Rainwater Catchment in Nepal: An Answer to the Water Scarcity Problem of the Next Millennium

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Abstract

For the past two decades, provision of safe drinking water facilities for the population has been given high priority by both governmental and non-governmental agencies. Water has been brought closer to communities thus saving people much time and energy.

Catchment and utilisation of the tremendous natural rainwater resource is one of the right choices in Nepal's present context. Advantages of utilising rainwater can be summed up as: women and children benefit first; quality of rainwater can be maintained with simple and minimal efforts; catchment systems are independent on a household level; simple construction and easy maintenance; low environmental impacts; reduction of soil erosion and flood hazards by intercepting roof run off; and, improvement of the ground water table due to reduction in abstraction.

Introduction

Since the last two decades, provision of safe drinking water to Nepal’s population has received high levels of attention and been a major program by both governmental and non-governmental agencies. Facilitating communities by providing closer water sources, undoubtedly saves time and energy being spent on fetching water from long distances; thus it is a wise school of thought heading in the direction of poverty eradication.

As a result of collective efforts made in the past from sector agencies, the national water supply coverage figure of 63% was obtained at the end of 1997 in Nepal, as a result of huge amounts of investments in the form of governmental subsidies, grants from friendly countries, and normal and soft loans from various countries and banks. A co-ordination gap between and among the sector actors always remained very wide in the past. Ad hoc scheme selection, task duplication and repeated budget allocations are some of the examples that often were faced and need more attention in the present also. Another factor noted from past experience is that there has been quite a lack in innovation. Traditional technologies like gravity flow water systems in the hills, and tube wells in plain areas have been commonly used technologies from ancient times which have omitted a large number of the population from the coverage point of view.

Although a national coverage figure of 63% in water supply till the end of 1997 provides some ray of hope for the future, looking at the poor service levels of a provided facility in
terms of quality shows that there is sufficient room for questioning the improved health status of the community. Further, findings in Lumbini zone (one of the 14 zones of Nepal, in the 1992 RWSSP survey) reflect the situation that nearly 14% of the total population is facing acute water shortages and are completely devoid of water resources to establish any type of water supply scheme. Population settlements along the ridges, hill tops and bhabar area (southern foot hills of Shivalik range) result in the most hardship, where women and school-age children live a very tiresome and disappointing life.

The demand for water has been increasing day-by-day with the rapid growth of population, urbanisation and changing lifestyle of the people. Due to unavailability of water, sanitation conditions remain always at a low level, thus resulting in higher health risks. Furthermore, depletion of available quantities of water from surface sources and from groundwater sources has been a nagging issue, necessary to be discussed, studied and taken care of in the near future. It is thus very clear that finding alternative technologies to address the above situation is an urgent need. Otherwise, the population of hill tops and bhabar areas will remain in the same alarming situation for decades to come.

Harvesting and utilisation of the tremendous natural water resource in the form of rainwater would be one of the right choices and solutions in the present context of Nepal. Advantages of utilising rainwater can be summed up as: women and children benefit first; quality of rainwater can be maintained with simple and minimal efforts; harvesting systems are independent at household level; simple construction and maintenance of the system by the users; low environmental impacts by reduction in soil erosion and flood hazards by intercepting roof run off; improvement in the ground water table due to reduction in abstraction; time and energy saving, etc.

**Traditional practices on rainwater utilisation**

Rainwater catchment systems have been used since ancient times. Using roof catchment and storing run off from the hill sides for both domestic and agricultural purposes has been a centuries old practice in different parts of the world. The art of rainwater collection as a principal source of water undoubtedly is becoming more and more popular in many countries of Africa, Latin America and Asia with the successful implementation of rooftop collection, particularly in rural communities.

The practice of rainwater collection and its uses for household needs has been a age-old practice in the context of Nepal as well. Evidence of many traditional water collection ponds, especially in the hill villages, date back to the historic kingdom time of Nepal (Baise Chaubise Raja's time). Many water collection ponds were made during that era and the technique has become more developed since then. Water is deposited in the ponds during the rainy season and is used during the dry spells in many domestic needs including washing, bathing, drinking, etc.

The technology of rainwater collection from rooftops in ferrocement tanks for domestic purposes is becoming more and more popular in the remote households of Nepal, after its
successful pilot project in Daugha, through the Village Development Committee (VDC) of Gulmi district by the Rural Water Supply and Sanitation Project.

Efforts of rural water supply and sanitation projects: an introduction of rainwater catchment systems in Nepal

The Rural Water Supply and Sanitation Project (RWSSP), jointly funded by the governments of Nepal and Finland, is being implemented in the six districts of Lumbini zone. The project gathered information on the drinking water situation during 1992-1993, from all the villages (nearly 3,100 villages of 408 Village Development Committees in Lumbini.Zone) to determine the relative hardships of different areas. Level of hardship is the main criteria used in selection of areas for water supply projects in the RWSSP so as to prioritize the area in real need, which also helps to avoid any possible external influence in the selection of projects. (*Hardship is a function of Service Level which is determined on the basis of quality, quantity, accessibility, reliability of the source and continuity of the facility*)

Criteria Used for Determining Water Supply Service Levels:

<table>
<thead>
<tr>
<th>Service Level</th>
<th>Quality</th>
<th>Quantity (l/c/day)</th>
<th>Accessibility (min)</th>
<th>Reliability (mon/year)</th>
<th>Continuity (hr/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Good</td>
<td>Protected Source</td>
<td>&gt;45</td>
<td>&lt;15</td>
<td>12</td>
<td>&gt;6</td>
</tr>
<tr>
<td>2 Acceptable</td>
<td>Acceptable Source</td>
<td>&gt;25</td>
<td>&lt;30</td>
<td>&gt;11</td>
<td>&gt;5</td>
</tr>
<tr>
<td>3 Poor</td>
<td>Any source</td>
<td>&gt;15</td>
<td>&lt;60</td>
<td>&gt;10</td>
<td>&gt;4</td>
</tr>
<tr>
<td>4 Very Poor</td>
<td>All other water supplies</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

The overall hardship ranking is calculated using the method as follows:

\[ HS = (0 \times L1 + 1 \times L2 + 2 \times L3 + 3 \times L4) \]

where,

- \( HS \) = hardship score
- \( L1 = \% \) of people falling into service level 1
- \( L2 = \% \) of people falling into service level 2
- \( L3 = \% \) of people falling into service level 3
- \( L4 = \% \) of people falling into service level 4
As a result of analysis based on explained assumptions, Daugha Village Development Committee of Gulmi district was found to have the most hardship in Lumbini Zone with respect to drinking water situation. Having no other feasible options, people of Daugha and the RWSSP agreed upon to introduce the rainwater collection system at the household level on a pilot basis. With the promising outcome of the pilot program, the technology is being replicated to other neighbouring villages and districts in the near future. Until the end of March 1999, nearly 1,700 ferrocement tanks of 2000 litres capacity have been constructed in 20 Village Development Committees in the hills of Lumbini.

**Implementation policies**

Mobilisation of local resources (money, materials, manpower); training of local people on building the system; and involvement of private sector organisations in the program as a partner are the main policy issues in rainwater harvesting projects which eventually ensures sustainability.

Key issues defined and followed by the RWSSP are explained briefly here under:

**Information Base**

The database related to water supply was established at the Village Development Committee and district level, to identify the existing water situation and the respective hardship of the communities, which ultimately eased the process of project selection and prioritisation, thus avoiding other external influences.

**Community participation**

Besides the hardship criteria, another essential criteria of the RWSSP in project selection is the commitment of the beneficiaries for their participation in the program, both in cash and kind. It has been made a prerequisite that apart from labour contribution, the beneficiaries also must contribute some money for investments and implement a fund raising system for operation and maintenance purposes.

**Private sector involvement**

Involvement of local NGOs/CBOs and other private firms has been considered important and useful in assisting communities for program implementation. The concept is in-line with the principle of institutionalisation, rather than to merely obtain a certain goal.

**Step-by-step process**

The RWSSP, with its long experience in water and sanitation related activities, has been able to design a step-by-step procedure flow chart to successfully implement a project. Furthermore, this step-by-step flow chart is gender-sensitised and incorporates various environmental-friendly aspects.
Capacity building at local the level

Capacity building at the local level is the key to sustainability. Transfer of technology by the training of local people in various technical and managerial related issues has been the main thrust of the RWSSP in the water harvesting programme.

Cost sharing by different stakeholders

Stakeholders at various levels need to collect their commitments to match the set percentage amounts of the project cost. This has been made a prerequisite in the RWSSP program for project selection. The same commitment needs to be materialised before the project enters the implementation phase.

Collecting rainwater from thatched roofs

Water collected from a thatched roof was not accepted by the population. Hence to start the program, it has been agreed that those households which have CGI roofs will construct two water collection jars, whereas households with thatch roofs will receive 180 sq. ft. of CGI sheet and initially construct one jar.

Revolving funds

The objective of the establishment of a revolving fund is to facilitate lending of financial resources for construction of additional jars. A household with 6 members needs at least 6 jars to meet present consumption of 100 litres a day. Revolving funds are to be established at each ward of the Village Development Committees, which will be loaned to the needy people and be administered by the Water User's Committee.

Monitoring & Evaluation

The RWSSP has developed project monitoring and evaluation guidelines in consultation with the district level authorities which clearly explains Who?, Why?, When?, How? and Where?. The stage at which the M&E team should visit the project areas has been fixed in the project flow chart.

Technology and the steps of the program

Technology:

The technology developed is aimed to reach the individual households in the community, in which 2000 litres capacity jars are constructed to collect rainwater from the guttered roof eaves. Ferrocement jars are constructed of thin-walled reinforced concrete, commonly constructed out of cement mortar and reinforced with closely spaced layers of wire mesh.
Technical designs have been made based on:

Dr. Reissner's Theory
Carpenter's Theory
assuming base and walls are monolithic

To check:

the hoop tension resistance;
water tightness.

Steps:

Design of the rainwater collection system;
Testing phase on pilot and demonstration basis;
User demand through Village Development Committee and priority setting;
Feasibility studies (Technical, Social, Health...);
Formation and registration of Water User's Committee;
Training of Water User's Committees on managerial aspects;
Program implementation (jar making program);
Training of local people to serve as capable Mistri to construct the jars;
Establishment of revolving funds;
Jar construction activities on a continued basis;
Initiate sanitation related activities;

**System cost and its sharing**

As explained earlier, an average household with six family members needs six jars to reach the basic service level, for which an investment of nearly US $ 56 per capita is needed. To initiate the program with 2 jars of 2000 litres capacity per household, an investment of US $ 24 per capita is calculated. The remaining number of jars needed to reach the basic service level are to be added by the households themselves. With this concept, the system has become a self-reliant water supply system, where more than 2/3 of the total amount is provided by the community. All the stakeholders in the program are required to contribute to reach the amount of US $ 24 per capita, as follows:

Cash:

US $ 5 per capita from Village Development Committee contribution;
US $ 5 from each household (it is nearly US $ 1 per capita) from the beneficiaries;
US $ 18 from the district water supply and sanitation fund. The district funds are constituted on the basis of 50-50 matching grants from the governments of Nepal and Finland.

Kind:
Collection and transportation of local materials by the beneficiaries;  
Transportation of provided materials from the nearest road head to the construction sites;  
Provision of unskilled labour for construction of the rainwater collection system.

**Institutions involved**

The principle strategy of the RWSSP involves many locally-based NGOs and CBOs working together in the districts as partner organisations. There are 21 rainwater collection projects presently being implemented in the Lumbini hill districts where 10 locally based NGOs and 21 Water Users Committees are involved as partners. It is interesting to note that some of the NGOs and Water User's Committees have attained quite a high managerial and technical level of knowledge in the rainwater harvesting program in a rather short period of time, as a result of the partnership venture.

**Conclusions**

There are clear indications from the communities that people have started internalising the rainwater harvesting technology as an appropriate one for the hardship areas. Therefore, the technology should also be replicated to the other parts of Nepal, where water resources are also not easily accessible. It is also common knowledge in Nepal that water scarcity and the most hardship effects mainly the underprivileged people. Therefore, *the rainwater harvesting program has also the credibility of serving the poorest of the poor of society*. Rainwater needs to be recognised as a potential drinking water resource from the government agencies; as well, they should place an equal emphasis to launch such programs in the most needy areas. To address the water scarcity problem, harvesting and utilisation of rainwater may be the right choice and answer for the next millennium.

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