A hidden link between water and food security: the multiple use of domestic water supplies[1]

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Introduction

Both water and sanitation[2] and food[3] are recognised as human rights. These are rights that every world citizen is entitled to enjoy. Our professions, governments and agencies work diligently, but mostly separately on these two issues. In some places, such a clear separation of efforts is not always possible or sensible though. Water and food are especially closely linked in rural and peri-urban areas in low income countries, and here, efforts to improve access to water and food security demand integrated components that build on the potential synergies. Families integrate their own efforts after all, and many traditional water supplies schemes cater for multiple uses. To maximize the developmental impact of their work, this is something that professionals and organisations need to get better at too. This article highlights one neglected area – the productive use of domestic water supplies - where such a coordinated approach is required.

Links between water and food security

Some of the links between water and food security[4] are obvious. Some 70% of the world's water abstractions are for irrigation of crops (WWDR, 2009), and the rain-fed bread-baskets of the world like the North American Great Plains underpin the global food supply. But near the household, there are links between the provision of basic water and sanitation services and food that are hidden.

Most poor families – in rural and (more obviously) urban areas - do not have access to irrigated lands or fields watered by adequate rainfall. But, governments and their development partners are working hard to extend access to domestic or 'basic needs' water and sanitation to everyone. While universal coverage is still a long way off in many countries, and globally 780 million still do not have access to an improved water source according to the latest Joint Monitoring Programme report (WHO/UNICEF, 2012), a lot more people do now have access to domestic water supplies than they did a couple of decades ago. An increasing proportion of those use piped water supplies[5]. Improved or not, these 'domestic' or 'drinking' water supplies provide a supply of water fairly close to the home, and it is not only drunk. Drinking might be the most important and high profile use, but most of it will be used for something else.

We all only need a few litres of water for drinking, but the so-called domestic water supplies do something else that is only rarely recognized. At the household level a little water sometimes goes a

[1] This article is based upon a presentation by the author for the seminar '*Agua y alimentacion, por derecho*' organised by Ongawa in Madrid on 20 March 2012.
[2] Water and sanitation recognised as human rights since UN resolutions in 2010, see www.righttowater.info
[3] Food as a human right has a longer history linked to the International Covenant on Economic, Social and Cultural Rights, see http://en.wikipedia.org/wiki/Right_to_food
[4] Linking water and food security was the thematic focus of the World Water Day in 2012 and is the subject of several related events and conferences in 2012 including the Stockholm World Water Week.
[5] Access to piped water supplies was estimated as 46% for the developing regions in 2010, compared to 32% in 1990 (WHO/UNICEF, 2012).

long way, and a growing number of case studies show that rather a lot of domestic water supplies are also used for food production and other cost-saving or income generating activities (Butterworth et al., 2003; Moriarty & Butterworth, 2003; Moriarty et al., 2004; Butterworth et al., 2008; van Koppen et al., 2009). Small gardens are frequently irrigated from domestic water supplies or the small quantities of wastewater that each household generates, and a few livestock may drink much more than their owners.

Something similar goes on in the irrigation or 'productive' water sector which for a long time ignored other demands or use of water within irrigation scheme command areas such as for livestock, domestic water supply or smaller-scale home gardens. Studies have more recently shown these uses to make major contributions to the productivity of irrigation schemes (Bakker et al., 1999; Van Koppen et al., 2009) with much potential for improvement.

When we plan and design domestic water supply systems in low and middle income countries, people turn out to have a persistent habit of using that water not only for drinking and other basic domestic uses (like food preparation, washing and cleaning) as recognized by the WHO and the national governments that establish standards on what domestic uses are considered to be and how much water is required for these activities. In practice, it's quite hard to stop people trying to be productive and using some of that water for productive uses like small-scale gardening, keeping a few livestock or micro-enterprises. In some parts of Ethiopia (a country that we will use a case study later), people let their livestock drink before themselves.

Although actual use is always context specific and with lots of variation linked to opportunities and the availability of alternative sources, it is not a bad rule of thumb that half of domestic water supplies in rural areas in developing countries will be used productively rather than for basic needs. This has been found in cases from Ethiopia where water consumption might only be 10 litres per capita per day (lpcd) in some drier areas, to more humid locations in Colombia where consumption could be over 150 lpcd. Or put another way, the use of domestic water in productive activities is more likely to be closer to 50% than 0% as is commonly assumed. The potential for more productive water uses as the volume of domestic water provided increases is neatly captured in the ladder of domestic and productive uses developed by Van Koppen et al. (2009).

This multiple use is recognized only to an extent. Domestic water supply systems in the pastoral areas of Ethiopia for example do take account of livestock demands, and elsewhere in the country, livestock drinking water troughs are frequently constructed as part of domestic-focused rural water supply systems. More commonly, productive uses of domestic water supplies are unplanned or de-facto. Use of domestic water systems for productive activities isn't always officially permitted, sometimes it is criminalised, and it is very rarely planned for, but families frequently do it anyway. At best, a blind eye is turned, but this means that multiple uses are rarely optimized and problems are invited relating to the fair allocation of water, hydraulic performance, and collection of revenue to cover costs. While the logic of production and income generation comes to the fore for poor families in using water, this can contrast with the health-driven pre-occupations of most professionals working in the water sector and their more specialised approaches.

One irony is that while we focus on safe drinking water for its health benefits, we ignore other health-related benefits of domestic water supply systems including impacts on nutrition through small-scale production and the use of bulk water for keeping ourselves and our homes clean. We don't know how

many calories are produced depending on such domestic water supplies and other small-scale water sources near the home. And probably, rather than calories, it is the high nutritional value of many productive uses of domestic water that is even more important. Examples include the vitamins produced by a single papaya tree that might be irrigated by wastewater, the milk and eggs produced by a few small livestock, or the green vegetables grown on a small backyard plot. And as well as being consumed, even very small levels of production can, if regular, have an important impact through costs saved on food purchases or small amounts of cash generated by sales that can then be saved and re-invested.

A study synthesizing information on costs and benefits of multiple uses of water (Renwick et al., 2007) suggested that the extra benefits of providing the extra water needed more than cover the incremental or extra costs. However, there is as yet little information for communal domestic water supply systems on whether those extra benefits can be turned into revenue to help keep systems running. The results of the most recent studies in Senegal and Kenya therefore are intriguing. In studies on piped water supply systems in Senegal and Kenya, Hall *et al*. (2012a, 2012b) found a positive correlation between sustainability and the level of productive uses.

Seeking integrated approaches

Perhaps we shouldn't want to stop activities that have important benefits for food security, nutrition and income generation? Perhaps it makes sense to link these rights better in implementation? One way to do that, is through the multiple use water services (MUS) approach that is being championed by the MUS group, a network of water-related agencies across the WASH and irrigation sectors[6].

Multiple Use water Services (MUS) is an old concept that is now rediscovered (and promoted by the MUS group) as a promising participatory approach to water development and service provision. MUS takes the multiple needs and priorities of water users, and recognition of the practice of widespread use of multiple conjunctive sources, as the starting point for planning investments in new infrastructure or rehabilitation, or better management (van Koppen & Smits, 2011; IWMI/IRC/GWP TAG, 2006).

Different modalities for MUS are identified by van Koppen & Smits (2011) as: *de facto MUS* (see above) where users make adjustments to existing systems to meet their needs (with sustainability and equity risks), two partially integrated models termed *domestic +* where planned improvements are made to mainly domestic water supply systems and *productive +* where similar improvements are made to irrigation systems, and two more fully integrated models at the household level (*user driven MUS*) and community level (*community MUS*) where systems are conceived and designed from the outset to serve multiple uses.

MUS is another attempt to integrate things in the water sector like WASH, IWRM, and watershed management (Srinivasan *et al*., 2012). But integration or coordination of interventions like this comes with its own complications. It is not always obvious or straightforward what to do to maximize the benefits that people can derive from their water supply systems without compromising on safe water quality and the health benefits that we want to see. The institutional barriers within the water sector are in reality a powerful disincentive to integrating provision of water for domestic and productive uses.

[6] Details of members of the MUS group and their work can be found at www.musgroup.net. One of the members WINRock recently produced an accessible video and guidelines at http://www.musgroup.net/page/1461 and http://www.musgroup.net/page/1480. Another more detailed set of guidelines by Adank *et al*. (2012) are also available.

Designing and managing communal schemes for multiple uses can be complex and challenging with the competition and conflicts hard to reconcile or avoid. That said, there are a growing number of examples to add to many traditionally integrated approaches, and the next chapter focuses on some examples from one of the poorest but most rapidly developing countries in Africa.

Case study: multiple use services (MUS) in Ethiopia

Water and food security are both vital concerns in Ethiopia, and closely related. A history of food insecurity and terrible famines is underpinned by low levels of access to water, but that is slowly being addressed through water and agricultural sectors efforts to provide domestic water supply systems and small-scale irrigation projects. MUS could apparently make an important contribution, and the ideas are being picked up and embraced, in the dialogue at least. However, there is much to be done for MUS to become a service delivery model in its own right, or even a recognised and deliberate component of other service delivery models.

Box 1: Linking domestic and livestock water supply

In 2002, a borehole with a diesel pump was installed in the central village of Ajo in Legedini, Eastern Harerghe. Later this was extended with several reservoirs and a network to reach the hamlets of Hallo, Edo and Edo Bolo. The improved water supply was used for domestic purposes, including the watering of small and dairy animals that are kept near people's houses. Domestic water consumption increased but remained were low at only 8-17 lpcd, but even this was sufficient to facilitate some multiple uses, in particular for livestock watering which has a high priority. Animals could now drink twice a day instead of once every two days. Because they did not have to walk so far, the number of spontaneous abortions in cattle diminished. They had better appetites and, combined with the higher water intake, produced more milk per animal. Now women could sell 0.5 – 0.75 liters of milk per day in the market with extra income spent on the household. The better water supply also enabled people to use kitchen wastewater for irrigating papayas for the local market and home consumption.

The system has allowed for different water needs as identified by the community and can easily be extended and upgraded over time. Though the cost of pumping is high and fuel is not always easy to obtain in this remote area, users have been interested in contributing local material, labor and even cash to further develop their water supply. By setting up a water committee, the community reported they had gained access to banks as a new way of saving instead of keeping livestock as assets. The community members went as far as to say that a multiple use approach to water is the only way to manage limited supplies in an arid environment.

Source: Eline Boelee (IWMI), based on work by Esther van Hoeve, Pauline Scheelbeek, Martine Jeths and Desalegne Simachew.

MUS in policy, parlance and practice

A report produced recently by IRC and partners for the Rockefeller Foundation, reviewed the potential for multiple use services[7] in Ethiopia and identified some possible entry points for interventions (Butterworth et al., 2011; see also Adank *et al*., 2012 and Faal *et al.*, 2009 for further examples). The

[7] Stakeholder meetings in Ethiopia have preferred talking about multiple use services (MUS) to multiple use water services, highlighting the interests in sanitation and productive use of wastes as well as water.

study reported reasonably wide recognition of the potential merits of MUS in Ethiopia as a result of innovation by NGOs and advocacy by research institutes, including participation in the global MUS Group international conference that happens to have been held in Addis Ababa in 2008 (Butterworth *et al.*, 2008). MUS was also mentioned as an approach in the guiding strategic plan for the water supply sector, the Universal Access Plan, in 2009 (MoWR, 2009).

Several NGOs in Ethiopia have been implementing and upgrading community managed systems that cater for domestic and productive water uses like irrigation, watering livestock and other micro-enterprises, and integrating these different uses to try and maximize the broad livelihood benefits that are linked to various health, food security and economic development outcomes. This includes the development of point sources like wells and boreholes, the development of springs and in drier areas, the tapping of river bed aquifers (see Boxes 1 and 2 for some examples). The provision of livestock troughs with community domestic water facilities is also a fairly standard intervention (although they are not necessarily widely used). In addition, households have been implementing systems that serve their multiple needs for water through the approach known as self-supply (Sutton *et al*., 2012). Family wells have been developed by tens of thousands of households, and more often than not are used for multiple purposes with increasing productivity being a key driving force for making this private investment.

The acronym 'MUS' is itself increasingly a part of the sector discourse in Ethiopia and interest in MUS is apparently on the rise. Workshops are organized on the topic and more and more often IRC and its partners are invited to talk about it. However, MUS interventions and modalities have generally not been scaled up widely in the country. This seems largely due to the same barriers that MUS faces elsewhere: the conventional institutional structuring of water policies, water services implementation programs, and professional disciplines into fragmented, parallel operating 'vertical' sectors of single water uses such as rural water supply and agriculture.

Box 2 Sand rivers for MUS

The NGOs HCS and RiPPLE are developing water resources in some of the driest parts of Ethiopia for multiple use schemes that meet irrigation, livestock and domestic requirements. In some of the drier lowland parts of Ethiopia, ephemeral sand rivers are a vital water resource. Walk along any sand river in the dry seasons and you will meet many women collecting water from scoop holes in the dry river bed. Many will mention that they are there because a distant hand pump has broken down. The sandy rivers beds contain an aquifer of water that can be exploited in other ways. Sub-surface and sand dams both aim to increase the storage of water in these sand river aquifers so that it can be more easily utilized. Sub-surface dams aim to retain the underground base flow along such sand rivers behind an impermeable below-ground structure constructed in the sandy bed. Possible materials include clay, masonry or plastic sheeting structures. Sand dams have a similar function but are constructed largely above group along sand rivers, at points where there are stable banks, usually of masonry. The sand dam quickly fills with new sandy sediment behind the structure creating a new or deeper sand aquifer. The structures can be raised each year capturing more sandy sediment and increasing the storage capacity. Both kinds of structures are vulnerable to flood damage and their lifespan can be rather short. Much of the research on these kinds of structures has focused on how to build structures at low cost that do not get quickly washed away. The water retained by sand dams and sand surface dams can be exploited from wells in the river bed or on the river banks, or alternatively through canals to downstream irrigation areas.

Source: MUStRAIN project

Scaling up MUS

MUS could play an important role in helping the domestic water sector achieve its target of universal access by 2015 by generating the income needed to drive private investment in self-supply, and potentially improving the sustainability of communal water supply schemes. It is also likely that good entry points could be identified through further engagement with the agricultural sector which has its own ambitious plans to develop 1.5 million hectares under smallholder cultivation over the next 5 years, which represents a seven-fold increase. MUS approaches would have the potential to make a contribution to this target, and the inclusion of domestic water thinking could help to broaden the benefits of agriculturally-focused development of groundwater (Box 3).

Box 3 Improving irrigation-focused programmes

Sutton & Hailu (2011) found IDE and its partners to have one of the best models for taking the rope pump to scale through a programme that also includes manual drilling. However, manual drilling includes the use of animal manure to lubricate the drill which potentially contaminates wells. Many rope pumps installed for irrigation in other programmes were found to be badly installed, and relatively simply protection (installing the pump slightly above ground level) which reduce contamination. This is important since many of these wells will be used for drinking, whether that is intended or not.

In rural water supply, conventional improved sources are found to hold more limited potential for MUS. There are exceptions such as spring developments and the exploitation of sand rivers discussed in Box 2, but the pressures on wells and boreholes developed for domestic water supply are typically high and the designers are generally not given flexibility or able to design for multiple uses beyond providing livestock troughs. However, two new formalized and more decentralised financing and service delivery mechanisms in the rural water supply sector create new opportunities for scaling up MUS and related technologies: the Community Managed Project (CMP) approach and self supply. These mechanisms offer potential for scaling up MUS because they both decentralise aspects of decision-making to people in communities or households. And we know, that given the choice and enough influence over planning, people will try and build in multiple uses where relevant and possible (see Box 1 for example).

Self-supply

Self supply, the development of water sources through household-led investment, has been found to be as important for productive uses as it is for drinking water supply and other domestic uses. Two surveys of family wells in 2010/11, undertaken in SNNPR and Oromia, investigated the use and performance of traditional wells, making comparison with protected communal sources (hand-pump on dug-well or borehole) and focusing on potential for such traditional sources to provide safe and reliable domestic water supplies (Sutton *et al.*, 2011; Sutton *et al*., 2012). The sample was therefore specifically of family wells that were used for drinking (many other family wells that exist were not included in the study). Nevertheless the study also identified that family wells are often used for multiple purposes, while this was rarely found to be the case for communal handpumps (Box 4).

Box 4 Making multiple use of traditional wells

Productive use of water was found to be almost non-existent from communal supplies (limited to some animal watering only in about 15% cases). Often these sources are located distant to the home, and collecting water frequently involves a lengthy wait as well. In comparison, family wells were found to be widely used for animal watering, especially in SNNPR (85% wells), and also used for irrigation. Irrigation

use was typically made of 15-30% of the family wells without improved lifting devices in the different regions and studies. Rope pumps and mechanised pumps were found to support animal watering and irrigation. Irrigation use increased to 43% of wells when they were fitted with rope pumps. In Oromia, a study of mechanised wells showed found that owners who had invested in diesel or electric pumps almost always used them for animal watering, and 68% also used them for irrigation.
Source: Sutton *et al*., 2012.

Two main conclusions were drawn about multiple uses from these studies. Firstly, communal handpumps do not generally contribute to productive uses of water. Secondly, having your own well allows an owner to water animals more easily and so keep larger numbers, and the higher the level of investment in a lifting device the more likelihood of the well generating income from irrigated crops. However even basic unprotected sources are often used for growing vegetables for sale or own consumption. A family well can therefore contribute to poverty reduction directly through productive water use, as well as indirectly through aspects such as time saved and improved health.

Self-supply is currently not actively supported by government, although since earlier this year it is now policy (self supply is now one of the four rural water service delivery models) to do just that and a Self-Supply Acceleration Programme (SSAP) is being developed. What we do know is that family wells are used for multiple uses (by design) and there are existing experiences at scale to learn from, albeit without support having been available. In seeking to overcoming weaknesses in the enabling environment that currently hamper acceleration and do little to encourage safe water quality, sustainability or multiple uses, the existing incentives that seem to work, at least partially, in letting self supply develop at scale should be built on.

The SSAP involves creating a better enabling environment for self supply so that it takes off faster and more wells are upgraded (making drinking water safer) and equipped with improved lifting devices (improving water quality but also facilitating more bulk water use for animals, irrigation and other activities). This is planned through a mix of awareness raising and promotion, work on technology options and advice, strengthening the private sector, supporting financial systems to do more to extend micro-credit and enabling government policies and planning at all levels, and monitoring, research and learning. It is an initiative that is only just starting, but should self supply take off in Ethiopia, it is likely that it will be because of the productive uses and benefits as much as the need for more sources of drinking water.

The agricultural sector also has ambitious plans to extend self-supply and there is potentially much to gain in terms of access to safe water and increased productivity through linking these efforts, although to date, that has not yet happened.

Community Managed Project Approach (CMP)

Another opportunity identified to scale up MUS is through the Community Managed Projects (CMP) approach. CMP is a nationally recognized approach for rural WASH, in fact now the priority approach for communal supplies, and being rolled out nationwide[8]. In theory, the decentralization of decision-making to communities in CMP ought to facilitate MUS. However, this has until now not been actively promoted or facilitated to date by agencies involved in CMP. Working with the micro-finance institutions involved, one option is to pilot mixes of 100% grant (the current modality) for basic WASH infrastructure, mixed grant/loan for some add-ons and additional 'productive infrastructure' at community level, and 100%

[8] See www.cmpethiopia.org for more information

loans for household level investments. A new UNICEF-implemented integrated project that mixes WASH, MUS and community-based nutrition (a project known as NUWI2), and which also uses the CMP approach, aims to now test MUS approaches at scale. It is probably the most substantial effort to implement MUS at scale through a 'domestic-plus' modality anywhere.

Coordination requires investment

Scaling up MUS in Ethiopia through self supply, CMP or other pathways is going to require learning within the sector, development of links to other sectors (especially agricultural and micro-finance) and an active programme of action research. But currently there is no learning network or community on MUS developing policy and practice in Ethiopia, learning from experiences in other countries and encouraging coordination across departments and institutions. MUS has not yet been comprehensively picked up by any of the sector platforms or networks. This would be timely given that there are several new MUS initiatives in the country and rising interest. Coordination and learning could improve within the Ethiopian water sector (especially between sectors like water, health, education and agriculture) and between levels (national, regional, woreda or district). A well run and well documented capacity building and learning platform or network on MUS could create synergies and maximize impacts. Activities might include workshops, training courses, a dedicated website, additional case study documentation to support ongoing initiatives and seed funding new initiatives. But that is a project for a far-sighted development partner interested to build links across sectors, in a context where investment is pushed towards new infrastructure development, and anything else risks being seen as a distraction or an unnecessary overhead. What will be critical over coming years is whether the government engages with MUS, including both water and agriculture and at federal and regional levels. Unless there are more champions within government, and more replicable models that are well documented and shared, it is hard to envisage rapid uptake.

Concluding thoughts

This article started by linking rights to water and food, and we have seen that recognizing and unpacking the productive uses of domestic water through the Ethiopia case study is one important area where coordination or integration of activities through MUS could yield better results. Three key policy implications are identified.

Effective cross-sectoral collaboration requires investment

MUS hinges on cross-sectoral collaboration and the Ethiopia case illustrates that that is something NGOs find easiest given their limited scale, interest in participatory approaches and portfolios of interventions, but it is harder for the UNICEFs and more critically, government. Different approaches require different forms and degrees of collaboration. Self supply, which requires more minimal government support with hardware being funded by users, needs different forms of collaboration to communal improved water supply investments where finance and more aspects of planning need to integrated. In Ethiopia, the lack of champions for MUS in government and the limited available investment for action research and learning would suggest that upscaling of MUS, if it happens, might well be a slow journey.

'Some for all' need not be interpreted as only focusing on basic domestic needs

Unplanned MUS probably does not reach the poorest, and MUS raises equity concerns as a result. But the need is to look more at planned at deliberate multiple use systems to see how these perform. While there is no harm, and it's a necessity in fact, to make sure that everyone has their basic needs fulfilled, higher levels of service that facilitate productive uses need not mean that some people get less (in terms of quantity or quality). Less compared to what? Less compared to the situation before? Or less compared to what other people are getting? Perhaps water supply is not always a zero sum game in

terms of water or the funds available for investment? In fact 'some for all' might even depend on providing 'more for some'. If people that have higher water demands don't find these met in a planned way, they tend to try and access more water anyway, and that can have detrimental impacts on the less fortunate. And if well designed and planned, productive uses provide a potential source of income and cross-subsidy for the financing of water supply schemes. The sustainability of rural water supply systems is poor enough that this needs to be given some thought.

MUS keeps some of the food supply local, and involves highly intensive and efficient productive activities

Diets are changing as meat consumption grows and trade increasingly shifts food around the world to meet demand. While it is not going to help in the production of wheat or steaks, small-scale gardening and livestock keeping, does have a small and positive contribution to make. Because they are very small-scale, these productive activities tend to be very intensive and efficient. Gardens of a few square metres and small numbers of poultry, small stock or a cow or two at household level tend to be carefully looked after and productivity very high (per unit area or litre of water, although not necessarily in total for the household). The products produced tend to be nutritious: some green vegetables, a few tomatoes, eggs or milk. What MUS does do then in contributing to food security is well worth having as we all need to do more with less water. And, the food produced is more likely to be locally consumed or sold nearby to neighbours helping to keep down the food miles.

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