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Scoping the current situation in access to drinking-water

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INTRODUCTION

Any economic appraisal or evaluation is only as good as the physical foundations on which it rests. Describing the physical situation accurately and linking factors causally together convincingly are necessary conditions for putting socio-economic values on the costs and benefits and arriving at a reliable estimate of the net worth of an intervention. The causal connections in the physical specification are essential for the attribution of outcomes to the intervention. Attribution is always a challenge in a complex, dynamic situation where many external variables operate. Therefore the next three chapters will be concerned with specifying the physical context for drinking-water interventions. To get an idea of the extent of the problem we are addressing, this chapter provides information on the level of access to safe drinking-water globally and highlights the challenges faced by communities with restricted access to water and those served by small water supplies.

Part of specifying the physical context of water interventions is to understand the ways in which the target population is behaving and the role that collecting and using water plays in the total scope of activities of people. Many of the technical issues and challenges faced by communities using small water supplies are similar, both in the developed and developing country context. The management and financial aspects associated with small water supplies often pose specific problems due to their remote and isolated locations. Communication and education measures that are essential in small supply programmes also tend to be hampered for the same reasons.

Improved access to adequate water can have a significant impact on health, participation and successful completion of formal or informal education programmes economic productivity, and dignity in rural areas and thus plays a key role in efforts to reduce poverty – another MDG target. While the majority of MDGs focus on developing countries, developed nations have recognized that small community supplies, particularly rural, remote and indigenous communities are the most vulnerable: they are most liable to contamination and failure, and consequently pose a consistent public health risk. Communities using small supplies are often not able to overcome the challenges they face for a number of reasons:

Isolation and remoteness lead to increased costs associated with accessing supplies.

The quality of drinking water in small supplies tends to be poorer but they are sampled less frequently and often not treated.

The financial resources available for funding capital and operating expenses are limited.

The per capita costs for water sampling and testing is high.

Recruiting and training competent or certified operators is a challenge, especially when funding is scarce.

Little capacity exists to undertake risk assessments or sampling.

Owners of very small supplies and private wells often lack the knowledge about or interest in the relationship between poor water quality and ill health.

Operators often lack a support network, standard operating procedures and technical support.

Training for operators and managers of small community water supplies and management expertise are lacking.

The infrastructure of small water systems is often characterized by poor construction and inadequate maintainance.

Communities often lack the skills or financial means to protect source water and have little influence on source water impacts.

The community perception of risk is often inaccurate.

The risks and risk factors are often hard to quantify and compare in small systems.

Surveillance of waterborne diseases associated with small water supplies is especially difficult due to under-reporting of waterborne illness. Collection of data is often not done in a systematic way.

Small communities are often faced with a number of other priorities such as housing, hygiene and socioeconomic issues which compete with concerns over water issues.

Communication to the public is deficient, including about management of water within the home.

There is insufficient political engagement.

Regulator agencies do not have the resources to regulate small community water supplies appropriately.

The perception that there is no ownership and/or awareness of the true cost of water may result in poor decision making.

Poor infrastructure in rural areas in general inhibits delivery of safe water.

The following actions have been identified by the International Network on Small Community Water Supply Management and others to overcome some of the challenges facing small community water supplies:

Better management of community water supplies.

Management of priorities.

Information generation and dissemination.

Bringing communities together to share experiences.

Development of communication strategies to facilitate risks to the public and decision makers.

Development of tools to ensure that decision makers at community, regional and national levels are aware of their responsibilities.

Advocacy and political will at all levels.

Identification of appropriate regulations for community water supplies.

Commitment and responsibility of governments to investment

Adequate institutional support to ensure outreach mechanisms.

Capacity building for water operators and managers, including incentives to stay within the community.

Promotion and strengthening of community-level capacity to manage water supplies, including the establishment of regional level networks to facilitate information sharing and mentoring.

Investment by small communities in their own supplies.

Cost benefit/cost effectiveness analysis tools can help overcome some of the challenges faced by communities by obtaining evidence to show that continued investment in small community water supplies is necessary.

On a global level, the share of assistance to water supply and sanitation in the OECD Development Assistance Committee members' total ODA fell from 8% in 1999-2000 to 6% in 2001-2002 and remained at 6% in 2003-2004. Although there was a downward trend in the amount of assistance for water and sanitation since the middle of the 1990s. the trend now appears to be in reverse, but is the assistance remains concentrated around relatively few donor and recipient countries. Between 2000 and 2004 three quarters of total bilateral support for water supply and sanitation was given by Japan, Germany, USA, France and the Netherlands. More than half of the allocations were directed to Asia; 15% went to sub-Saharan Africa (www.oecd.org/dac/stats/crs/water). It has been estimated that investment must double annually to achieve the MDGs for the water and sanitation (Global Water Partnership, 2000). Table 3.1 shows the assistance supplied to water and sanitation by donors from 1999 until 2004. Most of these sources are used to finance investments in infrastructure (oecd.org/dac/stats/crs/water). There is evidence that small supplies receive less attention and fewer resources than large supplies.

Table 3.1. Annual average commitments to water supply and sanitation by donor. Source www.oecd.org/dac/stats/crs/water,

Country or multilateral aid organization	Millions of US dollars (average)		
	1999-2000	2001-2002	2003-2004
Australia	58	21	25
Austria	14	12	19
Belgium	13	37	19
Canada	35	23	80
Denmark	118	31	140
Finland	15	20	9
France	209	176	163
Germany	377	344	366
Greece	1	1	1
Ireland	8	13	18
Italy	45	32	30
Japan	1159	512	858

Luxembourg	10	12	11
Netherlands	70	155	122
New Zealand	2	2	1
Norway	33	44	18
Portugal	9	1	1
Spain	90	59	63
Sweden	31	51	47
Switzerland	33	29	32
United Kingdom	151	101	52
United States	165	275	521
African Development Fund	37	124	148
Asian Development Bank	50	177	137
European Community	188	193	351
International Development Association	229	675	684
Inter-American Development Bank, Special Operations Fund	54	0	0
UNICEF	34	28	16
Total water supply/sanitation aid	3238	3147	3934

As discussed in later chapters, the benefits and the costs of increasing access to improved water vary considerably depending on the type of intervention selected and the population characteristics. In some cases, for example where vulnerable sub-populations are involved, the benefits of having a drinking-water supply close by may be far greater than for other cases. For policy-makers, health professionals and engineers to make informed choices about the type of intervention to be implemented in a specific locality, it is essential to carry out a sound economic assessment of the various options available in that particular livelihood context. This publication will therefore not offer any universal panaceas, but develop a methodology for economic appraisals and evaluations that can be applied sensibly to a range of local conditions.

GLOBAL DRINKING-WATER COVERAGE

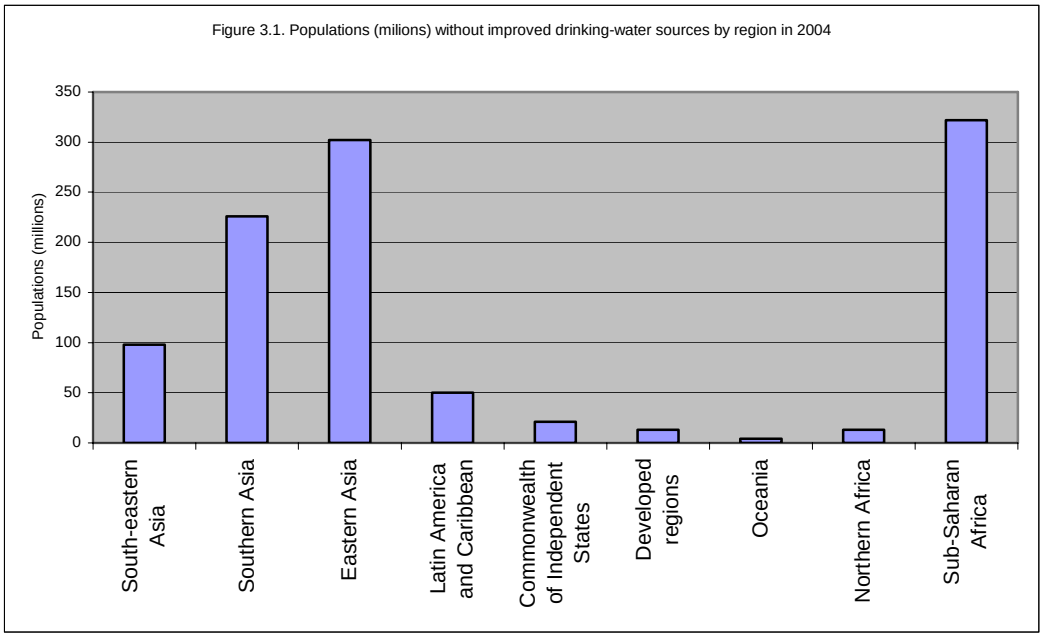
While the specific local contexts differ, there is a growing global challenge in accessing good quality fresh water. Competing interests of agriculture, industry and households together with growing human populations continue to place increasing demands on water resources and are having serious consequences on their quality. Globally, approximately one in three people live in areas of moderate to high water stress and it is estimated that two thirds of people will live in a water-stressed area by 2025 (UNEP 1999). The critical issues in terms of the causes and impacts of lack of water vary by region, but for developing countries the most urgent issue continues to be lack of access to safe drinking-water and adequate sanitation.

As discussed earlier, problems are not restricted to developing nations. Small communities in all countries face the greatest difficulty in supplying water of adequate quality and quantity because they have small customer bases and therefore often do not have the finances needed to hire experienced managers and to maintain and upgrade their water supply facilities. Interruptions in water service due to inadequate management, as well as failures of drinking-water standards, are problems for some of these systems in both developed and developing nations. Households may respond by storing water at home with new risks of contamination resulting from inadequate treatment or unsafe storage, as well as, in some parts of the world, the risk of increasing the breeding places of mosquito vectors of malaria and dengue. Although the problems of supplying drinking-water through individually operated small water systems are well known, the number of small water systems has continued to increase in some countries. For example, in the USA approximately 1,000 new small community water systems are formed each year (Committee on Small Water Supply Systems, National Research Council, 1997). Currently 9% of Canada's population are on private water systems and 16% on small distribution systems. At least one in ten Europeans (40-50 million people) receives his/her daily drinking-water from small and very small supplies, including private wells (Hulsmann, 2005), although the exact figure is not known. In some cases these supplies are not covered by national law and are not monitored unless requested by the owner.

For many people with vulnerable livelihoods, the daily problems associated with access to water seriously deplete energy, health, money and time. Inequalities based on wealth and location, together with flawed policies, mean that poor people pay the most and travel the furthest for water. Achieving even the basic minimum standard of access to water—20 litres per day of safe water from an improved source within one kilometre of the home—remains a huge challenge, with 1.1 billion people, including half of all people in sub-Saharan Africa, unable to meet this basic requirement (UNDP, 2006).

In 2002, 83 per cent of the global population used improved water sources (WHO/UNICEF, 2006) indicating that if improvements continue the MDG target will be reached. However, according to the Joint Monitoring Programme (WHO/UNICEF 2006) more than 1 billion people in 2004 were still without access to improved water sources. The global distribution by region is shown in Figure 3.1.

Figure 3.1. Populations (milions) without improved drinking-water sources by region in 2004



Each region has shown some improvement since 1990, with south Asia showing the greatest improvement in terms of coverage (+13%). The lowest drinking-water coverage is in sub-Saharan Africa and Oceania. Several regions such as northern Africa, Latin America/Caribbean and western Asia have achieved almost 90% coverage (WHO-UNICEF, 2006).

LIVELIHOOD ANALYSIS

In the 1990s, the livelihoods framework was developed to understand how people were coping in challenging situations, notably poor people in rural areas with low agricultural productivity. The framework assumes that every rural society can be

seen as having changing patterns of natural, produced, human, and, social wealth/capital. In summary:

- the physical environment is a reservoir of **natural wealth** important to human well-being in itself and capable of self-development;

- human activity in the natural environment results in **produced wealth** that has a physical life and productive potential beyond immediate human consumption;

- people can also develop their capabilities into skills whose expression over time as **human wealth** is both means and end to long term development;

- societies have collective histories of building trust, confidence and mutual security into relationships that constitute **social wealth**.

Conventionally, the basic building block of livelihoods analysis is the household where significant elements of the wealth portfolio are held in common and utilised to the joint benefit of all members of the household. In most societies the arrangements for collecting and utilising drinking-water would be an excellent example of such co-operative activities, though time and energy use in collection may well not be equally shared.

Though the household is the basic building block, livelihoods analysis can be adapted to recognise intra-household inequalities, as in gendered differences in responsibility for collecting drinking-water. It can also be adapted to recognise the importance of numerous forms of migration which give many households a "fuzzy" boundary in terms membership, often resulting in inflows of financial remittances that can offer possibilities of investing in improving drinking-water access if favourable natural and social conditions exist.

Livelihoods analysis provides a micro-level tool for understanding the opportunities and constraints faced by the target population for an intervention. But it is policy decisions on larger scales up to and including the global, that are crucial to determining whether resources are made available to radically change access to drinking-water. As discussed in Chapter 1, an increase in the sustainable access to safe water in developing countries is a major international goal that is embodied in the Millennium Development Goals (MDG's) (UN 2006). The benefit to livelihoods of improved access to safe drinking-water, notably working through improved human wealth in terms of better health and increases in time and energy made available for additional productive activities, is a strong argument to support additional resource allocations towards achieving this goal globally.

WATER FOR DRINKING AND LIVELIHOODS IN RURAL AREAS

Sustainable access to sufficient safe drinking-water, sanitary removal of excreta and personal hygiene are three major factors which contribute to enhance public health in rural areas. The quality and reliability of a water supply service is an important factor for the improvement of the population's health. Ideally, the whole community should be served efficiently and effectively. However, the water supply service in rural areas often has limited coverage and/or low continuity. This means that much of the population has to resort to other sources of water and/or to store water in the household to cover their basic needs. Both of these measures can result in the deterioration of the water quality and the consequent exposure of consumers to communicable water-related diseases. Unsafe storage can also increase the risk of vector-borne disease transmission.

Data from the JMP report (WHO/UNICEF 2006) show that in 2004, 84% of the population without access to an improved source of drinking-water live in rural areas. Figure 3.2 shows clearly the disparity between urban and rural areas in terms of global populations served by an improved water source (as defined in Table 3.2), highlighting the magnitude of the challenge that faces the international community to improve the living conditions of the poor. According to (WHO/UNICEF 2006), in 27 developing countries less than 50% of the rural population have access to improved drinking-water (Figure 3.3) and face health risks as a consequence.

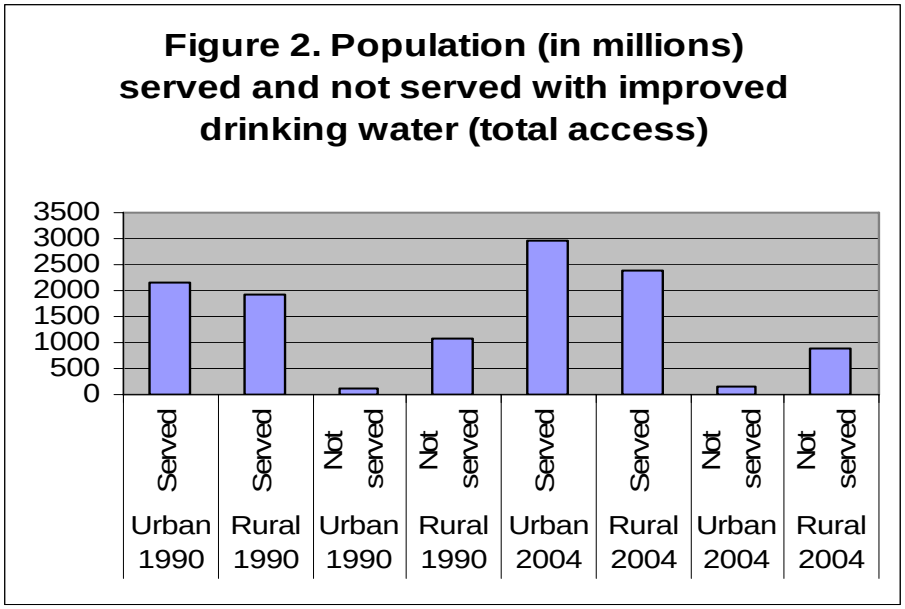


Table 3.2 JMP definitions* of improved/unimproved sources of drinking water (WHO/Unicef, 2006)

Improved water supply	Unimproved water supply
Piped into dwelling, plot or land	Unprotected dug well
Public tap/standpipe	Unprotected spring
Tube well/borehole	Cart with small tank/drum
Protected dug well	Tanker truck
Protected spring	Surface water (river, dam, lake, pond, stream, canal, irrigation canal)
Rainwater collection	Bottled water

*These are the definitions that are current at the time of publication; they are evolving and are likely to change over time.

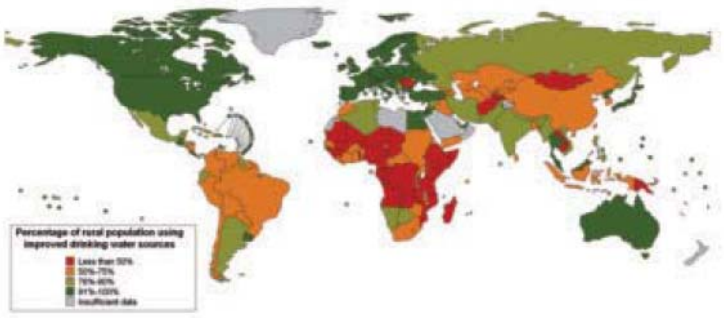


Figure 3.3 Rural coverage of drinking water from an improved source in 2004 (WHO/JMP report, 2006).

In the 2006 Human Development Report, *Beyond Scarcity: Power, poverty and the global water crisis*, the UNDP claims that the statistics published in the JMP report may underestimate the numbers of people without access to improved water due to under-reporting by some countries (UNDP 2006). According to UNDP (2006) there are three distinctive features of rural water provision that explain the low coverage: (1) the rural population tend to live in dry areas which are subject to seasonal shortages of rain (a natural wealth constraint in livelihood terms); (2) in most rural areas, people self-provide, maintain and expand the water systems using scarce human and produced wealth resources. This requires high levels of community mobilization (social wealth in livelihood terms) and often the involvement of local government rather than large municipal providers. The accountability of these bodies and the strength of community involvement influences coverage; (3) highly dispersed rural populations, especially in marginal areas, often have very little political influence and therefore little say over resource allocation.

UNDP (2006) also notes that because the poor are particularly vulnerable to the inadequate provision of services, they will benefit disproportionately from improvements to these services. For example, household surveys conducted by UNDP have shown that in Uganda, access to an improved water source reduced the risk of infant mortality by 23%. Similarly, in Egypt, access to a flush toilet reduced the risk of infant death by 57%.

Health and livelihood issues associated with access to water

The types of interventions with potential to reduce diarrhoeal disease in rural communities will be discussed in Chapter 6. Because diarrhoeal diseases are generally of faecal origin, interventions that prevent faecal material entering the environment are likely to be of greatest significance for public health. Yet, there are a host of livelihood issues which are influenced by the need for water. Livelihoods comprise the capabilities and assets that people need to make a living and maintain their well-being (UNDP, 2006). In rural areas water plays a crucial role for obvious reasons. Access to a reliable supply of water allows people to expand their livelihoods, increase productivity and reduce the risks associated with drought.

Most research undertaken in the area of benefits and costs of providing sustainable access to safe drinking-water to households has focused on the relationship between water and disease. Less has been written about the costs to health other than diarrhoeal diseases that may affect individuals involved in collecting water. This issue is introduced here but will be discussed in further detail in Chapter 5.

In broader livelihood terms, women and young girls are particularly at a disadvantage since they sacrifice their time and their education to collect water. In addition, Ferguson (1986) suggests that women, in particular, are subject to a high degree of physical stress resulting from carrying heavy loads of water. Evidence of such stress and accompanying ill-health is presented using data from a survey conducted in Kibwezi Division of Machakos District, Kenya. Higher-than-average economic dependence on women is shown in the demographic structure. Water collection patterns show that 70% of all trips are made by women over 15 years of age over a median distance of 3.5 km and that 87% of women collecting water carry loads without any mechanical assistance compared with 42% of men. Using functional criteria, the data suggest a higher prevalence of chronic disablement amongst women, compared with men, and the disabilities mentioned tend to reflect the hard lifestyle of women in Kibwezi.

Previous studies undertaking cost-benefit/cost-effectiveness analysis have tended to ignore the benefits other than improvements to health in terms of reduction of diseases as a result of improved water availability. A report commissioned by the World Bank concluded that the most obvious benefit is that water is made available closer to rural households (Churchill *et al.,* 1987). This allows time saving, more convenience, saving of energy, and money, and prevention of injury from carrying heavy containers of water.

The time-saving by the provision of access to water close to the home is substantial in some cases. As indicated by the UN Commission on the Status of Women (UNCSW 1995), excluding India and China, Africa emerged as the region

where the largest number of rural women (56 per cent of those between 10 and 49 years of age) are affected by water scarcity. This compares with some 32 per cent, in Asia; and 46 per cent of all rural women in the same age group in Latin America. Such a high proportion indicates that, despite the highly urbanized nature of Latin America and the general abundance of water, there is still a significant number of areas where water scarcity, at least seasonally, imposes a burden on women in their daily lives. On average, women in developing countries may spend as much as 1.6 hours a day collecting water in the dry season, and 0.6 hours a day in the wet season. Unfortunately, no studies have been made of the relationships between desertification, deforestation and water collection time. (http://www.un.org/documents/ecosoc/cn6/1995/ecn61995-3add1.htm; accessed 13 November 2007). A study by Wodon and Blackden (2006) (Table 3) shows the time women and men spend in collecting water (per trip) in rural areas in selected countries.

Table 3. Time (minutes) women and men spend collecting water (per trip) in rural areas (adapted from Wodon and Blackden, 2006)

Benin, 1998		Ghana, 1998/99		Guinea, 2002/03		Madagascar, 2001	
Women	Men	Women	Men	Women	Men	Women	Men
62	16	44	34	28	6	32	8

A study by Roy et al. (2005) showed that in the community of N'atipkong/ Ngendui, Kenya, women report spending an average of three and a half hours each day collecting water during the dry season and double that (because hillsides are slippery) in the wet season. They used between 40 litres (elderly women) to 100 litres of water each day. Eight women from this community provided estimates of water quantity collected and time taken (Table 4). The women's answers suggest weekly water collection times of almost 25 hours in the dry season and nearly 50 in the wet season. In the community of Kiptagan, where piped water has been introduced, women recall devoting 13 to 22 hours per week collecting 3 to 4 jerry cans of water per day. "Those who are connected to a piped water system," they reported, "*save an average of 15 hours per week. We can now use this time on economic activities.*"

Children also collect water, particularly at weekends, but they take longer because they play at the water source, and collect less; 10 litres instead of 20 per trip. Nevertheless, the woman or women of the household have less to fetch when the children are involved in collecting water (Swallow et al. 2005).

For comparison, it has previously been reported by data from the UN statistical office (Anon. 2000), that water collection times for villages in Kenya average just over four hours per day, in the dry season, and two hours in the wet. The same source reports times in the range of four to six hours in Burkina Faso, Botswana and Cote D'Ivoire. Water collection times of 17 hours per week are reported for Senegal and 15 hours for the dry season in Mozambique. Thus, the water collection times reported for Kiptagan (15 hours) and Ngendui (25 to 50 hours) are similar to, or higher than, the highest averages reported for Africa.

Table 4. Women's domestic water collection times in the dry season in Ngendui, Nyando Basin, Kenya (source: (Roy et al. 2005)

Woman	**Quantity (litres per day)**	**Time (hours per load of 20 litres)**	**Time (hours per day collecting water)**
1	80	1	4
2	80	0.5	2
3	60	0.5	1.5
4	100	1	5
5	60	1	3
6	100	1	5
7	40	1	2
8	40	1	2
Average	70	-	3.5

Another study undertaken by Swallow et al. 2005 looked at five villages in the same region of Kenya – the Nyando Basin. Table 5 shows that households in these villages spent on average 1.9 hours per day collecting water in the dry season and 44 minutes per day collecting water in the wet season. The average amount of water collected was 100 litres per household per day in the dry season and 25 litres per day in the wet season. It is not clear whether less water is used in the wet season or whether water is obtained from alternative sources.

Table 5. Dry and wet season collection of water in five villages in the Nyando Basin, Kenya. Source: (Swallow *et al.* 2005)

	N	Minimum	Maximum	Mean	Standard deviation
Time spent (hours per day) collecting water during dry season	134	0.02		1.9	1.5
Volume of water	139	18	270	100	47

(litres) collected in the dry season					
Time spent (hours per day) collecting water during the wet season	93	0	6.0	0.7	0.8
Volume of water (litres) collected per day in the wet season	140	0	160	25	32

Drawers of Water I, a field study undertaken in Kenya, Tanzania and Uganda between 1966 and 1968 (White *et al*, 1972) suggested that the addition of a closer but still distant water source, would not necessarily increase household water use. White et al. found that in situations where water must be carried, the quantity brought home varies little for sources between 30 and 1000 metres from the household. The study also showed that the provision of a rural water supply requires a more flexible approach than a supply driven approach, and promotes greater support for community-based and individual initiatives. In the late 1990s the study was repeated by Thompson et al. (2001). The study showed some changes had taken place and discussed the decisions taken by households to deal with the changes. In some places the reliability of the piped water supplies had deteriorated due to rising populations increasing stress on the system, and inadequacy of government authorities. In such a situation households may take the decision to store water as well as look for alternative sources which may be unimproved (and therefore a health risk) or private (and expensive).

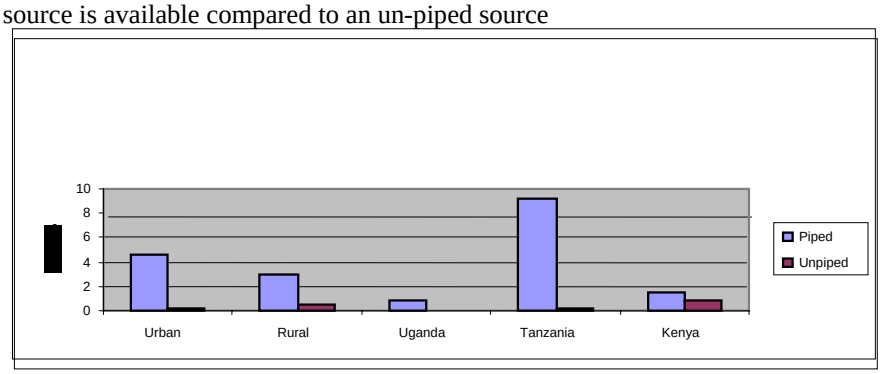
Inadequate access to water can restrict a household's choice. In the worst terms this means a choice between bearing the costs of potential ill health, use of scarce financial resources or large expenditures of time and effort (Thompson *et al.*, 2001).

Mertens et al, (1990) found that 10% of women in Sri Lanka had to travel more than one km to their nearest source of water. Feacham et al, (1978) suggest that providing a water source close to the home has very little effect on consumption unless it is closer thanone km (less than 30 minutes roundtrip) from the users' home. However, water consumption doubles or triples when house connections are provided (White et al. 1972) and this may significantly improve hygiene practices. It has been suggested that domestic hygiene is the principal determinant of endemic diarrhoeal disease rate (Caincross and Valdmanis 2006). Therefore, it may be that in some cases the additional cost of a house connection is offset by time saving benefits. Indeed, Cairncross and Valdmanis (2006) found that putting a standpipe in the vicinity of a house does not lead to improvement in health as compared to

having a more contaminated source nearby. The presence of a household tap significantly improves health. Putting an economic value on the time-saving benefit is discussed in Chapter 9.

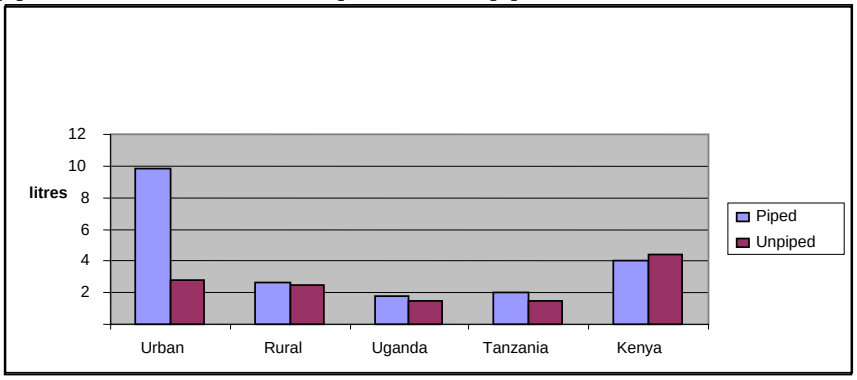
In terms of other uses of water there are also indications of differences reported in the quantity of water used when there is a piped source available compared to when an unpiped source is the only option. Figures 4 and 5 show the difference in use for amenity (e.g. watering gardens) and production (e.g. consumption by livestock, construction of houses, irrigation).

Figure 4. Difference in amount of water used (litres) for amenity use when a piped source is available compared to an un-piped source



Source: adapted from: Thompson *et al.*, 2001

Figure 5. Differences in amount of water used (litres) for productive uses when a piped source is unavailable compared to an unpiped source.



Source: adapted from: Thompson et al. 2001

As Cairncross and Valdmanis (2006) report there are several reasons to assign a monetary value to time saving. For example, households often pay others to deliver their water, or pay to collect it from a nearby source rather than collect it free from more distant sources. Thompson et al. (2001) showed that since the 1970s the proportion of urban east African households without a piped water supply paying for water had increased from 53% to 80%. Since the poorest households typically spend 90% of their household budget on food, any money that is spent on water is deducted from the food budget (Cairncross and Kinnear, 1992). The provision of water more cheaply indirectly contributes a nutritional benefit to the poorest.

CONCLUSIONS

Small and rural communities are particularly vulnerable to the problems associated with poor access to water and quality of small scale supplies. The availability of a good quality water source close to home has numerous benefits, especially in terms of human wealth with subsequent linkages to all the other dimensions of livelihoods. Such human wealth gains have an intrinsic value in terms of quality of life as a developmental end as well as a means for higher economic productivity. In developing countries women particularly benefit as they are usually the main collectors of water. In developed countries small water supplies are vulnerable to contamination and although communities reliant on these supplies in developed countries generally do not face the same issues of access to water they face other

challenges associated with the quality of the water supply. The benefits associated with the availability of safe water provide a strong argument for the provision of greater resources to fund interventions to improve access to drinking-water as a key entry point activity for much wider livelihood benefits.

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