GLOWS

# Learning about multiple uses of water

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This training module forms part of the wider set of Guided Learning on Water and Sanitation (GLOWS) modules that have been developed to support problem-based and guided self-learning on water and sanitation in Ethiopia. GLOWs training materials are currently used by several Technical and Vocational Education and Training College (TVETCs) and in a range of projects supported by SNV, Meta Meta, the Ethiopian Water Alliance, the RAIN Foundation and other partners. This GLOWS module on multiple water use is a fully revised and updated version of module 4 of the first GLOWS training package that was originally developed by Marieke Adank and Josephine Tucker. The revised module was developed by Jan Teun Visscher for IRC Ethiopia and reviewed by John Butterworth. IRC Ethiopia would like to acknowledge the financial support of the Dutch Partners for Water programme that made this update possible.

Pictures on front cover: Petterik Wiggers

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# Preface

Many water supply systems in Ethiopia are used for multiple purposes such as domestic water supply, livestock and irrigation, yet very few are designed and managed accordingly. Improvements are often needed related to water safety, longer term sustainability and equitable use. Planned provision of water for different uses is known as Multiple Use water Services or MUS.

Different initiatives are underway to further expand water coverage for drinking water supply and food security. Sometimes these efforts can be linked, coordinated or integrated. Essential for the success of such initiatives is to enhance the capacity of Woreda-based staff involved in community and household based water and sanitation initiatives for all purposes.

This training module on MUS contributes to that process. It is part of a family of training modules that adopt the innovative approach of Guided Learning on Water and Sanitation (GLOWS). This comprises guided problem-based learning at the place of work. Key to the approach is that participants receive a course package including training modules and additional resource materials. The self-learning modules comprise key information, specific 'learning-by-doing' exercises and a question and answer section where participants can check their own progress. The field assignments are to be implemented in small groups of participants from the same or adjacent woredas. Results are shared through internet, normal mail or face-to-face contact with the course facilitator/r esource persons who will come to the place of work of the trainees to review progress. This may also include working together in the field.

GLOWS has been piloted at Woreda level in SNNPR with support from RiPPLE, SNV, MetaMeta and UNICEF, and in Haraghe with support from RiPPLE, MetaMeta and the Dutch WASH Alliance through the Rain Foundation. In both areas the program uses trainers of TVETCs and resource persons from water and health bureaus and from other support organizations.  The positive response to GLOWS shows the potential of practical, problem-based learning in Ethiopia, which also is being incorporated in some of the regular training in some TVETCs. GLOWS is now being expanded in SSNPR and is also envisaged to be implemented in Hararge and Afar and entails the potential for a nation-wide up-scaling.

***Objectives of this multiple water use services module***
This module introduces the concept of multiple use water services (MUS) and how you can design water supply interventions to better meet the needs of communities with water requirements for different uses. It also explores how this can generate more benefits and the finance and interest needed to further develop systems and keep them running.

*At the end of this module the participant will:*

- *Be able to explain the implications of multiple water uses for water supply systems and people, including seasonal influences and the relationship with livelihood zone(s) and wealth groups in a community*
- *Be able to assist Water, Sanitation and Health Committees (WASHCOs) and farmers and households engaged in planning, designing and improving water supplies for multiple uses*
- *Will have developed an assessment of MUS in a location of his or her choice*

This module includes field assignments in which participants will work in small teams to analyse situations around MUS in a community and explore options for improvement.

## 1. Introduction

People in rural areas will have access to different water sources and use water for a variety of uses. These include domestic uses, like drinking, cooking, washing and cleaning. They also may use it for watering animals, gardening, irrigation, processing of agricultural products and small-scale industrial activities, like beer brewing and brick making. These different uses of water bring different benefits (Table 1). Domestic water use will mainly lead to an improved health situation with respect to water, sanitation and hygiene related disease, while productive use of water can result in direct economic benefits (income generation) and improved diet and greater food security (Moriarty et al 2004). The health and well-being of the population depends upon water and food security, as well as financial resources to among others support the sustained functioning of water systems.

Table 1. Multiple sources, multiple uses and multiple benefits at user level

| Multiple sources | Multiple uses | Multiple benefits |
|---|---|---|
| • Springs<br>• Water ponds<br>• Wells<br>• Streams<br>• Rain water | • Drinking, Cooking<br>• Washing<br>• Livestock<br>• Gardening/Irrigation | • Health benefits<br>• Time saving<br>• Nutrition<br>• Income |

An important problem exists however in that in many communities the available water sources and services vary in quantity, quality, accessibility and reliability over the year. This may be due to natural causes but also because of project interventions. Different ministries but also NGOs often have their own sector-specific targets, approaches, solutions, and sector specific financial resources which results in projects that are built to cater for a specific need (e.g. drinking water or irrigation). As a result an important mis-match between water supply and demand may exist in communities, leading for example to long waiting queues at water points (particularly in the dry season) but also to drinking polluted water drawn, for example, from irrigation systems. This clearly calls for coordinated action and collaboration between different actors in which the multiple water demands of communities are addressed in an integrated way instead of adopting water services that only focus either on water supply for domestic use, or on water for livestock or water for irrigation.

In this context it is promising that the successful approach to promote family wells for self-supply in agriculture, which has led to the construction of thousands of wells, is increasingly seen by the water sector as an option to also improve upon domestic water supply. This seems very feasible by putting stronger emphasis on water quality and possibly the introduction of household water treatment. Such an approach is a good example of how to buy into the potential merits of MUS, which obviously can very much benefit from further interaction between sectors (Butterworth et al., 2011).

**Why multiple use services?**

If people's multiple water needs are taken as a starting point, water services can be provided which will result in multiple benefits, rather than providing services that only bring one specific set of benefits, either health and time saving benefits from domestic water use, or economic benefits from productive uses. In terms of livelihood improvements, MUS concurrently improves health, food security, and income, and reduces women's and girls' drudgery, especially among the poor in rural and peri-urban areas where their multi-faceted, agriculture-based livelihoods depend in multiple ways on access to water (Butterworth et al., 2011). Furthermore, it is important to realize that providing for MUS may have a positive impact on sustainability of water systems. If water systems are designed for one specific use but used for multiple uses, the resulting extra pressure on services may cause conflict and premature system failure and breakdown. Taking multiple uses into account in the design and management of the system can help prevent that. Adopting a MUS approach can also positively impact the willingness of users to operate and maintain the system, since it better caters for their needs. People might also be more willing to pay for water they can use for different uses, including productive uses.

Key features of multiple use services:

- They take people's water needs as starting point
- Planning starts from an assessment of the actual situation
- A long term 'service delivery' approach is used, rather than just building systems
- Water supply and needs are matched in a reasonable way whilst looking at fair use and possible conflicts

Woreda-level staff should be able to help the Kebele leaders and WASHCOs to make equitable decisions to meet the demands within the available and future water system options, building on and strengthening existing hard- and software, where appropriate. In this it is important to give priority to drinking water supply, whilst also looking at food security. Woreda staff need to be aware of the heterogeneity of communities and their multiple water needs and need to deal with this in a transparent and equitable way (Van Koppen, et al., 2009).

In the next section several options will be explored that can provide entry points to better cater for MUS. In section 3 the main issues to be explored at community level to assess the local situation and the need for MUS are then introduced. This is complemented by a short description of tools that can be useful for the assessment in section 4, followed by a section which provides suggestions for taking action. The final sections include questions for self-evaluation and some exercises, with references and suggestions for further reading indicated in section 7 and the answers to the questions given in section 8.

# 2. Different entry points to enhance multiple use water services

Different types of systems provide different levels of potential for multiple water uses, may require different organizational arrangements, and may benefit from programs supported by different organizations. In general we can differentiate between the following options:

- Household-based systems (e.g. Family wells and rainwater harvesting systems)
- Communal water supply systems with single or multiple access points
- Irrigation systems

For each of these options cases of multiple water use exist in Ethiopia.

## *2.1 Household-based systems*

Most household-based systems are family wells (often involving household-led financing or Self-supply) but can also include household-level rainwater harvesting technologies (roof top harvesting systems and small catchments with ponds). Both the Ministry of Water, Irrigation and Energy (MoWIE) through its Self-supply acceleration activities (part of the One WASH National Programme), and the Ministry of Agriculture (MoA) under the household irrigation strategy are widely promoting groundwater development through family investment. Family wells, or shallow wells, can be used for domestic water use, and for watering animals, but are also being widely promoted (with a rope pump, treadle pump or petrol/diesel pump) for household irrigation. Households often build these wells themselves (with help of a local well builder), close to their house or to their land that requires irrigation. Sutton et al., (2012) indicate that on average, 'family' wells in Oromio and Southern Nations Nationalities and People's Region (SSNPR) are shared (normally for drinking or other domestic uses) by some 70 people and water from mechanised wells is shared with over 120 people. The use of the wells is dynamic in that users will also take water from other sources, for example river water for washing cloths so as to avoid lifting water and sometimes also water from pumps for drinking. Family-owned wells are very important for food security as they are far more commonly used for irrigation and livestock than communal water points. This situation has a lot to do with the difficulty to transport larger quantities of water over large distances (Sutton, et al., 2011).

The ministry of agriculture is strongly promoting the development of family wells under their responsibility for household irrigation (<5 ha) and small-scale (5-200 ha). This is a very ambitious program that has the intention of 'one family, one well' in suitable areas. This programme is supported by the agriculture extension workers at Woreda level.

A key concern with many of these wells is the risk of bacteriological contamination related to inadequate protection and poor pump installation. Such problems may be identified by a sanitary survey. Hence in many cases the main intervention to enhance the safe multiple use of such wells is to introduce proper protection measures and improve pump installation and water handling. This may be quite feasible as many examples exist of shallow wells with rope pumps that deliver good quality water free from bacteriological contamination. An important advantage is that such wells are often used by a small user group thus reducing the risk of a large outbreak of diarrheal disease.

Where the risk is estimated to be relatively high and for example diarrhoea episodes are frequent, it may be necessary to introduce simple household water treatment by filtration and or solar disinfection, or the use of household chlorination. This is also a good example of the need for collaboration among different actors. The agriculture extension workers can team up with the Woreda staff working on drinking water supply and the HEWs to introduce water quality improvements that make wells meant for irrigation also suitable for domestic water supply. This is a win-win situation as it will contribute to increasing access to good quality water which is a goal of MoWIE and will help farmers to become more healthy which may increase their productivity.

Rainwater harvesting also has potential for multiple use, but more often as a supplementary source. An interesting option that may exist is to distinguish between high quality rainwater that can be used for drinking and cooking (some 5 litres of water per person per day) and needs good quality storage and low quality rainwater that does not need to be of the same quality and does not require (costly) good quality storage. This issue is being addressed in more detail in another GLOWS training module on rooftop (rainwater) harvesting

The potential for multiple uses of household water supplies can be improved by improvements in the water lifting potential, for example by equipping a shallow well with a simple pump like a rope pump. When more water can be easily extracted from the source, this water can be used to irrigate more land, water more livestock etc. A recent development is the introduction of manually drilled wells initially aiming at providing water for irrigation but increasingly also being adopted for drinking water supply. Interestingly this is one of the more affordable solutions for farmers to use groundwater for irrigation and now also for multiple water use. Typically wells are 5 to 15 cm in diameter with a depth of up to 30m and a cost of some 3750 to 5000 Birr (Mekonta & Boelee, 2013a). Different examples exist of the use of these wells equipped with rope or treadle pumps that make an important impact on their owners. Wells may be used for drinking water, cattle and small scale irrigation. Well users may carry the water in buckets to their animals to reduce the risk of contamination by the cattle if it would come close to the well. When used for small scale irrigation, farmers may get a considerable benefit as shown by different examples presented by Mekonta and Boelee (2013a) from selling tomatoes, green peppers, onions etc. Yet with growing numbers of farmers with this type of household irrigation in different areas the rate of return on investment may diminish depending on the availability of local markets where products can be sold.

Still household-based systems seem to be one of the most promising options for providing water for different uses, including drinking, watering livestock and watering plants. To enhance this potential self-supply would need support in four main areas: technology options and advice, strengthening the private sector, supporting financial systems and enabling government policies (Butterworth et al., 2011). This implies that households need to get access to low cost credit facilities. Support is also required in the form of advice about the risks involved in terms of water quality and how to overcome these, but also in terms of the potential risks involved in not having sufficient a market for their products. A related issue is that these kinds of improvements can benefit a lot by strengthening the private sector. Already different private sector actors are involved in well construction and provision of pumps and spare parts, but the quality of their interventions can be improved considerably.

### *2.2 Communal point source systems*

This type of system includes hand dug wells and boreholes with hand pumps, boreholes with electrical pumps or protected springs with one public tap stand or a small distribution network with several public tap stands and sometimes also house connections. Communal point source systems generally have limited scope for multiple use services unless they are specifically designed for this purpose. Often the number of users is quite high resulting in long queues at tap stands and even rationing of water, with inadequate supplies for domestic uses let alone productive uses.

Still boreholes with handpump and piped systems with scattered public standpipes can offer an opportunity for some productive use. This may include provision of cattle troughs but also some small scale irrigation (close to the point of discharge). The question arises however about the equity of the benefits from these productive uses. When people pay enough for the water used for the cattle to meet the production cost then at least they do not benefit more than other community members with fewer or no livestock. For small scale irrigation it is likely that only community members with land close to the water point can benefit, for example from spill water. This still may be a fair deal if in return they undertake the maintenance of the facilities or participate in the WASHCO. Or it may compensate for the use of land. In fact such an arrangement may enhance the sustainability of the system as it may make the maintenance and the participation in the WASHCO more attractive.

The equity issue of different groups within the community: man and women, different livelihood groups (e.g. livestock keepers and crop farmers) and different wealth groups not benefitting equally from water systems seems to be overlooked and no guidance seems to be available how to deal with this type of ‘hidden conflict’. It can be argued that it would be fair that those benefitting more would also contribute more to the running cost of systems and in fact this may be very important for their long term sustainability. Hence a set of rules need to be established in case of multiple use of communal systems that sets out the terms and conditions for the users. Such types of arrangements may be expected to require external support from Woreda level or regional level, also depending on the organizations involved in system development.

In Ethiopia, gravity-based spring systems in mountainous areas often supply water for domestic and other uses, like watering animals and irrigating small plots. Sometimes these springs are developed to supply either water for domestic use, or for irrigation. However, in reality people will use the water for both. Run-off water will be used for irrigation and watering animals in case of a water supply system. In case of an irrigation system, people will often fetch water from the storage reservoir or the irrigation channels (Figure 1). These multiple water uses can easily be facilitated by add-ons to the single use infrastructure, for example by adding a public tap stands for domestic water use to an irrigation reservoir, or by adding small-scale irrigation infrastructure (small lined canals) to guide the run-off water from a spring water supply system (Box 1). The main problem however is that the water may be contaminate,d hence just putting an add-on is often not sufficient. Measures may be needed to improve the water quality either at the source or at the household level.

**Box 1:** Technological add-ons to facilitate multiple use of water: the case of Ido Jalala and Ifa Daba

In Ido Jalala, a community in Gorogutu Woreda, East Hararghe zone, Oromya Region, the Ethiopian NGO HCS capped a spring and installed a water point to improve the quality and the easiness in which the water can be collected and used for domestic use. Initially, the spring had been used for domestic water, as well as irrigation. Therefore, HCS decided to add an irrigation component to the system, with a separate night storage reservoir (to avoid the risk of blocking the flow of the spring) and lined canals, to improve the efficiency of water use.

In Ifa Daba, in the same woreda, HSC capped a spring and diverted the water into an irrigation reservoir, from which lined irrigation canals divert water to irrigated plots. However, people collected water from the irrigation reservoir for domestic water as well. Collecting this water was not easy and quite time consuming (see picture). Therefore, HSC decided to add a water tap from which people could collect water for domestic use.

**Figure 1** Woman collecting water from the irrigation reservoir in Ifa Daba

An interesting multiple use case is the Avola spring in Senkegna, Yilma Densa (Mekonta & Boelee, 2013b). This spring was developed under the Community Managed Project (CMP) approach and comprises one water point with four faucets, one laundry basin with four compartments, two shower rooms, one cattle trough and a storage reservoir. The surrounding land also contributes to sustaining the system as it has been turned into a protected (non-grazing) area which is now producing hay that is harvested by the community. Income of the system includes user contributions of 4 Birr per family per year, income from selling hay and income from taking a shower (1 Birr per use). Over the last six years the system has generated a considerable profit and the WASHCO has some 15000 Birr in its account. This example however also raises equity issues. Six families living downstream of the spring are now benefitting from the surplus water which they use for irrigation free of charge. Furthermore the income is used to pay for the guard and the maintenance but it is not clear what will be done with the surplus. In fact the system was built with a grant of the Government of Finland of some 35000 Birr and a community contribution of 10000 Birr.

CMP is a nationally recognized approach for rural communal water supplies which in theory ought to facilitate MUS, because it is based on decentralized decision-making of communities. In practice however this potential is not realized as typically wells with a handpump are provided for 50 families leaving little space for other than domestic water supply (Butterworth et al., 2011). Hence further analysis is needed to explore if a stronger emphasis on MUS could be adopted for example by installing two handpumps on one well provided that water resource conditions allows abstraction of more water.

**Communal distribution systems** are piped systems with household connections and/or tap stands, bringing water closer to people. These systems supply water to taps closer to people's homes. Theoretically this may offer a good opportunity for multiple uses and to be complemented with 'add-ons' like drip irrigation to water home gardens in an efficient way, using domestic water from the piped network. The difficulty with most of these systems is that they are designed for domestic water use based on the prevailing level of 15 l/p/d, leaving no scope for other uses, except for people re-using the water at home. In fact several systems in Ethiopia suffer from the addition of house connections over time often by local technicians with inadequate knowledge on the requirements of water systems in terms of pressure distribution. A case in Afar shows that the addition of house connections led to a dramatic drop in water pressure at tap stands resulting in increasing waiting lines and in the end in the total collapse of the system. Hence any intervention in the distribution network needs to be assessed beforehand, and it is also necessary to look at such interventions including the introduction of house connections from an equity perspective too. Usually the better off will be able to afford such a connection whereas the poorer sections in the community then may have to wait longer to collect their water from a tap stand.

## *2.3 Multiple systems for multiple uses*

Providing multiple use water services which respond to people's water needs does not mean that all uses of water have to be addressed through one single system. There may be multiple systems providing services for different uses. This raises an important point for reflection in that under a MUS approach it can be considered to split the domestic water supply in water for drinking and cooking (washing vegetables etc.), in general some 5 liters per person per day and other water use (for personal hygiene, washing cloths etc.). The five liters need to be of very good quality but this is a relatively small volume that can be taken for example from a safe water point or produced through household (or even communal) water treatment.

Rainwater harvesting for example can be split in a part that is collected for drinking and cooking (some 5 l/p/d) which needs to be of good quality and requires a good roof and good quality water storage, and a part for washing, watering cattle or irrigation which can be of lower quality and can be kept for example in lined water ponds. If conditions are favourable, other rainwater harvesting techniques can be considered such as rock catchments but also sand dams as explained in more detail in some of the other GLOWS training modules.

In terms of using multiple water sources, roof top water harvesting can also be of great help in areas where groundwater for example has a high fluoride concentration. Roof top collection and storage then can cater for the water required for drinking and cooking whereas groundwater can be used for example for washing and bathing.

## 3. Planning for multiple uses of water

In order to ensure that communities have access to water services for their multiple uses, all year round, it is important to first understand what these uses are, and what water sources and infrastructure are available to meet them, and to understand the barriers people face in accessing these resources. This can be done through a participatory assessment of the situation looking at the water sources and their use throughout the year.

**Water Resources**
There are 3 main types of water resources and for each some key questions may be relevant:

- Ground water (where are the sources located, in which months is water available, what is the quality of this water, can water storage be improved, and what options for additional wells exist)
- Surface water (where are the sources of surface water, in which months are they available, what is the quality of the water, and can subsurface storage be improved)
- Rainwater (what are the rainy periods, what is the intensity and how strong is their fluctuation, can rainwater harvesting be improved through rooftop or catchment harvesting or enhanced infiltration and subsurface storage)

There can be seasonal variations in the availability and quality of water resources, for example:

- Water tables drop during the dry season; this may even happen during the wet season as a result of over abstraction and/or climate change
- Seasonal ponds and pools appear when it rains and disappear in the dry season.
- Rivers may be seasonal and dry up (or partly dry up) during the dry season. With the reduction in discharge often comes an increase in level of contamination as less water is available for dilution
- Boreholes may break down in the dry season because other sources of water have disappeared and they are therefore over-used.

These variations are part of normal seasonal cycles and are seen in a normal year, but they are often intensified by droughts. They may also be the consequence of changes in the catchment area which may lead to reduced water infiltration resulting in lower water availability or even totally drying up of water sources. Deforestation, overgrazing and the use of inappropriate agriculture techniques (e.g. not applying contour ploughing) may lead to erosion, changes in run-off patterns (increased peak flows), and reduced infiltration resulting in lower availability of groundwater. Hence water resources problems need to be analysed in order to find their cause(s) and to be able to introduce appropriate mitigation measures. In addition it is also needed to look at the possible effect of mitigation measures. For example banning cattle from a certain catchment area implies that farmers need other grazing grounds or fodder will be needed possibly from the same catchment area or from elsewhere.

**Infrastructure**
A variety of systems are used to abstract water from these different sources (Box 2). For drinking water supply systems include rope pumps, handpumps (Afridev and India Mark 2) and electrical pumps with a generator; for small scale irrigation systems can be found such as rope pumps, treadle pumps, petrol/diesel pumps, as well as electrical pumps. Important variations exist between regions in the presence of some of these

systems. IMWI (2011) indicates for example that over 14000 treadle pumps were installed in Amhara whereas in Oromia they found only some 160. Such differences may have complications as with fewer pumps installed the expertise with that particular pump may expected to be lower and spare parts may be more difficult to obtain.

**Box 2.** Water supply systems

Ground water based:

- Springs (confined or unconfined)
- Dug and manually drilled wells (unprotected or protected, with or without a lifting device)
- Boreholes with a hand or rope pump
- Boreholes with an engine driven pump and water tank
- Boreholes with distribution system (with or without treatment)

Surface water based:

- Open sources (ponds, lakes, canals and rivers) ;
- Gravity water supply systems (with or without treatment)
- Pumped water supply systems (with or without treatment)

Rainwater based:

- Direct collection in pots and pans
- Roof catchment systems
- Rain water ponds

When regarding multiple use water services, a considerable number of shallow wells constructed under the agricultural programme usually can also provide for the quantity of water needed for drinking water supply. An important problem however is that the current poor quality of the installations entails considerable risks of contamination. Hence the first check to be made is whether the system and pump installation can be improved to reduce this risk. If the latter cannot be achieved at short notice than at least users need to be informed about options for household water treatment. For existing communal systems the situation is often more complex in that their design perhaps may include water for animals (cattle troughs), but rarely will include water for fodder production or other types of small scale irrigation. Also it may not be easy to include the latter in new systems as this will increase the cost which often is subsidized and comes with specific design criteria which may not allow building a larger system to, for example, enable (drip) irrigation. A related problem is that subsidized systems in theory should contribute to enhancing equity, but in practice it may be expected that some can benefit more from the systems than others.

### Demand

Water demands of communities are likely to include:
Domestic use:

- Drinking and cooking
- Personal hygiene and sanitation
- Washing clothes and utensils

Productive use:

- Growing crops (hence it is important to understand the type of crops that are used and the area of land that is irrigated in the community)
- Livestock (hence it is necessary to have an indication of the types and approximate numbers of livestock community members keeps).
- Other activities such as beer brewing or brick-making (hence it is also necessary to find out how much water is used for such other purposes).

The minimum volume of water for **domestic use** in Ethiopia is defined as 15 litres per person per day within a distance of 1.5 km. This includes

- 5 litres per person in a household per day for drinking and cooking needs
- 6 litres per person per day for hygiene and sanitation needs plus

- 4 litres per person per day for laundry.

These minimum requirements are used by the Ministry of Water Irrigation and Energy but are also in line with those indicated in the SPHERE manual (although the latter suggest a maximum distance of 500 meters and also indicates a maximum waiting time of 30 minutes (http://www.spherehandbook.org/en/water-supply-standard-1-access-and-water-quantity/)

The volume of water needed for **productive uses,** will depend on the number and types of crops, livestock and other activities and may also vary between seasons (Table 2).

Table 2. Daily Water Requirements for Livestock Across Seasons (Lpcd)

| **Daily Water Requirements – Livestock (voluntary intake)** | **Wet seasons (23 - 27°C)** | **Cool dry seasons (15 – 21° C)** | **Hot dry seasons (27°C)** |
|---|---|---|---|
| Camels | 13 | 25 | 28 |
| Lactating camels | 17 | 30 | 33 |
| Cattle | 9 | 20 | 22 |
| Lactating cows | 13 | 26 | 29 |
| Goats | 2 | 4 | 4 |
| Sheep | 2 | 4 | 4 |
| Horses & donkeys | 5 | 16 | 18 |
| **Voluntary intake** is the daily amount of water drunk by an animal assuming that fodder contains 70-75% moisture during the wet season and 10-20% moisture during the dry season. (Source Coulter, 2010) | | | |

Also important differences exist in the water requirements of different crops (Table 3) and these depend mainly on environmental conditions. Plants are using a very small amount of water for their growth and a lot for cooling purposes. The driving force behind the cooling process are prevailing weather conditions and the moisture of the soil. The highest crop water needs are found in areas which are hot, dry, windy and sunny. The lowest values are found when it is cool, humid and cloudy with little or no wind. The maximum water requirements of different types of crops also may not occur at the same time of the year which implies that mixing different crops may be an attractive option to reduce peak consumption in a specific time of the year. The water requirement of crops also varies from one growth stage to another and they may respond differently to water stress (Table 4).

Table 3. Example of approximate values of seasonal water needs of some crops

| **Crop** | **Crop water need (mm/total growing period)** |
|---|---|
| Banana | 1200-2200 |
| Barley/Oats/Wheat | 450-650 |
| Bean | 300-500 |
| Cotton | 700-1300 |
| Maize | 500-800 |
| Onion | 350-550 |
| Sugarcane | 1500-2500 |
| Tomato | 400-800 |
| | Source: FAO, 1986 |

| **Whereas it seems attractive to introduce water pumps and (drip) irrigation also for small scale farming, it needs careful analysis and requires comparison with improving rain fed agriculture which may be a less costly alternative** |
|---|

An important point to also take into account is that alternative options to improve rain fed agriculture without using pumps may be an attractive possibility and may involve less investment and recurrent cost making solutions more manageable.

Table 4: Examples of critical growth stages of some crops in Colorado

| **Crop** | **Critical period** | **Symptoms of water stress** | **Other considerations** |
|---|---|---|---|
| Corn | Tasseling, silk stage until grain is fully formed | Curling of leaves by mid-morning, darkening color | Needs adequate water from germination to dent stage for maximum production |
| Sorghum | Boot, bloom and dough stages | Curling of leaves by mid-morning, darkening color | Yields are reduced if water is short at bloom during seed development |
| Beans | Bloom and fruit set | Wilting | Yields are reduced if water short at bloom or fruit set stages |
| Onions | Bulb formation | Wilting | Keep soil wet during bulb formation and dry near harvest |
| Tomatoes | After fruit set | Wilting | Wilt and leaf rolling can be caused by disease |
| | | | Al-Kaisi & Broner, 2009; based on the Colorado Irrigation Guide |

Water demand will vary over the year and will not be the same for everyone within the community. This requires careful analysis, planning and discussion of the distribution of the additional cost involved in multiple use systems. Also some families and particularly female headed households may need more support to benefit from MUS. A briefing note from IMWI (2011) for example indicates that female-headed households were less likely to adopt water lifting technologies as they only represented 3% of the adopters. A complicating factor for communal systems is that construction costs are largely paid by the government or NGOs. Providing a larger system that also provides water for small-scale irrigation may not fit with the purpose for which financial resources are provided. Institutions and projects may just focus on providing domestic water supply and may not be willing or able to pay for the additional cost of a larger system, whereas communities may not be able to get a loan to pay for the additional cost themselves and may not be able to repay these cost as this would require growing some cash crops and selling these on the market. Hence multiple water use in communal systems may be complex and may require institutional change.

**Who has or will have access**

Different people within a community may be expected to have different water needs and different levels of access to water services. Some may face more important barriers than others and these may include:

- Physical barriers:
    - Long distances to water infrastructure
    - Physical difficulty of collecting water (steep slope, heavy pumping)
    - Long time to collect water because of a low discharge (flow)
    - Long queues at the water point

- Social and legal barriers
    - Source is on private land, and access is blocked by the landowner at certain times
    - Certain people are excluded from using water from certain water points
- Financial barriers
    - Water fees are too high for poorer people or for certain uses
    - Lack of resources to collect and store water (e.g. lack of a donkey to collect water from a nearby community, lack of jerry cans etc.)

Access to water resources and water services are also subject to seasonal influences. For example:

- People may have to travel long distances to collect water in the dry season if the source near to their home dries up (Figure 2).
- People fetching water may face long queues in the dry season
- Landowners may prevent other households collecting water from springs or other sources on their land at certain times of year.

These seasonal variations in access to water have impacts on livelihoods, food security and health, which often also show seasonal patterns. For example:

- Use of seasonal pools and ponds, which are unprotected sources, for drinking is associated with peaks in diarrhoea occurrence.
- Long waiting times for water during the dry season use up household labour, preventing household members (especially women) from engaging in income-generating activities or devoting time to childcare.
- Livestock which do not receive adequate water during the long dry season produce less milk, which can affect the food security of pastoral households.

**Looking for opportunities?**

Long waiting lines at water points are an important burden for people and particularly women and children. This is aggravated by the fact that no sanitary facilities are available in the area of the water points. This burden however can be turned into an opportunity by establishing a public toilet in the area. If separate urinals are installed the toilet can become an important source for urine that can be used as fertilizer. Local farmers may be willing to pay for this fertilizer and these resources can be used to manage the toilet.

**Figure 2** Donkeys carrying several jerry cans of water

## 4. Assessment tools for multiple use water services

To maximise the benefits of multiple water use it is necessary to make an assessment of the water resources, existing infrastructure, and the demand and access to water. Some tools that can be helpful to jointly with community members explore the situation include:

- Community water mapping
- Livelihood grouping
- Wealth ranking
- Seasonal calendar

### *Community mapping*

Community mapping allows for a better insight into the (seasonal) availability and use of water resources, the existing infrastructure, demand and access for water for multiple uses. Community mapping can be initiated with community leaders or the WASHCO, but can also be used with other groups within the community, like different livelihood groups, different wealth groups and with men and women separately. This can give insight of the differences in water demand, access and use between the different groups, which also may help community members to better understand their own situation. Box 2 provides an overview of the steps that need to be taken to establish a community map.

It is important to take into account that community members have their daily tasks and being involved in community mapping or other activities initiated from outside the community takes time. Hence depending on the local situation you can take different approaches which may include developing the map with a group of 10 (as shown in Box 3), but you may also make a first map with fewer people and then use the draft to make it more precise in a community meeting or in meetings with separate groups. This has the advantage that you create a transparent process where a larger number of people will be aware of the situation and the results whilst not spending a lot of time in the exercise.

**Box 3** How to do community mapping

- Identify and agree with local actors who will be the team and the team leader which you will support in developing the mapping. Usually this will be either the WASHCO or other persons nominated by community leaders.
- Arrange for a meeting with a number of people from the community (not more than 10) to participate in the exercise. Ask the community team leader to make sure the participants are a good representation of the community (men / women, poor / less poor, people with livestock/ people without livestock, people who irrigate / people who do not irrigate), unless separate meetings with these groups are planned to discuss the draft map
- Ask the team leader to explain that together a map will be developed of the community with all the water sources, the houses, roads, farm land (irrigated or non irrigated) water infrastructure, communal grounds, forests etc. as a basis to identify potential problems and solutions
- Explain the use of the material (flipcharts + markers in different colours, or locally available materials, like stones, twigs etc.)
- Facilitate the mapping process and encourage everyone to have an input in drawing the map allowing ample time to draw the map(s); also ensure that distances are added to understand the time it may take different families to reach a water source
- Discuss the results by asking the group to explain what they have drawn.
- This map can now be used to discuss possible problems related to the water supply situation and to the different water uses that apply for the different water systems.
- Ensure that notes are taken of the discussion and register key points on a flipchart
- Make a sketch or picture of the map(s) as the map will stay in the community.

### *Livelihood grouping, making of livelihood zone profiles*

Demand for and access to water for multiple uses may vary widely over different livelihood groups. Livelihood groups consist of people who are involved in similar activities to sustain their livelihoods, for example cow farmers or farmers mainly growing a particular crop.

All woredas in Ethiopia have already been delineated in 2009 into 'livelihood zones' by the early warning department and the Disaster Risk Management and Food Security Sector (DRMFSS). Livelihood zones are areas with similar agro-ecology, market access, and livelihood activities. Some woredas lie entirely within one livelihood zone, while others include several zones. For each livelihood zone, short profiles are available with the Woreda Agriculture Desk which includes a 'seasonal calendar' showing seasonal (month by month) patterns of food availability, disease, and main farm and non-farm activities. Finding out the livelihood zone of your Woreda by getting access to these profiles or by asking the staff from the desk is helpful to be able to get a feel for the situation and to take this information to the community for the assessment of the situation. If you do not have access to this information you can also generate it in the visit to the community. As part of the mapping exercise you can also ask about the different livelihood groups that may be present and it may even be feasible to add this information to the map. In fact you may be adopting a refined approach where you for example distinguish between farmers with and without irrigation systems.

### *Wealth ranking*

Just as for livelihood groups, wealth groups and their characteristics (in terms of what assets they generally possess) have already been identified for socio-economic groups in all woredas and livelihood zones in Ethiopia in 2009 through the DRMFSS's livelihoods baselines. The livelihood zone profiles describe the typical characteristics of better-off, middle, poor and very poor households in the zone. Woreda officials can use these wealth group breakdowns – found in the livelihood profiles for each livelihood zone and woreda – as a guide to help understand the different assets held by each wealth group and how these affect demand for and access to water. It may also be useful for selecting people to participate in participatory mapping exercises, like the participatory mapping, mentioned above and to establish the need for a discussion at community level about possibilities for example for differential tariffs.

You can also generate this information at community level and this may be quite relevant to explore whether for example poorer members or even sections of the community are disadvantaged in terms of water access and use. Particularly female headed households and elderly people may be poorer and may face specific problems. Creating more openness about such problems may help the community to agree on specific support measures for disadvantaged families.

### *Seasonal calendars*

A useful way to bring together information on access to and use of water for multiple uses, is through a seasonal calendar. In preparation for the work in communities and Kebeles it will be useful to collect data on seasonal variations in water availability and in water needs for cattle and crops. With this information you can work with the community group involved in the mapping to jointly prepare a seasonal calendar, to better understand water availability and needs whilst linking it to at least one other key livelihood aspect being the incidence of diarrhoea (which can be checked with the Health Extension Worker). The approach to making a seasonal calendar is shown in Box 4 and an example of such a calendar is shown in Table 5.

**Box 4 How to make a seasonal calendar**

To create a seasonal calendar of water sources, draw a table with a column for each month of the year. For each of the main water sources indicated on the community map, add rows to represent different uses of the source (drinking, washing, irrigation, livestock and any others). Shade the boxes to show in which months water is used for each purpose. Then add a row to record average waiting times at different times of the year for each water point. More details can be added by collecting information from the group or the HEW about the peak months for diarrhoea (waterborne disease) and add this as a row to the table. Also it may be useful to add information on the water needs for different crops which may encourage community members to opt for crop diversification.

**Table 5.** An example of a seasonal calendar

| | | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Source 1 (protected spring) | Waiting time (hrs) | - | - | 2 | 3 | - | - | - | 2 | 3 | 3.5 | 3.5 | 4 |
| | Drinking & cooking | | | | | | | | | | | | |
| | Washing & laundry | | | | | | | | | | | | |
| | Irrigation | | | | | | | | | | | | |
| | Livestock | | | | | | | | | | | | |
| Source 2 (unprotected spring) | Waiting time (hrs) | 1.5 | 1.5 | 2 | - | 1.5 | 1.5 | 1.5 | 2 | - | - | 2 | 2 |
| | Drinking & cooking | | | | | | | | | | | | |
| | Washing & laundry | | | | | | | | | | | | |
| | Irrigation | | | | | | | | | | | | |
| | Livestock | | | | | | | | | | | | |
| Diarrhoea | Peak months | | | | | | | | | | | | |

You can opt for different levels of detail and you may need to be very practical about it because often you do not need too much detail to get a reasonable impression of the situation. For example the collection time is an average and you may establish this on the basis of the experience of the people participating in your meeting. On the other hand it may also be useful to add some more data for example to Table 4.such as the average number of users of a specific source in the different periods of the year. Some sources may have many more users in the dry season, and average waiting times may become very high in this period. In some cases even rationing may be applied. These are important data and may help to visualize the situation to clearly identify the different problems.

A seasonal calendar helps to visualize the information about water sources and uses together. It enables community members to understand their situation and to identify specific months when there are problems such as use of unprotected sources for drinking water or long waiting times. Seasonal calendars can also show, for example, months where high labour demand for agriculture coincides with peaks in time required for water collection etc. For further information you can consult the resource materials on the CDRom.

**Transect walk in the catchment area**
A transect walk is a systematic analysis of the catchment area where the water from the water sources is coming from. It basically consist of an assessment of the catchment area by walking along a straight line to explore the situation. A transect walk in the catchment area may be very important to identify possible risks that may affect the long term water availability or water quality. If the water catchment is not well protected and signs of deforestation, overgrazing and erosion are visible the water source may be at risk. Furthermore farming using fertilizers and pesticides may also negatively affect the water quality of the water sources and may lead among others to increase in nitrate levels which may generate a risk for small babies. Experience is needed to implement a transect walk and additional information is available in the resource material in the CD provided.

**Sanitary survey**
To assess water quality risks a first step is to implement a sanitary survey which is a systematic analysis of possible risks that may occur in the water supply chain from catchment to consumer (catchment area, water source, water supply system and household water storage and use) (Lloyd, B. and Helmer, R. 1991). The most important risk may be related to bacteriological contamination from human and animal excreta. Possible risk thus can be identified by exploring if water in the water resource can come in contact with pollution. This may include for example the inflow of dirty water in a well through cracks in the lining or well cover, but also by infiltration of polluted water just upstream of a spring, or direct hand contact with water that is drawn from springs, wells and pumps. The risks mainly concern drinking water and water for cooking (washing vegetables etc.) as this may lead to direct ingestion of bacteriological contamination which may cause disease. For other uses of water such contamination is less of a problem or no problem at all. An experienced person is likely to detect whether a water source is at risk and only in case of doubt it may be needed to do bacteriological water quality testing or testing for harmful chemicals such as Fluoride and Nitrates. Further information of water quality is included in the GLOWS manual.

## 5. Establishing multiple use services

After having done a participatory assessment of available water resources, infrastructure, demand and access related to multiple uses of water in the community, the WASHCO and the community can start thinking about what can be improved in order to better match the water services to people's multiple demand in a sustainable and equitable way.

The main point is to take the different types of water needs of people as a starting point and to carefully explore different options available to them to obtain financially sustainable and equitable water services that respond to those needs or to explore options to reduce those needs. In this process it is important to take into account that it may be feasible to both influence the availability of water (additional water points, better catchment management, rainwater harvesting etc.) and the water demand (crop variation, efficient water (re)use)

In the development of the multiple uses of water sources and systems in a specific location in general two options can be distinguished. The community mostly depend on communal systems such as handpump wells, tap stands and water ponds. Here the scope for multiple water use of existing systems may be limited but some options may be available in promoting water use efficiency and possibly more importantly efforts may be needed to ensure that people at least use water from safe systems (which may require system improvement) for drinking and cooking. To enhance the use of water for productive use in this type of communities the possibility of additional water points needs to be explored.

Management of communal systems needs to be taken into account when thinking of multiple uses of multiple systems. Within a community, there can either be one single water committee, which is responsible for the system(s) providing water for multiple uses, or separate committees for different uses, for example a committee for water supply for domestic use, and an irrigation committee for irrigation. In several communities where the CMP approach has been applied even several WASHCOs may exist as under this approach each water point that is being developed has its own committee that organizes the work, oversees construction and thereafter takes responsibility for management and maintenance. Hence depending on the situation it will be necessary to work with one or more WASHCOs.

In other communities household wells may be the most important water source and these may already be used for multiple purposes. This in a way may be less complicated particularly where such systems are built and financed by users possibly making use of a credit facility. Still different activities may be needed to enhance and improve the multiple uses of these systems. It may be anticipated for example that specific efforts may be needed to ensure that the water quality of these sources is also suitable to be used for drinking water. This may require improvement in well construction and pump installation (if available). As an alternative it can also be considered to introduce household water treatment or to construct a new safe water point where people can obtain a restricted quantity of good quality drinking water.

A common issue in both types of communities is the need to strengthen the link between the different sectors and particularly water, irrigation and health. Encouraging collaboration particularly at Woreda level (but also at higher levels) between these sectors can contribute considerably to effective multiple use systems. One of the clearest examples is the promotion of wells with rope pumps for small scale irrigation by the ministry of agriculture which is supported by the agriculture extension workers at Woreda level. By teaming up with the Woreda staff working on drinking water supply and the HEWs wells meant for irrigation (but also used for domestic water supply) can be turned into safe water supply (thus contributing to meeting the access for all targets) instead of being a health hazard for the users.

# 6 Self evaluation

This is an individual evaluation of your understanding of the information presented in this module. Answer the (multiple choice) evaluation questions and check your own answers. In case your answers had many mistakes it is suggested that you review the module again before doing the assignment.

**Q1. What is the difference between a well people use for irrigation and for drinking water?**

A. There may be no difference
B. Wells for drinking water always have better water quality
C. Wells for irrigation always have a larger discharge than wells for drinking water

**Q2. Which of the following systems has most potential for multiple uses of water?**

A. A piped system with 100 household connections and 4 communal tap stands
B. A household level shallow well
C. A community level hand dug well with hand pump used by some 50 households

**Q3. What can be said about the following statements?**

i) Multiple uses of water can be facilitated by adding a technological add-on to existing systems
ii) Multiple uses of water can be facilitated by supporting community level institutional arrangements for prioritising water uses and conflict management

A. Statement i is correct, statement ii is not correct
B. Statement ii is correct, statement i is not correct
C. Both statements are correct
D. Both statements are not correct

**Q4. Which is not an example of a livelihood group?**

A. The best-off / wealthy people in the community
B. Day-labourers
C. Cattle-farmers

# 7 Assignment

1) Find a water source nearby your office or in one of the communities you work and identify the different uses made of the water in the dry and the wet season (do they need a table for this? i.e. Separate drinking, other domestic, livestock, irrigation, other).
2) Find 2 or 3 families using the water source, and ask about their use of other sources in the dry and wet season. Why do they use other sources?
3) Could the water source that you have studied, be improved to supply water for more of the requirements of the families living in the area? Who would benefit from the interventions? Who might not benefit or lose out through the interventions?

# 8 References and further reading


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# 9 Answers to self evaluation questions

1: **Answers A is correct**. In many locations household wells are used for both drinking water as well as small scale irrigation. Answer B is not correct as a considerable number even of protected wells that are used for drinking water in Ethiopia are polluted often as a result of poor design and/or maintenance and repairs. Answer C is not correct as the same wells may be used for both purposes and the discharge depends on the groundwater conditions

2**: Answer B is correct**. A household well can provide for both drinking water and water for other use including irrigation provide the environmental conditions are favourable. Piped systems are usually designed only for domestic water use and the large number of house connections may imply that the system is already being stretched. A communal well generally has limited scope for multiple use services that may include watering cattle, and perhaps some irrigation of land close to the well.

3: **Answer C** because multiple uses of water can indeed both be facilitated by adding a technological add-on to existing systems and/or by supporting community level institutional arrangements for prioritising water uses and conflict management (traditional or with external support)

4: **Answer A** because: “The best-off / wealthy people in the community” is a wealth group, rather than a livelihood group. The fact that people in this group are wealthy does not say anything about the livelihood activities they are involved in.

*If you failed to provide several of the correct answers, then review this module again.*

## Organizations involved in developing GLOWS in Ethiopia

RAIN is an international network with the aim to increase access to water for vulnerable sections of society in developing countries - women and children in particular - by collecting and storing rainwater. RAIN focuses on field implementation of small-scale rainwater harvesting projects, capacity building of local organizations and knowledge exchange on rainwater harvesting on a global scale.

www.rainfoundation.org

Research-inspired Policy and Practice Learning in Ethiopia and the Nile region (RiPPLE) is a 5-year Research Programme Consortium funded by DFID aiming to advance evidence-based learning on water supply and sanitation (WSS).

www.rippleethiopia.org

Building on the development priorities set out in Ethiopia's poverty reduction programme and consistent with its commitment to strengthen synergies with the programmes of its key partners, SNV Ethiopia is working in two impact areas: *Access to Basic Services* and *Increase in Production, Income and Employment.*

www.snvworld.org

IRC International Water and Sanitation Centre is a knowledge-focused NGO that works with a worldwide network of partner organisations in order to achieve equitable and sustainable water, sanitation and hygiene (WASH) services. IRC's roots are in advocacy, knowledge management and capacity building. The organisation was founded in 1968.

www.irc.nl

MetaMeta Communications tries to close the gap between knowledge suppliers and practitioners through a range of services in capacity building, training and communications. MetaMeta Communications offers specialized communication services for international development agencies and resource management institutions.

www.metameta.nl