Effects of multiple-use of water on users' livelihoods and sustainability of rural water supply services in Honduras

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The de facto use of rural water supply systems for productive purposes is a practice that has only recently received recognition in Honduras. This paper presents the results of 14 case studies, which focus on the role of multiple-use of water in people's livelihoods as well as on sustainability in service provision. The extent of this practice differs significantly between different user categories, and ranges from the use of small amounts of water for a backyard garden and some animals, to complementary irrigation of field crops or livestock at commercial scale, though in this case often private sources of water are used. This de facto multiple use of water supply may bring risks to the sustainability of service provision. However, a number of relatively simple measures can be considered in regulating water use, thereby mitigating the risks. By adopting such measures more widely certain degrees of multiple-use of water can be accommodated into service provision without causing negative impacts, while still maintaining the positive impact on users' livelihoods.

Keywords: multiple-use water services, regulation of water supply, sustainability, tariff structure.

THE MULTIPLE-USE OF WATER SUPPLIES has been studied and discussed in various countries in the Latin American region, ranging from multiple-use water services (MUS) in piped water supplies in Colombia (e.g. Cinara, 2007), the use of rope pumps for productive use at household level in Nicaragua (e.g. Alberts and Van der Zee, 2004) and multiple-use of small piped water supplies in peri-urban areas in Bolivia (e.g. Heredia, 2005; Heredia et al., 2008). In Honduras, however, the topic has until recently received little explicit recognition. During a first workshop on the topic with field technicians and engineers from government agencies, SANAA (Autonomous National Water and Sewerage Service) and FHIS (Honduran Social Investment Fund) as well as from NGOs including CARE and Entre Pueblos, participants recognized that most

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Problems with using water for production include over-exploitation of water resources, inequity within communities and unauthorized connections

rural water supply systems they know are used de facto for productive purposes (RASHON and IRC, 2007). Although they recognized the importance of these activities in people's livelihoods, they also identified sustainability problems related to multiple-use of water, such as over-exploitation of water resources, inequity within communities and unauthorized connections and use of infrastructure. In the past the productive use of rural water supply was explicitly discouraged or prohibited, a situation to which the workshop participants, as technicians and engineers, had contributed. One of the recommendations coming out of the workshop was to carry out a detailed analysis and documentation of multiple-use practices, and to take a fresh look at it in terms of both providing support to the management of existing systems and for the design of new systems. It was recognized that productive uses could perhaps be looked at as an opportunity rather than as a threat.

Objective

The study looked at impact on livelihoods, and the sustainability of water supply

To follow up the workshop, such a study was undertaken by IRC International Water and Sanitation Centre and RASHON (Water and Sanitation Network of Honduras – a network which brings together the main government agencies, donors and NGOs in the Honduran water sector), the latter represented by some of its members: SANAA, FHIS, Entre Pueblos and CARE. The objective of the study was 'to develop a better understanding of actual practices of multiple use of water and its impacts on the livelihoods of users, as well as on the sustainability of rural water supply services'. A full report of the study can be found in Smits et al. (2009) (in Spanish). This paper presents the main findings of that study, focusing specifically on:

- characterizing water use practices for multiple purposes by different user groups;
- characterizing the impact of multiple-use practices on users' livelihoods;
- analysing the impact of multiple-use practices on sustainability of services.

Methodology

The methodology of the study consisted of a series of community case studies, and the subsequent synthesis of generic lessons learnt. This section presents information about case study selection, a conceptual framework for the studies and data collection methods.

Case studies

Case studies were carried out in a total of 14 communities across five departments in the centre and south-east of the country. The sites were purposively selected to cover a diversity of contexts, including the performance category of the services, predominant livelihood characteristics, geographic conditions, size of the community and certain known practices related to multiple-use. (All rural water supply services in Honduras are classified with a mark from A to D, representing their performance or degree of sustainability. An A is given to systems performing adequately; B for systems that do not need infrastructure improvements, only improvements in management; category C systems require minor investments in infrastructure which can easily be covered by the community itself; the ones classified as D need major infrastructure investments, for which outside support is needed.)

The operation and maintenance technicians provide ongoing support to community water services

The selection was informed by field experiences of the TOMs (operation and maintenance technicians), SANAA employees, who provide ongoing support to existing community-managed water services in aspects such as book-keeping, training, technical supervision and so on, with the aim of ensuring the sustainability of the installed facilities (see Trevett, 2001 for more on this). They were to carry out the field work and had detailed prior knowledge of these communities. Table 1 provides details of the selected case communities. All are piped water systems with yard connections, which is the

Table 1. Basic information on the case communities

Name of community and Department	*No. of households*	*Sustainability category*	*Predominant livelihood activities*
Bella Vista, La Paz	36	D	Coffee growing
Cancire, La Paz	72	D	Subsistence agriculture and coffee growing
Chirinos, Francisco Morazán	31	B	Livestock and subsistence agriculture
Durasanal, La Paz	27	N.A. (under construction)	Subsistence and vegetable production
Guajiquirito, La Paz	40	D	Subsistence agriculture and coffee growing
Manzaragua, El Paraíso	181	B	Commercial vegetable production
Panuaya, Olancho	138	B	Livestock
Paso Alianza, Choluteca	36	B	Subsistence agriculture
Quebraditas, Francisco Morazán	30	A	Subsistence agriculture and livestock
Río Hondo, Francisco Morazán	222	A	Off-farm employment and subsistence agriculture
Santa Ana Yusguare, Choluteca	520	B	Off-farm employment and subsistence agriculture
Santa María, El Paraíso	432	A	Off-farm employment and subsistence agriculture
Talgua, Olancho	496	B	Livestock and agriculture
Terreritos, Francisco Morazán	96	A	Subsistence agriculture and livestock

most common technology option in Honduras. With the exception of two, all are gravity-fed from springs or streams.

Analytical framework

The study followed the analytical framework presented by Van Koppen et al. (2006), and adapted by Van Koppen et al. (2009), which has been used as a framework for analysing cases from eight countries across the globe. Central to this framework is the individual user who uses water for different livelihood activities to generate benefits such as improved health (both through reduced disease transmission and improved nutrition and food security), income or production of food. At this level we tried to characterize livelihoods benefits and to differentiate these between different user groups.

The extent to which households can use water depends on their actual level of access

The extent to which households can use water depends on their actual level of access. According to the framework, access at household level is shaped by the interplay between four factors at the second (community) level:

- *Water resources*. This refers to the way in which communities are able to access surface or groundwater sources.
- *Technology*. Often water resources may be relatively plentiful, but technology or infrastructure to abstract, convey and distribute is lacking. Different types of technology create different access levels.
- *Community institutions*. The way community institutions are set up and managed may also affect access. For example, internal allocation rules may limit access to some.
- *Financial arrangements*. Access can be limited or facilitated by the price people have to pay for investment and/or operational costs.

For each of these factors, we looked into how these actually shape access, but also into the sustainability of these. For example, if the tariff is very low, actual access may not be limited by this tariff, but it puts the sustainability of the system at risk.

Data collection

Data collection focused on obtaining information at household and community level. Data collection methods consisted of participatory tools such as community mapping, wealth classification and focus group discussion, in combination with consumption measurements and technical reviews of the systems. In addition a household survey was carried out covering 200 households across the 14 communities. These were selected on the basis of a classification according to types of user. The user categories identified are given in Table 2. Further

Table 2. User categories

Category	*Description*	*Number of interviewees*
Labourers	Doesn't have his or her own agricultural production. Receives salary for either off-farm or on-farm labour. Also includes people with their own small enterprise	38
Subsistence farmer	Produces basic food crops (beans, maize) for home consumption only. Doesn't have an additional salary for off-farm labour	47
Small and medium farmer	Produces crops (basic food crops, coffee or vegetables) for the market, but may also use part for home consumption. May also have additional salary	56
Large farmer	Produces crops (basic food crops, coffee or vegetables) for the market as main source of income. Doesn't have an additional source of income. Has a reasonable level of wealth	16
Livestock rancher	Lives on the commercial production of cattle, pigs, chickens or fish	29
Entrepreneur	Owns a non-agricultural enterprise, which requires large water inputs, such as brick making	6

information, including a detailed overview of the data collection tools can be found in Smits and Mejía (2008).

Results

Household level water use and benefits

Sources of water for different uses. Consumption for domestic uses (drinking, cooking, washing, cleaning and sanitation), for the majority of interviewees, ranged between 45 and 110 litres per person per day (l/p/d), with a median of 64 l/p/d. These ranges are in line with the assumed domestic consumption in gravity-fed piped systems with household connections in rural areas of Honduras.

Nearly all categories have a base consumption of a few litres per day for some chickens, a cow or a garden

Productive use of water happens nearly universally, with only 12 of the 200 interviewees not reporting any productive use of water. The median consumption for productive purposes is 59 l/p/d. However, these uses differ considerably between different user categories (see Table 3). Nearly all categories have a base consumption of a few litres per day for some chickens, a cow or a garden. For subsistence and small farmers, these quantities become bigger as they tend to have a few more animals or bigger plots, which provide their main livelihood. The category of small- and medium-scale farmers represents the category of highest diversity. It includes, for example, farmers who may use small amounts of water for their cattle only. Others may

Coffee farmers also use large amounts, but only in the months of processing the beans

use large quantities in certain periods, for example for emergency irrigation of crops in the dry summer, as is seen among the vegetable farmers in Manzaragua and food-crop farmers in Quebraditas and Terreritos. Coffee farmers also use large amounts, but only in the months of processing the beans, for example in Bella Vista and Cancire. Finally, the large farmers, cattle ranchers and commercial non-farm users do have high consumption levels year-round.

Most important though is that only a relatively small percentage of the water used for productive purposes comes from the main water supply schemes, reflected in the large difference between the median consumption for productive purposes and the median consumption for productive purposes from the main water supply system. The other sources of water for productive uses are either private sources, such as wells or individual surface water intakes, or open sources, such as rivers and streams.

The types of source used for productive purposes are closely related to the types of user group mentioned. The first two categories of labourers and subsistence farmers almost exclusively use the main water supply system, because their productive uses are very small anyway. The categories of large farmers and livestock ranchers tend to have alternative sources (private wells or surface water intakes) which they use exclusively for production. Entrepreneurs use a mix of private sources and the main supply system. The middle group of small- and medium-scale farmers represents a mixed case. Most of them do not use the water supply system year round for productive purposes, mainly because they are rain-dependent, and some have private sources. But, during the periods indicated above or when private sources dry out they may resort to the water supply system, sometimes through unauthorized connections. In one of the cases

Small and medium farmers at times resort to the water supply system, which sometimes leads to shortages

Table 3. Water consumption for productive use

User category	*Median consumption for productive purposes l/p/d*	*Range of consumption for productive purposes from main water supply system l/p/d*	*Median consumption for productive purposes from main water supply system l/p/d*	*Percentage of interviewees only using alternative sources for productive uses %*
Labourers	2.7	1–20	2.7	5
Subsistence farmer	12.3	1–60, but some interviewees > 200	11.0	4
Small- and medium-scale farmer	135.0	1–150, but some 25% of interviewees >150	40.3	7
Large farmer	483.7	0–200	67.3	31
Livestock rancher	280.0	20–200	87.5	34
Entrepreneur	82.7	1–125	8.0	0

Table 4. Role of multiple-use of water in livelihoods

User category	*Median net income from productive use of water US$/family/year*	*Importance in families' livelihoods*
Labourers	80.57	Only home consumption of eggs and chickens. Not real income, only expenditure reduction on these products
Subsistence farmer	110.82	Home consumption of vegetables, meat, eggs and basic food crops such as beans and maize. Not real income but expenditure reduction
Small- and medium-scale farmer	695.88	Production is main source of family income. Some home consumption of basic food crops such as beans and maize
Large farmer	5587.62	Production is main source of family income
Livestock rancher	1546.39	Production is main source of family income
Entrepreneur	7422.68	Production is main source of family income

Exchange rate: US$1 = 19.4 Honduran lempiras (May 2008)

(Manazaragua) this led to shortages in the water supply system, also because in this area a relatively large proportion of the users actually belonged to this middle group of users.

Benefits and contribution to livelihoods. The benefits and the relative importance of the productive use of water within a family's livelihood are obviously linked to the scale of these uses. Table 4 provides estimations of the net income (or equivalent expenditure reduction) for a family, generated by productive use of water. For the first two categories mentioned in Table 3, productive activities are mainly geared towards production of food for home consumption (i.e. eggs, chicken, some vegetables etc.). This production is complementary to their other livelihood activities. This kind of production tends to be for high-value food, which in turn may lead to health benefits. For small- and medium-scale farmers, the activities for which water is used do often represent the main livelihood. Water is used as input into products which are sold, such as coffee, vegetables or food crops. Finally, for the big farmers, ranchers and entrepreneurs, water is used productively in their main livelihood activity, and hence represents an important component of their income. The value of the production is thus very high compared with the other categories.

Access to water for multiple uses, through service provision

The previous section has characterized practices of multiple use at household level. This section analyses the implications of these practices at the community level. It looks on the one hand at how access is created and facilitates multiple use, and on other hand, how multiple use impacts on sustainability of service provision.

Water infrastructure needs to be able to provide water for a differentiated demand

Water quantity. The findings from the previous section imply that water infrastructure needs to be able to provide water for both a differentiated demand, and a demand which at times is much higher than the domestic demand only. This is particularly the case in larger communities, which are more heterogeneous in terms of presence of different user groups, such as Santa Ana Yusguare and Santa María, and communities with a relatively large presence of small- and medium-scale farmers, who make occasional high demands on the water supply, such as Manzaragua, Paso Alianza, Quebraditas and Terreritos.

Relatively large system design capacity is one of the factors that facilitates high water consumption levels, for multiples uses. The measured inflow into the systems was in most cases equivalent to more than 300 l/p/d, so two to three times the gross demand. In various case studies, we witnessed storage tanks overflowing, indicating that even with a certain degree of productive use happening there is still spare capacity in the systems. Only two of the cases (Manzaragua and Terreritos) had intake levels close to actual consumption levels, and both also report occasional water stress. One of the main reasons for this is that systems are often overdesigned in order to cater for future population growth. However, communities tend to use the systems at full capacity from the beginning of their life span onwards. These findings are supported by others. Work on multiple-use in Colombia, where gravity-fed schemes are common in a similar environment, also showed similar levels of system capacity, facilitating multiple-use (see Cinara, 2007).

Systems are often overdesigned in order to cater for future population growth

Despite this high system capacity, water may not necessarily be equally distributed within the community. Poor design and operation of distribution systems is an important factor affecting this. For example certain sectors in the communities of Bella Vista and Paso Alianza reported water stress due to high distribution losses, high water pressures in the pipes and malfunctioning distribution and pressure-break tanks. Addressing these problems would 'free up' water for productive uses.

The quantities required by labourers and subsistence farmers are small enough to fit within existing design parameters

Taking these factors into account, one can also deduce which types of multiple-use can be included in rural water supply system design. The quantities required for typical consumption by labourers and subsistence farmers are so small that they easily fit within existing design parameters. The amounts required for the commercial operations of large farmers and ranchers would imply a huge increase in demand, and would therefore best be supplied by separate, private supplies, rather than through communal supplies. The demands of the small- and medium-scale farmers form, again, an intermediate category. Their median water demand may still fit into system design capacity, particularly at the start of the life span of a system. However, the peak demands in certain periods of the year may prove to be more

problematic from a system capacity point of view, and would require some form of regulation.

Water treatment and chlorination. With respect to water treatment infrastructure, only Río Hondo has a MSF (multi-stage filtration) drinking water treatment plant, which is not common in rural water supplies in Honduras. Interviewees mentioned that water use patterns have changed in that community since the plant was put into use. Water for productive uses is increasingly being taken from alternative (private) sources, in order to keep the treated water for domestic use only.

A large proportion of rural communities does not regularly chlorinate its water

More relevant are the experiences with chlorination and its relation to multiple-use. Despite huge efforts in promoting chlorination, a large proportion of rural communities does not regularly chlorinate its water – in 2004, it was only 14 per cent (WSP, 2004). One of the hypotheses was that some communities do not want to chlorinate because they don't want to 'waste' chlorine on water which is used for purposes that don't need it, or because they fear chlorine may in fact affect crops or animals. The study found that all communities did have chlorination devices, but that these were actually being used only in a third of the cases. Water committees mention as the main reasons for not using chlorine the cost and lack of knowledge about the operation of chlorination devices. Only in one case did the user mention that they didn't want to chlorinate as they feared chlorine might affect crops they irrigated and fish they were keeping in ponds watered from the supply system. Productive use of water may thus be an additional reason why communities do not chlorinate, but it is not the only one.

Water resources. In nearly all communities, access to water resources was not found to be a limiting factor either. Most take in much more water than needed, as shown in the previous section. In six of the communities, there is even much more water available in the source, without any other claims from neighbouring communities. The relative water abundance of the cases is also reflected in the large number of individual water sources (often merely hosepipes into the streams), indicating a kind of 'free for all' situation, in which an individual or community can develop yet another intake without causing competing claims with others users. This may be an adequate approach while resources are still plentiful, but not when there is increasing demand and limited resources. The community of Quebraditas illustrates such a situation. It shares a mountain stream with two downstream communities. The latter put forward complaints when Quebraditas was developing its current domestic supply system, fearing downstream water availability would reduce. In the absence of clear water resources planning and allocation mechanisms, this conflict has gone on for years. Users in Quebraditas use the system for small-scale productive

In one village householders hide their use of water to avoid conflict with neighbouring communities

purposes, but in a hidden way, often through unauthorized connections or at night, in order not to increase the conflict with the neighbouring communities. Even though access to water resources isn't an immediate limitation to multiple use of water in most cases, it may become so in the future, or in parts of the country with more water scarcity, requiring mechanisms for planning and allocation of water resources, particularly at local level.

Community institutions and regulations. All cases studied are community-managed systems, with arrangements typical for rural water supply in Honduras. Responsibility for executive management lies with the Water Committee (JAAP), sometimes hiring a plumber or operator. Final decision-making resides with the community assembly.

Some of the communities struggle with aspects of day-to-day management

Some of the communities studied here are struggling with various aspects of day-to-day management. Problems include poor financial administration (see also next section), conflicts between the JAAP and the broader user community and non-payment of tariffs. These problems are not unique to communities practising multiple-use, and the root causes for these problems are complex and reflect much wider problems with community management. Yet, ultimately such factors have a negative impact on sustainability, and hence on access to water for multiple uses.

One specific aspect of community institutions affecting multiple-use are internal regulations around water use. JAAPs are supposed to develop internal statutes and by-laws, following the General Regulations for Water Committees. In these, they may specify local regulations around water use. Three types of arrangement can be distinguished:

- No explicit regulation that prohibits or allows productive use, or tries to differentiate between consumption levels. This is found in the smaller communities with less differentiated consumption patterns, and where it is tacitly allowed (Paso Alianza), or simply never considered (in Bella Vista and Cancire). This may well work in these cases, but may lead to inequity, especially when a community grows and diversifies its demand.

Some arrangements permitted multiple-use, but differentiated between small- and large-scale users

- Permitting multiple-use, but regulating it through a differentiation between small- and large-scale users. This is done either by specifying which uses are permitted (as in Manzaragua and Santa María – see Box 1), or by starting to consider differential tariffs and installing micro-meters (as in Río Hondo and Santa Ana Yusguare). These tend to be relatively bigger communities, with a more heterogeneous population.
- Prohibiting multiple-use and imposing sanctions, as in Quebraditas and Terreritos. In practice, these JAAPs are mainly controlling the bigger users, and allowing those who only use small quantities to continue.

Box 1. Examples of internal rules and regulations for water use

Some of the communities have developed internal rules and regulations for water use, which somehow reflect the local context. For example:

In Manzaragua, irrigating flower gardens is allowed, but not crops. People cannot water more than two heads of cattle from the supply system. Unauthorized use of the supply system during summer to irrigate vegetable crops is a recurring subject in assemblies.

In Santa Ana Yusguare, currently, users who have household storage tanks pay a higher tariff, as they tend to use more water. This is not yet a volumetric payment, but plans are under way to install water meters.

In Santa María internal regulations permit small-scale productive uses, specified as using water for chickens and not more than three pigs. Watering cattle and irrigating crops are prohibited. Brick making for building of one's own house is allowed, if prior notification is given to the JAAP. Discussion started on tariff differentiation and micro-metering.

These types of regulation show that locally relevant arrangements are needed to ensure equity in access. Some communities can develop these arrangements themselves; others may need support.

Financial management. In the cases, we looked into two aspects of financial management: 1) tariff structures, as these determine how access to water is governed financially; and 2) performance in financial administration, with respect to the way book-keeping is handled, non-payment rates, and so on.

In all systems a flat rate tariff is applied. Only in Santa Ana Yusguare and Santa María are higher flat tariffs applied to those considered bigger users; that is, those who have household storage tanks, and owners of shops, kiosks and hotels. In these and some of the other larger villages, discussions have started about volumetric payment and metering of water, in order to have more equity in payment for water and to move away from these current criteria for what constitutes a bigger user.

Discussions have started about volumetric payment and metering of water

The tariffs charged are considered low by Honduran standards with 12 out of 14 cases having tariffs of between 0.40 and 1.20 $/family/month. Most of these tariffs are typically established based on a communal agreement of what is considered fair, often with support from TOMs. However, in many cases, these tariffs are not regularly updated; only in Río Hondo, Santa Ana Yusguare and Santa María are tariffs regularly revised to check whether they are in line with operational expenditure, and if needed, adjusted. These are also among the few who have a reasonably good financial administration, with up-to-date books and low non-payment rates. Others are struggling in basic financial administration activities.

Although the multiple use of water brings a range of benefits, including financial ones, this does not automatically lead to higher levels of fee collection or re-investment in the system. The reason for

Multiple use of water does not automatically lead to higher levels of fee collection

this does not lie in multiple use of water as a practice in itself, but rather in the generalized limited financial management capacity of JAAPs to establish adequate tariffs, keep track of non-paying users and carry out basic book-keeping.

Discussion: sustainability and multiple use

This section discusses how multiple use of water affects the sustainability of service provision. Table 5 summarizes, for each of the villages, the performance of each system in terms of infrastructure, water resources, community institutions and financial management, and the implications for the overall system performance or sustainability. In order to identify the role of multiple use in this, those factors where multiple use has a *direct* influence on the performance of that factor, are shown in bold. It is realized that multiple use may also have indirect impacts on sustainability, but these cannot be identified as easily and may end up being mixed with the complex of factors affecting sustainability.

Table 5 shows that multiple use of water has a direct impact on sustainability only in a few cases. Most of the factors that contribute positively or negatively to the sustainability of the service are not directly related to multiple use. Rather, they are caused by poor financial

Table 5. Sustainability of service

Community	*General state of infrastructure*	*Infrastructure: quantity*	*Infrastructure: water quality*	*Water resources*	*Community institutions*	*Financial management*	*Overall degree of sustainability*
Bella Vista	-	+	-	+	-	-	D
Cancire	-	+	-	+	-	-	D
Chirinos	+	+	+/-	+	+	+	B
Guajiquirito	-	+	-	+	+/-	-	D
Manzaragua	+	+/-	-	+	+/-	-	B
Panuaya	+/-	+/-	+	+	+/-	+/-	B
Paso Alianza	+	+/-	-	+	+	-	B
Quebraditas	+	+/-	+	-	+/-	+/-	A
Río Hondo	+	+	+	+	+	+	A
Santa Ana Yusguare	+	+	-	+	+/-	+/-	B
Santa María	+	+	+	+	+	+	A
Talgua	+	+	-	+	+	+/-	B
Terreritos	+	+	+	+/-	+	+	A

+ = good performance on this factor, contributing to service sustainability
+/- = medium performance, with no immediate negative impact on service sustainability, but with risks
- = poor performance in this factor, with negative effect on service sustainability

management or problems around community management, which are not unique to communities practising multiple use of water.

In a number of cases, multiple use was found to pose a risk to sustainability

However, in a number of cases, multiple use was found to pose a risk to sustainability of services by contributing to conflicts over water resources between communities, as in Quebraditas, and by contributing to inequitable water distribution and over-use during certain periods of the year, as in Manzaragua and Paso Alianza. In turn, this may lead to conflicts and impact on community institutions. Manzaragua is a community which presents such risks. It is notable that these problems present themselves mainly in those communities with more diverse user categories and with a relatively large group of small- and medium-scale farmers. This is the group most difficult to accommodate in rural supply schemes.

In order to address these issues, while still catering for different degrees of multiple uses, the following measures can be considered:

Internal rules are needed to regulate consumption, differentiating between different user groups

- Regulating water consumption, through internal rules and regulations, which differentiate between different consumption patterns and user groups. Small-scale uses can mostly easily be accommodated; special measures are needed for the larger ones, including caps on their consumption, and specific regulations would be required for the middle category. The cases have shown under which conditions such regulations would be most relevant: that is, in larger communities with more diverse user categories.
- Differential tariffs, including volumetric payments, to achieve equity in payment for operation and maintenance costs. This would mainly be relevant in larger communities with a more differentiated demand, where the transaction costs of establishing such tariffs are offset by the benefits.
- Improving the operational efficiency of the systems (e.g. through leakage reduction). Part of the water demand for multiple use can be accommodated by better use of water that is available at system level.
- Planning and allocation of water resources to deal with competing claims on water resources, between communities, as well as between large numbers of individual users. Currently, such water resources planning and management is not happening much in Honduras. Only with the recently approved Water Law would the path be opened for a more structured approach to water resources management, at catchment scale.

Conclusions

Before this study was carried out, there was anecdotal evidence that rural water supply systems in Honduras were used for small-scale

productive purposes, and that this sometimes caused negative impacts on sustainability.

The small amounts used by day labourers bring extra food for home consumption

This study confirmed that productive use of rural water supply systems is common across systems and users. However, its scope differs between user categories. At one end of the spectrum are day labourers and subsistence farmers who only use a few litres per day for some small animals or irrigating a kitchen garden. The small amounts of water do bring an important additional benefit in the form of extra food for home consumption, which in turn may positively affect users' health, and occasionally provide some complementary income. They draw nearly exclusively from the main water supply systems. The other end of the spectrum sees large farmers and ranchers, who may use up to 500 l/p/d for farming and livestock at large scale. Most of them use water from their private wells or surface water intakes for that. Finally, there is a group of small- and medium-scale farmers, who use water for their farm animals, crop irrigation or coffee bean processing, these being their main livelihoods. They tend to use the water supply systems for this, only requiring large quantities during certain short periods of the year.

Most of these demands can easily be accommodated within current water supply system design and management practices, particularly the small-scale ones. As the larger users tend to have their own sources, they do not pose challenges for service provision either. The consumption pattern of the middle group poses the biggest challenge. Because of the quantities they require, particularly in peak periods, their water use may have a negative effect on sustainability, as it can contribute to conflicts over water resources with neighbouring communities or to inequitable distribution of water within a system. However, it is one out of many factors affecting sustainability. The cases also show the need for different sets of measures which can facilitate multiple use without causing sustainability problems, including:

Differential tariffs are needed for greater equity

- Regulating water consumption, with clear differentiation between consumption patterns and user groups.
- Establishing differential tariffs and volumetric payment, in order to generate more equity in access and payment for the services.
- Improved mechanisms for planning and allocation of water resources.

Through this combination of measures, multiple use of water can be turned from an unrecognized, de facto practice, into a regulated component of sustainable rural water supply services provision, contributing to the livelihoods of subsistence and small-scale farmers.

References

Alberts, H. and Van der Zee, J.J. (2004) 'A multi-sectoral approach to sustainable rural water supply: the role of the rope pump in Nicaragua', in P. Moriarty, J. Butterworth and B. Van Koppen (eds), *Beyond Domestic: Case Studies on Poverty and Productive Uses of Water at the Household Level*, Technical Paper; no. 41, IRC, NRI and IWMI, Delft, The Netherlands.

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* [online], CPWF-MUS Working Paper, Cali, Colombia, available from: http://www.musgroup.net/page/865 [accessed 12 November 2009].

Heredia, G. (2005) *Estudio de caso: asociación de usuarios de agua potable Challacaba* [online], CPWF-MUS Working Paper, Centro AGUA, Programa Agua Tuya e IRC Proyecto MUS, Servicios de Uso Múltiple, Cochabamba, Bolivia, available from: http://www.musgroup.net/page/909 [accessed 12 November 2009].

Heredia, G., Valenzuela, L. and Heredia, A. (2008) *Diseño y evaluación de alternativas para un sistema de uso múltiple de agua para la comunidad de Caico Alto, Cochabamba, Bolivia* [online], CPWF-MUS Working Paper, MUS Project, Agua Tuya, Cochabamba, Bolivia, available from http://www.musgroup.net/page/901 [accessed 12 November 2009].

RASHON and IRC (2007) *Memoria del taller 'Usos Múltiples del Agua'*, Tegucigalpa, Honduras, 27 September 2007.

Smits, S. and Mejía, T. (2008) *Guía de sistematización de experiencias de usos múltiples del agua en Honduras*, RASHON – IRC, Tegucigalpa, Honduras.

Smits, S., Mejía, T., Rodríguez, S. and Suazo, D. (2009) *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.

Trevett, A.F. (2001) 'The SANAA technician in operation and maintenance program in Honduras', in *Institutional Arrangements for Rural Communities*, Strategic Paper No. 1, *Case Studies on Decentralization of Water Supply and Sanitation Services in Latin America*. Environmental Health Project, prepared for the USAID Bureau for Latin America and the Caribbean EHP Project No. 26568/Other.LACDEC.CS.

Van Koppen, B., Moriarty, P. and Boelee, E. (2006) *Multiple-use Water Services to Advance the Millennium Development Goals*, Research Report 98, International Water Management Institute, Colombo, Sri Lanka.

Van Koppen, B., Smits, S., Moriarty, P., Penning de Vries, F., Mikhail, M. and Boelee, E. (2009) *Climbing the Water Ladder: Multiple-use Water Services for Poverty Reduction*, Technical Paper Series 52, IRC International Water and Sanitation Centre and International Water Management Institute, The Hague, The Netherlands.

WSP (2004) *Decentralization of Rural Water and Sanitation Services: New Roles for Rural Water Associations and Boards in Honduras*, Field Note, Water and Sanitation Program, Lima, Peru.