Addis Ababa, Ethiopia, 4-6 November 2008

INTERNATIONAL SYMPOSIUM ON MULTIPLE-USE WATER SERVICES

Characterising the multiple use approach at community level: findings from case studies in 8 countries

S. Smits, B. van Koppen and P. Moriarty [Netherlands]

Multiple-use services (mus) have gained increased attention, as an approach to of providing water services that meet people's multiple water needs in an integrated manner. This paper tries to characterise key elements of mus at community level, and assesses performance through a review of case studies conducted in Bolivia, Colombia, Ethiopia, India, Nepal, South Africa, Thailand and Zimbabwe. The cases show that people almost universally use water for domestic and productive activities at and around the homestead. The case studies demonstrate how levels of access can be provided by different types and combinations of technologies, and incremental changes made. These need to be accompanied by additional financial and management measures to ensure sustainability of services. The additional requirements posed are considered not to be insurmountable and can all be addressed in a feasible manner, and often justified by the additional benefits.

Introduction and objective

Over the last few years, the multiple-use services (mus) has emerged as an alternative approach to providing water services (Moriarty *et al*., 2004; Van Koppen *et al*., 2006). It is defined as an *approach* to providing water services that meet people's multiple water needs in an integrated manner (Van Koppen et al., 2006). This approach aims to overcome some of the limitations of sectoral approaches to water services which often limit people's access for their multiple water needs: domestic water supply programmes do not cater for people's small scale productive needs, while irrigation projects mostly do not explicitly cater for people's domestic needs or their productive activities around the homestead. The multiple-use approach is an approach to considering these needs in water programmes, and explicitly tying to cater for these. It is not a specific type of technology or system, but rather an approach to, or even philosophy of, water services provision.

Whereas this is a broad all-encompassing definition, it does not provide planners, policy-makers and other water sector stakeholders with clear guidelines and tools on how to provide such services in practice. The MUS (Multiple Use Systems) Project, a project under the Challenge Programme on Water and Food (CPWF), aimed to fill this gap by researching *de facto* and planned multiple-use services, and developing operational models for mus on the basis of these practices. The objective of this paper is to present a characterisation of the multiple-use services studied in the project, and to define how these can be used as building blocks in applying a multiple-use approach.

Methodology

Framework for analysis

This paper follows the framework proposed by Van Koppen et al. (2006). Central in this multi-layered framework is the individual user: who uses water in a range of livelihoods activities. At this level, we characterise water use patterns in relation to people's water-related livelihoods activities. The framework also considers that the extent to which water can be used for livelihoods, is determined by the level of access to water, defined by factors such as quantity, quality and distance between source and point of use.

We can therefore usefully analyse the relation between the use of water in people's livelihoods and access levels, and present this in the form of a water ladder.

Access, in turn, is determined at the level of the community by four inter-related factors: technology (or infrastructure), community-level institutions, financial arrangements and water resources. For each of these elements, an analysis is made in this paper of how they affect access in the case study locations. On the basis of these findings, indications are given on how these factors need to be addressed in order to facilitate multiple use of water. The framework can therefore help to frame better interventions.

Finally, the framework indicates that in order to support and scale-up mus, a number of elements need to be in place at intermediate and national level. Although the MUS Project did look into those issues, they are reported elsewhere and this paper limits itself to characterizing the factors at community level.

Case studies

The MUS Project was carried out in 8 countries: Bolivia, Colombia, Ethiopia, India, Nepal, South Africa, Thailand and Zimbabwe. Over 30 (groups of) villages were studied across these countries. In each of the villages, the different elements of water use, access and water services provision were assessed, using both qualitative and quantitative methods. The results have been synthesised in the form of a series of case studies (see Van Koppen et al (forthcoming) and MUS Project, 2008 for an overview). The case studies were complemented by bringing together service-providers, policy makers and other relevant actors in so-called Learning Alliances (Smits et al., 2007) acting as fora to guide the action-research, and to discuss the implications of findings for service provision and scaling-up. Table 1 provides an overview of the study areas, and the main focus of the study. The countries and cases represent a wide range of contexts, in terms of geography, socio-economic characteristics, types of systems and institutional settings. Nearly, all the cases discussed here however can be classified as "domestic-plus" systems, i.e. they provide water for productive uses, on top of domestic uses.

Table 1. Study areas

Country	Study area	Main focus in study area
Bolivia	5 communities around Cochabamba	Community initiatives for planned multiple-use services in peri-urban areas
Colombia	6 communities in the Quindío and Valle del Cauca Departments	De-facto multiple-use of domestic gravity-fed piped systems, and inclusion of lessons-learnt into government water programme
Ethiopia	One Peasant Association of 11 villages in Dire Dawa woreda (district)	Mus pilots by NGOs in extremely poor areas, with very low levels of access to services
India	Two villages in the Nasik district, Maharashtra	Piloting mus within the government domestic water supply programme.
Nepal	Three communities in different districts in the Southern Himalayan foothills	Piloting gravity-fed piped systems for multiple-use
South Africa	One ward of 11 villages, in Bushbuckridge Local Municipality	Introducing mus into the integrated development planning of the Local Municipality.
Thailand	4 groups of farmers in Buriram, Chayaphum, Khorat and Yasothon provinces in Northeast Thailand	'Farmer Wisdom Network' focusing on self-sufficient farming, through rainwater harvesting
Zimbabwe	Marondera, Murehwa and Uzumba Maramba Pfungwe districts	Technological innovations of NGO programmes

Findings

Water use and access to services

In all of the cases, water was being used nearly universally for a broad range of small-scale productive uses around the homestead such as kitchen gardens, animals and home-based industries alongside domestic use and field-scale agriculture (both irrigated and rainfed). However, the type of use, and the relative importance of these uses is highly variable across countries, communities and even households since such uses are closely related to the level of access provided. Two of the most important, out of four characteristic affecting 'access', are quantity of water and distance between water point and point of use. The table below provides an overview of the relation between access and the types of use of water found in the cases.

Table 2. actual water use and livelihoods activities

Site and technology	Distance or roundtrip	Range of average daily water use (lpcd)	Use of water
Ethiopia Communal piped systems with very few standpipes	Roundtrip up to several hours	8-17	Domestic uses, few litres a day of grey water re-used for fruit trees
South Africa Communal piped systems with scattered street taps	Roundtrip up to an hour	30	Domestic use, few families have gardens and home-based industries
India Communal piped systems with frequent standpipes	At homestead or short roundtrip	40 (design supply)	Domestic, small backyard gardens and communal cattle troughs
Zimbabwe a communal boreholes with hand pumps b. individual shallow wells with windlass and buckets c. individual shallow wells with rope pumps	a. 0-500 m b. at homestead c. at homestead	a. 10-15 b. 60-70 c. 80-90	a. Domestic, few cattle and community gardens b. Domestic and household gardens c. Domestic and extensive household gardens
Bolivia a. tankers b. piped systems with household connections	a. at homestead b. at homestead	a. 30 - 40 b. 60 – 80; in one village up to 140	a. Domestic use only b. Domestic use of 50-60 lpcd and remainder for dairy cattle (6-8 heads per family), or household garden (up to 50 m^2)
Nepal Communal piped systems with stand pipes shared between 2-3 houses	Short roundtrip	137-225 (design supplies)	Around 45 lpcd for domestic uses, remainder for extensive household gardens of 125-250 m^2
Colombia Communal piped systems with households connections	at homestead	75-120 in peri-urban communities, and 190-250 in rural ones	a. around 75 lpcd for domestic uses, remainder for irrigation of extensive gardens (up to 350 m^2), over 10 heads of cattle and small animals, and processing of coffee
Thailand a. farms with ponds and other sources b. farms without ponds, with other sources	a + b: at homestead	a. 80-1000 b. 80-500	a + b. domestic uses: 20-60, gardens: 100-300 b. Rice irrigation: >500

The cases show a high diversity of consumption patterns, ranging from less than 17 litres per capita per day (lpcd) in the villages in Ethiopia, where a roundtrip to fetch water may take several hours (Scheelbeek, 2005; Jeths, 2006), to over 200 lpcd in communal systems in Colombia (Cinara, 2007), and up to 1000 lpcd use in Thai farm-pond systems. Despite these differences, in all cases people used the water for productive as well as domestic purposes. Even in Ethiopia, people use a few liters a day for a cow or some fruit trees. But, with higher access to water, the extent to which water is used for small-scale productive uses increases disproportionately. With increasing access domestic use stabilises at some 40-75 lpcd, and any quantity above that is used productively. As the distance between water points and point-of-use increases, quantities used decrease rapidly as for example is found in Ethiopia (Scheelbeek, 2005).

These empirical data, in combination with data from other studies and expert estimates have been used to describe a more generic relation between access characteristics and the water needs that can be met in the form of a water ladder (Van Koppen and Hussain, 2007; and further adapted by Renwick et al., 2007), categorising "multiple-use" service levels (Table 3). Because of the variability of contexts, the ranges are quite broad and boundaries between categories are not always clear. This table can be used by planners, in thinking through the access characteristics that need to be in place to meet a certain level of water needs.

Table 3. Multiple-use ladder (based on Van Koppen and Hussain, 2007, and Renwick et al., 2007)

Service level	Distance or roundtrip	Quantity (lpcd)	Potential needs met
Maximal multiple-use service	Water at the homestead	>100	All domestic needs Not all but in some combination: Livestock Extensive gardening Small-scale enterprises
Intermediate level multiple-use service	Water at the homestead, or within 5 min roundtrip	40-100	Basic domestic needs Not all but in some combination: Couple of large livestock Gardening up to 50 m^2 Some micro-scale enterprises
Basic multiple-use service	Round-trip less than 15 min at distance between 150 -500m	25 – 40	Basic domestic needs Not all but in some combination: Some livestock Some gardening, especially with re-use Some micro-scale enterprises
Basic domestic service	Round-trip up to 30 min, or distance less than 1 km	10-25	Sufficient for drinking and cooking Hardly sufficient for basic hygiene Insufficient for other domestic uses Possibility for re-use for occasional trees and very limited livestock (e.g. few chickens or a goat)
No domestic	Round-trip more than 30 min, or more than 1 km	< 10	Sufficient for drinking and cooking Insufficient for basic hygiene

A quantity of water between 40-100 lpcd, within less than hundred meters from the point of use, is the estimated access level required to support multiple-uses of water at a significant scale. In addition, water needs to be available with certain reliability. Domestic uses require daily availability, either through daily supply from the system, or through storage at the household level. The same goes for livestock. For gardening, supply can be more be more infrequent. Water quality issues are not mentioned in the table above, but should not be forgotten. For drinking, the quality of water obviously needs to meet (inter)national quality norms at all levels of the ladder. For other uses, quality needs are less stringent.

Technological options

As already seen in Table 2, access is closely related to the type of technology. The technologies found in the case study locations were assessed in terms of their potential to provide a certain level of access on the ladder (Table 4). From the case studies we identified various incremental changes that can be made to develop technologies with the specific aim of facilitating multiple-use.

Table 4: Potential of different technologies for multiple-use services

Group	Technology	Potential for reaching multiple-use level	Incremental changes in technology	Examples from the MUS Project
Household-based options	Wells	Intermediate level of mus, although reliability may be limited due to fluctuations of groundwater levels.	Installing additional lifting capacity to facilitate multiple-use.	Family wells in Zimbabwe.
	Rooftop rainwater harvesting	As stand-alone source, it normally it does not have sufficient storage capacity, particularly not in semi-arid areas, for all uses. It can be used as complementary source to increase household access level.	Increasing storage capacity for as far as possible.	Rooftop systems in Zimbabwe and Thailand.
	Household ponds, and other in-field rainwater harvesting measures	Potential for meeting water for productive uses to maximal level. Water quality is mostly not apt for domestic consumption, and needs to be complemented by good quality source.	Including point-of-use treatment technologies.	Farm ponds in Ethiopia and Thailand.
Communal single access point systems	Communal wells or boreholes with hand pumps	Basic domestic to basic multiple use level.	Include communal infrastructure for productive uses such as a communal cattle trough, or community garden next to water point. Increasing household storage capacity.	Bushpumps in Zimbabwe
	Village ponds	Maximal level of access for productive purposes around the pond. Sometimes also domestic uses, though water quality and distance may be limiting.	Including point-of-use treatment technologies.	No examples in MUS Project, but more can be found at www.smallreservoirs.org
Communal distribution networks	Piped systems	Potential for multiple-use depends on system capacity and average distance between point of use and water points. Household connections can provide up to maximal access level. With scattered standpipes, only basic domestic level can be attained. Water quality may be a concern in case of surface water sources.	Reducing average distance between point of use and water points. Increasing household storage capacity Increasing overall capacity of different infrastructure components. Various treatment options at different levels in the system	Spring systems in Colombia, Ethiopia and Nepal Groundwater-fed systems in Bolivia and Ethiopia
	Gravity fed open canal systems	Potential for maximal level. Continuity and quality may limit domestic uses.	Various treatment option, especially point-of-use treatment Increasing household storage capacity.	No cases in MUS Project. But more can be found for example in Boelee and Laamrani (2004).

The findings show that mus does not require any “new” technologies. Current common technologies all hold potential in providing the required access though to different degrees. Technologies that bring water close to the homestead, i.e. household wells and ponds or piped systems with household connections, can achieve the highest service levels. Least potential in meeting productive needs lies with communal boreholes with hand pumps or piped systems with scattered standpipes, as distances to the point of use are high and design supply quantities are low. These can accommodate communal-level multiple-uses, such as community gardens or communal cattle troughs, but normally don’t allow for productive uses at or around the homestead.

This table of technologies, in combination with the water ladder (Table 3), can be used to identify the technology needed to provide a certain level of access, and types of livelihood activities that might be supported. In addition, it can help to identify incremental changes that can be made to existing systems to improve the access level. Finally, it allows for the planning of combinations of technologies to achieve a certain access level, such as building rooftop harvesting tanks to complement a communal borehole (as in Zimbabwe) or various overlapping distribution systems (as in Chaupisuyo, Bolivia).

Community-level institutions

Providing water services for multiple-use brings additional management challenges compared to conventional services. Providing a higher level of access in itself may not be a key management challenge. The main difference lies in explicitly catering to a wider diversity in demands within a community where not everyone has similar livelihoods needs, and ensuring a basic supply to everyone without overuse of services by some impacting negatively. This section looks at measures applied by community-level institutions[1] in dealing with these *additional* management challenges.

Most of the studied community organizations (with de facto mus systems) hadn’t developed specific measures to deal explicitly with the additional management challenges of multiple-use of water. Only some of the ones with planned mus systems had developed such measures. They included:

- Rules and regulations to ensure that everybody gets some water before larger users take more. For example, in one of the South African villages, the community established a rule that everybody should first be able to fetch two buckets of water before additional productive use would be allowed (Cousins et al., 2007).
- Regulations to limit the maximum amount of water to be used for productive purposes. In one of the Bolivian villages, the community established that water could only be used for livestock and backyard gardens, but not for irrigating larger field plots (Heredia et al, 2006). Some of these measures were hardwired into the technology, e.g. through metering in Bolivia and Colombia; through the use of small diameter pipes for household connections in India; or, by only allowing excess water from the tank to be used for irrigation as in Nepal (Mikhail et al 2007a and 2007b).

In nearly all these cases, communities were assisted by an external agency in developing these rules but they were set locally. Most of these systems have only been functioning for a short while it is too early to assess performance of community institutions in enforcing the rules, and ensuring equity in access. Evidence from other cases, for example in Honduras (Smits et al., 2008), shows that these kinds of measures can indeed help to regulate multiple-use of water particularly when they differentiate between different types of users within a system.

The water committees responsible for *de-facto* multiple-use systems struggled more in addressing management problems - specifically related to multiple-uses - such as failure to ensure payment for the service or conflicts with other users in the catchment over water quantity. Nor did they receive external support in addressing these problems.

Both types of systems experienced a range of other problems within their community institutions such as lack of leadership or poor accountability between the committee and the community. These and other management challenges are not exclusive to multiple-use services, but may lead to poor performance of systems and actually lead to reduced access. For example, the capacity of the systems in Bushbuckridge in South Africa is in theory sufficient to provide a basic level of multiple-use services. However, due to a myriad of institutional problems in combination with poor technical operation real access levels are much lower (Cousins et al., 2007).

It is increasingly recognised that community-managed domestic supply services require external long-term support mechanisms to be sustainable (see Schouten and Moriarty, 2004; Whittington, 2007). This also applies to community-managed multiple-use services.

Financial management

Providing a higher level of service for multiple uses implies that investment as well as operation and maintenance costs may increase. This section assesses how these additional costs were addressed. The investments in the main infrastructure were in nearly all the cases largely made by an external agent, government, a donor or an NGO, with only small contributions by the community. Only in Bolivia, did users provide the bulk of investments in communal piped systems. For household options, like rainwater harvesting systems in Thailand, or complementary on-farm technologies such as drip kits in Nepal (Mikhail, 2007b), users did assume the bulk of the costs.

The operation and maintenance costs were assumed fully by the community in nearly all cases in line with the prevailing community-management model. Different types of tariff systems were found (see Table 5): 1) volumetric systems, i.e. payment per unit of water used (common in systems where water is lifted by pumps) where the unit-rate may be differentiated; 2) charging a flat rate per month (often in systems where water flows by gravity); or, 3) water is provided for free. In most cases, the tariff charged is more or less in line with the operational costs. However, few communities are making saving for major repairs, expansion or future replacement costs. High non-payment rates may in some cases put the financial sustainability of services at risk.

Table 5: tariff systems and financial sustainability

Site	Tariff system	Financial sustainability of service
Challacaba (Bolivia)	Volumetric system	Tariffs cover operational costs, as well as savings for expansion
Chaupisuyo (Bolivia)	Volumetric system, with different rates for domestic and irrigation users	Tariff is much higher than what is needed for operational costs
Cajamarca / San Isidro (Colombia)	Volumetric system, with different rates for large and small farmers	Tariffs cover operational costs
Various communities of El Chocho (Colombia)	Flat rate, with one case of cross-subsidy between poor and better-off	Tariffs cover operational costs, but actual income is too low, due to high default rate
La Palma – Tres Puertas (Colombia)	Flat rate for basic consumption, and volumetric above that	Due to high non-payment rate, actual income is too little to cover all required costs
Legedini (Ethiopia)	Volumetric system (payment per jerry can)	Actual income insufficient for major repairs
Samundi (India)	Flat rate	Tariff covers operational costs
Chhatiwan (Nepal)	No tariff system. A revolving loan is set-up, and the interest is used to cover operation and maintenance costs	Too early to tell, as system just went into operation
Senapuk (Nepal)	Flat rate and additional contribution of labour	Too early to tell, as system just went into operation
Ward 16 of Bushbuckridge (South Africa)	Water is provided for free to users as part of Free Basic Water policy. Municipality covers operational costs.	No data on implications of financial sustainability for the Municipality

Investments in multiple-use services have brought benefits to users. Renwick et al. (2007) analysed a global data set of multiple-uses and found that most of these investments are cost-effective. However, this does not automatically mean that the additional investments that are required or desired are fully auto-financed by users or indeed by anyone else. Shared financing mechanisms are required, for investment and operational costs:

- There is potential for user contribution to the incremental costs in communal multiple-use systems, especially for additional household-based hardware. However, there is still a large cost component for basic infrastructure. In line with current practices this can be expected to remain largely in the domain of public service delivery.
- Communities can assume the operational costs and use differential tariff systems according to the local situation. However, it is not clear whether many communities can also assume full replacement costs. This is not unique to multiple-use services. In conventional rural water supply systems it is not common to find tariff systems that successfully cover full replacement costs. To our knowledge there haven't been any reported evidence that communities are better able to raise tariffs to cover replacement costs of multiple-use services, than for conventional ones.

Access to water resources

Climbing the water ladder implies the use of more water as compared to basic domestic supplies. Yet the amounts required are still relatively small when considered at a catchment scale even if a large number of villages would develop mus systems. The extent to which water resources can accommodate such increases, and the type of measures required for management depend on the status of the basin:

- In closing basins, there may be some unallocated water for multiple-use. For example, in the Sand River catchment in South Africa, sufficient water resources are available in the area to increase supply up to 60 lpcd to the entire population of the Bushbuckridge municipality without negatively affecting other users (Smits et al., 2004). Only in fully closed basins, such as in the case studies in India would there be a need for re-allocation between other users (such as field-scale irrigation) and multiple-use services.
- Open basins with local or temporal competition between neighbouring communities that use water for multiple-uses were reported in Bolivia, Colombia and Nepal. For example, in the El Chocho mountain stream in Colombia, the *de facto* use of water for multiple purposes contributes to the competition between 4 rural communities, together with other factors such as rapid population growth and inefficient water systems (Cinara, 2007). In nearly all these cases, local mechanisms for dealing with competition were developed ranging from negotiations around customary water rights to springs in Nepal (Mikhail et al, 2007b) and Bolivia (Quiroz et al, 2007) to a catchment forum in El Chocho (Cinara, 2007).
- Open basins with no competition for water resources were also included. These are the typical cases of economic scarcity, such as Ethiopia and Zimbabwe, where water resources are available but where infrastructure is lacking to extract and convey water.

Conclusions

The objective of this paper was to present a characterisation of multiple-use services at community level and provide a basis for defining building blocks in applying a multiple-use approach. It did so by analysing case studies from over 30 communities in eight countries covering a range of physical, socio-economic and institutional contexts and including both *de facto* and planned multiple-use services.

We found that, even though not all inhabitants of a community may be involved, people almost universally use water for domestic and productive activities at and around the homestead even in places where access to water is very limited. The extent to which households undertake these activities primarily depends on their level of access to water. The better the access to larger quantities of water, delivered closer to the homestead, the more that additional water is put to productive use once basic domestic needs have been met. For small-scale productive uses to take place at a significant level, typically between 40-100 lpcd are needed, delivered within a short roundtrip from the homestead. The empirical relation between access to water and its use for different purposes was summarized in the form of a water ladder that can be used to plan for the level of access required to meet certain water demands.

The cases show how different types of currently common technologies provide different degrees of access. Household-based options or communal systems with household connections hold high potential for multiple use. Incremental changes can be made to existing systems to improve access.

Water committees managing multiple-use services face the additional challenge of having to deal explicitly with distribution of additional water, so that diversified demands in the community can be met while a basic supply to all can be guaranteed. Evidence was found that this is happening, particularly through establishing internal rules and regulations. But communities may need external support to develop rules. Specific attention needs to be given to this in support programmes for community-managed services.

Renwick et al. (2007) indicated that additional investments in multiple-use generally come at modest costs and can easily be justified through the benefits obtained from them. But, this doesn't automatically mean that multiple-use services can be easily financed (e.g. by users). While there is scope for significant community-contributions to the incremental investments, the public sector will probably need to continue to assume a large part of investment costs and eventual replacement costs. Communities can assume operational costs, but need support in developing equitable tariff structures and financial management.

Even though the amounts required for mus are relatively small, access to water resources can be a limiting factor to mus development in closed basins. In open basins there is scope to develop access to water resources for multiple-uses. Where there is a risk that this will contribute to local and temporal competition with other users this needs to be managed within a framework for local water resources management.

The multiple-use services approach is in essence one of climbing the water ladder, i.e. creating higher levels of access to support people's multiple water needs. We have identified a number of implications requiring changes in the way in which water services are provided under the conventional approach to service delivery. However, none of these should be considered unfeasible, and can be justified by the additional benefits of the mus approach.

Acknowledgements

The author/s would like to acknowledge the Challenge Programme on Water and Food (CPWF) for the financial support to the MUS Project. We also thank John Butterworth for his comments on an earlier draft of this paper. This research has been a group effort, and all the project partners have contributed greatly to the results presented in this paper. We would like to thank the entire team: Rocío Bustamante, Alfredo Durán, Gustavo Heredia, Franz Quiroz and Lourdes Valenzuela in Bolivia; Silvia Corrales, Isabel Domínguez, and Inés Restrepo in Colombia; Eline Boelee, Michiko Ebato, Behailu Mintesinot, Samuel Simachew and Samuel Yehdogo in Ethiopia; Sudarshan Suryawanshi in India; Deepak Adhikhari and Dhruba Pant in Nepal; Tessa Cousins, Vusi Dlamini, Sylvie Morardet and Nyeleti Maluleke in South Africa; Sawaeng Ruaysoongnern in Thailand; Edward Guzha, Fungai Makoni, Cleophas Musara and Innocent Shoshore in Zimbabwe; and John Butterworth, Jürgen Hagman, Monique Mikhail, Frits Penning de Vries and Bob Yoder from the "global" team.

References

Boelee, E. And H.Laamrani (2004) Multiple uses of irrigation water in Northern Morocco. In: Moriarty, P, Butterworth, J. and Butterworth, and B. van Koppen (eds.) (2004) *Beyond domestic. Case studies on poverty and productive uses of water at the household level*. IRC Technical Papers Series 41. Delft: IRC, NRI, and IWMI.

Butterworth, J, Smits, S and M Mikhail (forthcoming) *Learning alliances to influence policy and practice: experiences promoting institutional change in the multiple use water services* (MUS) project. MUS Project working paper

Cinara (2007) *Los Usos Múltiples del Agua en Zonas Rurales de los Departamentos de Valle del Cauca y Quindío (Colombia): Resultado de Varios Casos de Estudio*. Cinara/Universidad del Valle, Cali, Colombia

Cousins T, Smits S and Chauke T (2007) *Access to water and poor peoples' livelihoods: the case of Ward 16 of Bushbuckridge Local Municipality*. Working paper MUS project

Heredia G (2005) Estudio de caso: "*Asociación de Usuarios de Agua Potable Challacaba". Centro AGUA, Programa Agua Tuya e IRC Proyecto MUS, Servicios de Uso Múltiple*. Cochabamba, Bolivia

Jeths M (2006) *Institutional environment and the local coping strategies for multiple use of water in Legedini, Ethiopia*. MSc thesis. Irrigation and Water Engineering Group, Wageningen Univesity, Wageningen, the Netherlands

Mikhail M, Suryawanshi S, Yoder R, Kapadnis S and Pawar R (2007a) *Mus projects in the Indus-Gangetic basin; the Maharashtra experience*. IDE – MUS Project

Mikhail M, Yoder R, Gautam KR, Sharma K, Adhikari D, and Khawas N (2007b) *MUS projects in the Indus-Gangetic basin*. The Nepal Experience. IDE – MUS Project

Moriarty P, Butterworth J, and Van Koppen B (Eds) (2004) *Beyond Domestic. Case studies on poverty and productive uses of water at the household level*. IRC Technical Papers Series 41. Delft, the Netherlands

MUS Group (undated) *Case studies*. Multiple Use Water Services Group [online] Available at www.musgroup.net/page/294

MUS Project (2008) *Multiple Use Systems Project*. www.musproject.net

Quiroz F, Valenzuela L, and G Heredia (2007b) *Concepción y construcción participativa de un Sistema de agua de Uso Múltiple en la zona rural de Vinto*. Proyecto MUS, Cochabamba, Bolivia

Renwick ME et al (2007) *Multiple Use Water Services for the Poor: Assessing the State of Knowledge*. Winrock International: Arlington, VA, USA

Scheelbeek P (2005) *Two containers a day; the search for proper water sources in Eastern Ethiopia. Water Quality and Sanitation in the Lege Dini Watershed Area, Ethiopia*. MSc Thesis, Irrigation and Water Engineering Group, Wageningen University, Wageningen, the Netherlands

Schouten T and Moriarty P (2003) *Community water, community management – From system to service in rural areas*. Delft, The Netherlands: IRC International Water and Sanitation Centre and ITDG.

Smits S, Pollard S, du Toit D, Moriarty P, and Butterworth J (2004) *Modelling scenarios for water resources management in the Sand River Catchment, South Africa.* WHIRL Project Working Paper 8. NRI, Chatham

Smits S, Moriarty P, and Sijbesma C (eds) (2007). *Learning alliances: scaling up innovations in water, sanitation and hygiene*. Delft, The Netherlands, IRC International Water and Sanitation Centre. (Technical paper series; no. 47)

Smits, S., Mejía, T, Rodríguez, S. and D. Suazo (2008) *Usos múltiples del agua y su impacto en la sostenibilidad en la prestación de los servicios del agua; sistematización de experiencias en 14 comunidades en Honduras.* RASHON, Tegucigalpa, Honduras

Van Koppen B, Moriarty P and Boelee E (2006) *Multiple-use water services to advance the millennium development goals*. Research Report 98. Colombo, Sri Lanka: International Water Management Institute

Van Koppen B and Hussain I (2007) Irrigation, Gender, and Poverty: Overview of Issues and Options. *Journal of Irrigation and Drainage* Volume 56 Issues 2-3 January 2007 pages 289-298 Irrigation and Poverty Alleviation: Pro-poor Intervention Strategies in Irrigated Agriculture. Issue Edited by I. Hussain. John Wiley & Sons, Ltd

Van Koppen B, Smits S and P Moriarty (forthcoming) *Climbing the water ladder: creative delivery of incremental multiple use water services*. MUS Project

Whittington D, Davis J, Prokopy L, Komives K, Thorsten R, Lukacs H, Bakalian A and W Wakeman (2007) *How Well is the Demand-Driven, Community Management Model for Rural Water Supply Systems Doing? Evidence from Bolivia, Peru, and Ghana*

Notes

[1] With the exception of three, all case studies were community-managed, which is the current management paradigm for rural water supply. The other cases involved management by a utility or directly by local government. These are not discussed further here.

Keywords

Multiple-use services, access, technology, institutions, financing, water resources

---

Contact details

Stef Smits	Barbara van Koppen	Patrick Moriarty
IRC	IWMI	IRC
PO Box 2869, 2601 CW Delft, the Netherlands	PBag X813 Silverton 0127 Pretoria South Africa	PO Box 2869, 2601 CW, Delft, the Netherlands
Tel: +31-15-2192939	Tel: +27 (0)12 8459100	Tel: +31-15-2192939
Fax: +31-15-2190955	Fax:+27 (0)12 8459110	Fax: +31-15-2190955
Email: smits@irc.nl	Email: b.vankoppen@cgiar.org	Email: moriarty@irc.nl
www: www.irc.nl	www: www.iwmi.org	www: www.irc.nl