the project implementation process some basic tools and training were provided to help maintain the pumps. A strong sense of ownership and responsibility for the water point was also instilled in the community (Lovell et al, 1996). Combined with the income generating capacity of the schemes, this meant that operation and maintenance costs for the schemes have been low to zero. The scheme pumps have been managed and maintained by the users who have bought spare parts with funds generated primarily from community garden revenues, or who have pooled labour resources to fix problems where possible. The US\$ equivalent paid towards operation and maintenance of the schemes each year per community varies between US\$50 (plus a US\$477 one off lump sum), and US\$205. The scale of these user payments across the seven pilot schemes is not insignificant. For comparison, a conventional rural water supply project in Zimbabwe estimated the recurrent operation and maintenance costs to the donor agency would be US\$90 per water point per year.

In 1995 a survey of 60 of the project households was undertaken to establish a hypothetical monthly willingness to pay (WTP) for maintaining the productive water points (Waughray et al, 1997a). A mean WTP of Z\$5 per month per household was elicited. Based on these stated WTP values, hypothetical water payments could reach US\$776 per scheme per year. This represents a potentially significant recurrent cost saving to the donor agency and suggests that replacement and even long run marginal costs of the schemes could be met.

Based on a reliable daily yield of 15 000 litres, the rural community's WTP for "productive" water equates to US\$1 per 7 055 litres of water, or more than six times greater a price than the water charges faced by the large sugar estates.

#### **4. Water Resource Management Problems and Options In Each Case**

##### ***4.1 The Syrian Case Study Area***

For water resource managers in the Syrian region the problem is to improve the supply of potable water in the region and simultaneously to arrest the declining water table in the shallow and deep aquifers, in order to avoid increased water insecurity and any further environmental damage occurring through saline intrusion and sulphide rich deposits. The wider policy environment has focused on the need to irrigate wheat to ensure food security for the region and less attention has been paid to other productive uses of water or its opportunity cost.

The problems associated with the large-scale surface irrigation from the Euphrates are manageable with sound agricultural practices and a realistic pricing structure for the irrigation system that reflects, at minimum, the replacement costs of the scheme. Properly designed and maintained drainage systems and crop rotations would also decrease the likelihood of salt deposition in the soil. Field surveys in the Sferah area suggest that after the introduction of channel irrigation the capacity of the shallow wells to irrigate has increased from 1 to 3 or 5 ha, and there is no evidence of declining groundwater quality (Mueller and Rodríguez, 1997).

However, whether water charges can be implemented that truly reflect the operation and maintenance costs (ESCWA, 1995b) or the opportunity cost of water for other uses (domestic or industrial) remains an open question beyond the scope of this paper. If the state introduced a degree of autonomous management by scheme users it would force the financing of the system to be addressed and more realistic charges to be introduced. Importantly, this would also ensure that the revenues generated from such charges (net of a small tax) would be controlled and deployed by the users themselves in the maintenance, replacement or expansion of the scheme (ESCWA/ FAO, 1996). Government's role would be reduced to that of regulating environmental or financial management targets for the large-scale systems and consequently, the burden of irrigation financing on the central treasury would also fall.

The problems associated with groundwater use in the Syrian case study area are related to both quality and quantity. Quantity is perhaps the most crucial. When wells dry up, farmers face the option of drilling deeper within the shallow-aquifer strata or choosing another location for a new borehole in the farm premises hoping to find water. If capital is available, a third option is to drill a deep well (Rodríguez, 1997). This is also a risky option but if the farmer succeeds the deep groundwater is relatively abundant. For example, the depth of the borehole may be 400-800 m and the depth of the water table may be 50-70 m. There is a widespread local regulation (not enforced) that limits the distance between wells to 500 m. This rule grants about 78 ha of catchment area per well. However, the local rule does not differentiate between the



groundwater rechargeability potential of different areas. Legal limits on the power for pumps to abstract groundwater in different hydrogeological environments, as spelled out in Aptekman (1973), require re-assessment of the fugitive nature of the groundwater resource (Mueller and Rodríguez, 1997) and support of the resource-users to enforce surveillance. The management of groundwater as a common pool resource needs to shift to common property management.

The low quality of the water from deep aquifers poses a threat to the quality of shallow aquifers. When contamination from shallow wells occurs there is no compensation for this negative externality, which could be avoided if the deep wells were lined. The Ottoman Majalla (the Civil Code) and the modern Syrian Water Law are not very clear on how such a case should be treated. Affected farmers, often resource-poor, have to rely on domestic water from other sources and in the most extreme case to purchase water.

Importantly, survey evidence suggests that the buying and selling of water for domestic uses is clearly socially acceptable. Furthermore, complex markets have developed related to the perceived quality of water. Lower quality water in water scarce areas is being put to highly efficient uses to create the capital to purchase higher quality potable water, often at premium prices. Consequently, when faced with water scarcity, households in the Syrian case study area are already allocating water to those activities with the highest value.

These aspects of “virtual water” trading (Allan, 1996) in the water scarce areas should be investigated in much more depth in order to better ascertain the population who participate in such market based water transfers and the financial and economic degree to which they can be developed, in order to maintain and enhance water security. If imaginative water resource policies can be developed which reflect and build upon the informal markets which are already ensuring that the opportunity costs of potable water are being realised, then the problem of water resource security and groundwater sustainability in the region can begin to be addressed. Attention needs to be given to the institutions, information flows and transaction costs upon which these transfer systems and prices are based, and policy needs to encourage these institutional costs to be reflected in the pricing of water rather than, perhaps, seeking an “environmental” value of water as an economic basis for charges.

#### ***4.2 The Zimbabwe case study area***

In the Zimbabwe case study area there is a need to improve water security within the communal lands, both for domestic purposes and for agriculture in order to decrease the devastating threat of drought. However, unlike Syria there is no problem with the over utilisation of the aquifer. Due to geological reasons the groundwater is quite difficult to exploit. Rather than for environmental management, the issue related to water pricing is one of infrastructural financing.

In Zimbabwe, a national water resource management strategy is being developed. It has emerged in response to the fact that the public sector institutions with responsibilities for maintaining rural water supplies face stringent manpower and capital expenditure constraints. As a result, it is focusing on the need to reduce public sector spending in the water sector, devolve public sector responsibilities for water resource management and increase water resource related economic opportunities in rural areas. It seeks to emphasise the potential of community self management to both relieve longer term recurrent financial and resource pressures and improve rural livelihoods (WRMS, 1996).

Water charges in this case study *do* exist for the large-scale commercial systems, calculated at the national level using the “national blend system”. However this system, whereby estates and

large farms purchase so called agreement water at a fixed charge calculated to recover the historical cost of the supply system, gives rise to major problems including substantial cross-subsidies which have benefited the commercial farming sector rather than communal farmers (Zimconsult, 1996). More specifically, in the case study area outlined here, following the drought of 1991/92, infrastructural investments to improve the security of supply have been taking place between state and large agricultural water users. However, the charges for water to be supplied by these schemes are also being calculated way below their economic cost - on a basis of meeting operational and maintenance costs only, significantly below the producer surplus of the operators. Consequently, less attention is being given to water use efficiency measures, such as drip irrigation technologies, which could both decrease water consumption and increase crop productivity within the large-scale water systems.

Thus, even with water pricing, the situation is untenable at present. Due to constraints on the Government budget, there are severe limits on the extent to which national financing can resolve the water security issue for large-scale water user systems, especially if the current style of financially based water charges which do not reflect the economic value of water continues. To resolve this problem there have been recommendations for the Government to devolve the management of large-scale water use systems to the local level, moving from an interventionist and capital investment financier to a more regulatory and supervisory role. The recent review into water pricing in Zimbabwe suggests that ways of making agricultural water rights more responsive to economic development should be explored, such as allowing sales of water and trading rights. Certainly, the local ownership and management of large-scale systems would force users to pay charges more akin to the long run costs of the system and, importantly, would allow the revenues generated to be re-invested in the scheme.

Devolving managerial responsibility for the large-scale systems and allowing the opportunity costs of water to be met, through the trading of water rights, would help resolve the financing problem of the Zimbabwean State Water sector in the case study region. However, such a move would, most probably, suffer from political inertia, as it requires widespread institutional reform and policy restructuring to ensure low transaction and information costs for water users. Again, these changes depend on the desire of the state to relinquish direct control of its large-scale water infrastructural developments and its political hold on the issue of "water security".

Before the restructuring of water policies, the objective of small-scale rural water supply projects in Zimbabwe had often been to simply supply water as a merit good to rural areas to meet state-perceived domestic water and sanitation requirements. A blanket demand for more water was often assumed rather than investigated, and economic appraisals focused on the cost effectiveness of different programme approaches. As a consequence, operating and maintenance costs for the projects in the case study area were met by national public sector agencies. The ownership and rights to management of the water supply infrastructure remained outside of the recipient community and the potential to utilise the productive capacity of the water as an economic good was not fully or formally realised. This approach meant that less attention was given to the wide and longer term economic benefits that water points could offer, such as communities being empowered to manage their own water points, communities using their water to help develop economic opportunities, and the market multiplier effects such activities could have.

The "productive water" pilot research project mentioned here has provided valuable information on how to change this approach and meet the requirements of the new national strategy for small-scale rural water supply and development in Zimbabwe (Waughray et al, 1998). The research has shown that community based productive water point projects can be successful. However, they must give particular emphasis to the social and institutional aspects

of their implementation, especially with regard to developing community self ownership and management of the scheme. This implies a relatively higher capital cost, both financially and in human resources, than for standard rural water supply projects. This extra cost could be seen to count against such projects. However, if more rigorous attention is given to the *benefits* side of the equation and communities' willingness (and ability) to pay for the type of small-scale water supply they want, the economic case for promoting the productive use of water resources in dryland areas becomes much stronger, particularly over time. It is by promoting water resources strategies of this nature that the impossible financial obligations of central government regarding water and food security for small-scale users and communal households, could begin to be eased.

## 5. Conclusion

In both case study regions interesting differences in the efficiency of water utilisation have emerged between large-scale, state controlled irrigation systems and much more small-scale community or household managed "productive" water use systems. It is the similarities between these productive small-scale systems, in two very different countries, that might offer concrete evidence as to the flexibility and adaptability of economic strategies for water resources management. Equally, the problems the large-scale government systems face offer some indication as to the common difficulties economic strategies for water resource management might encounter when they are scaled upwards.

In both the Syria and Zimbabwe case study areas the charges or prices faced by large-scale water users are not representative of the economic costs of supply. As a result, in both areas the resource problems related to water (declining water tables in Syria and an inability of Government to pay for water resource services in Zimbabwe) continue and will not improve. The issues of food and water "security" lie at the heart of the problems inherent in adjusting the prices each region's large-scale water users face. To restructure water charges efficiently, in order to reflect opportunity or long run marginal supply costs, management and financial decisions regarding the water resource infrastructure have to be devolved to the user - local government, the company or estates. The central Government's role becomes that of financial and environmental regulator. However, the current ability to rent seek from the granting of water rights to large state owned schemes and the hesitation to relinquish political and financial control over resources such as water and issues such as food security, means that unless substantive political restructuring takes place the will to resist such economic changes will not be budged.

Yet it is among the small-scale water users in micro-markets where, on a day to day basis, the state plays less of a role, that *practical* experiences in dealing with the economics of water resources are developed. In the Syrian case study the informal markets ensure that the opportunity cost of potable water is met in the drier areas, where small amounts of poorer quality and recycled water are utilised for vegetable production and the virtual water commodity is "traded" for the purchase of higher quality potable water. If this low level strategy could be investigated further and developed on a larger scale, then significant steps could be taken towards tackling the potable water shortages in the Syrian area without putting excess pressure on the aquifer. Similarly, in the Zimbabwe case study area, the research project schemes show that when a community is empowered to manage and run its own water resources for "productive" purposes, much more revenue than just operation and maintenance costs can be obtained from the users. Replacement and even the long run marginal costs of rural water supply schemes can be reached. And in both small-scale cases, the productivity of

water use was far greater than at the large-scale schemes, which at present carry much more political weight.

It is perhaps from the bottom up then, from the gathering together of the experiences, institutions and approaches of households and communities who have had to adapt to survive in water and food insecure regions, often in spite of rather than because of government policies, that the evidence will become insurmountable for wider policy shifts to take place towards devolving responsibilities for water and setting realistic charges for it. Interestingly, this runs contrary to the proclaimed fears of many governments who suggest that treating water as an economic good will adversely affect the welfare of the resource poor.

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