



Fog Water Collection in Nepal

An Innovative New Approach to Rural Water Supply

Fog Water Collection is one of the many innovative techniques that Nepal Water for Health (NEWAH) has pioneered for use in the water and sanitation sector. This leaflet describes the technology and how it is being applied in rural areas of Nepal.

"If the fog stays like this for three hours then today I won't have to go to fetch water"

- Chandra Maya Limbu,
Dhoje Danda, Dhankuta



Meeting a Unique Demand

The hills of Nepal are home to numerous communities who struggle to access adequate water and sanitation facilities. For the communities that have settled on hill tops and ridgelines, access is particularly challenging. In such communities conventional gravity flow schemes are unsuitable, as settlements are usually located at an elevation higher than suitable water sources. For lack of an appropriate alternative, people walk great distances along steep terrain to retrieve a single vessel of water. This water is not always safe, and is often inadequate to meet daily demands. What's more, water collection is usually carried out by women and children who sometimes spend 4-6 hours per day carrying water uphill.

Procurement of water in these communities poses a special challenge, and requires an understanding of both the physical and social environment to develop an effective solution. In Eastern Nepal, the environment is characterised by the presence of water laden fog which forms in the summer months. Fog represents a viable water source that can be collected with simple, passive technology.

Since mid 1990's NEWAH has been implementing fog water collection schemes to meet the demands of communities living above other suitable sources. These pilot projects have proven to be unique and effective in addressing the social need for water and sanitation in these remote areas. During the summer months NEWAH fog collectors are producing between 2,000 and 5,000 litres of water per day; reducing the burden of carrying water from distant sources, increasing sanitation and generating new opportunities through time savings. Currently, there are operational projects in Ilam, Dhankuta and Taplejung Districts of Eastern Nepal.



A Historical Precedence of Fog Collection

For many centuries people in the Middle East and parts of Africa have harvested water from fog. Using rudimentary mud walls or dried gourds, people collected the water droplets that rolled off trees after periods of fog.

Much later, scientists discovered that they could model this natural process, and collect large quantities of water in a systematic way. The technological adaptation of this natural process allows for considerable amounts of water to be harvested when combined with an effective storage system. Fog water has applications ranging from drinking supply to irrigation, forestry and livestock management.

Fog water collection has since been successfully utilised in many regions of the globe, including Chile, Peru, South Africa, Yemen and the Caribbean Islands. The technology was experimentally introduced to Nepal in the mid 1990's to supply ridge communities with a sustainable source of drinking water.

The Benefits of Fog Water Collection

- ◆ System is passive, requiring no energy input to operate.
- ◆ Multiple uses for water, including drinking, irrigation and reforestation.
- ◆ Reduces the burden of carrying water from distant, erratic sources.
- ◆ Through time savings, the community can pursue other income generating activities, and children have increased time to devote to studies.
- ◆ In many locations fog water is as, or more abundant than rainwater, another alternative technology available to hill and ridge communities.
- ◆ The available supply is only limited by the number of fog collectors one chooses to install in a given area.
- ◆ Easy to construct, and system is easily expandable.
- ◆ Atmospheric fog water is clean and abundant.

Fog Water: Key Issues

How Does the Technology Work?

The technology employed by NEWAH today essentially mimics the function of trees and other natural features, using large polypropylene mesh nets erected on ridgelines to intersect moving fog that is being carried by the wind. Fog is composed of millions of drops of water. Water droplets in fog impact the mesh, trickle into a collection trough, and the water is then stored in a series of tanks for use at local taps. Small community – based fog water collection schemes are capable of producing between 2,000 and 5,000 litres of water in 24 hours, and can provide enough fresh water for storage and use through the dry months of the year.

Where is Fog Water Collection Feasible?

Fog water is not applicable everywhere, and even within a small country such as Nepal its regional applications are limited. In Eastern Nepal many ridge and hill communities between 1,500 and 3,500 metres experience frequent fog episodes during the summer months. NEWAH has developed a protocol for site selection that allows us to empirically evaluate the potential for fog water production and identify the most suitable locations. Networking with partner NGO's and local communities, we are actively working to identify locations where communities will benefit from this technology.



Standard Fog Collector (SFC)

Standard Fog Collectors are used during feasibility studies to assess the magnitude and reliability of the fog water source. They are made of an aluminum frame which supports a 1m² polypropylene plastic mesh panel and collection trough. SFCs are placed in various locations in a village for a one year data collection period.



Large Fog Collector (LFC)

If a site is found to be suitable, Large Fog Collectors are installed to collect a fog water supply. An LFC consists of a single 4.2 x 8 metre (33.6 m²) mesh panel erected on 8 metre wooden posts, supported by a network of cables for stability in strong winds. The number of LFCs constructed is dependant on the water demand of the community.

Operation and Maintenance

Simple and low-tech, fog collection systems are community managed. Once communities have been identified, NEWAH works with regionally-based partners and the community to develop a fog collection system based on their needs. Once completed, a PMC (Project Management Committee) is locally elected to oversee operation and maintenance and caretakers are trained to carry out repairs and maintenance, ensuring that the benefits of the fog water system last well into the future.

Water Quality

Atmospheric water is abundant and clean. Water quality testing has found all parameters to be within WHO guidelines. Regardless, issues of turbidity have arisen in discussions with users. During periods of no fog, dust accumulates on the collection mesh and is washed into the water supply, resulting in turbidity. However, these issues are related to system operation rather than the source. Proper design and maintenance of the system can effectively control and abate risks of turbidity and contamination. NEWAH is dedicated to continuing innovations in fog water technology and implementation, and is developing a flushing system to be used with fog water schemes.

Sustainability

Sustainability is a principle objective of NEWAH's fog water collection program. Through monitoring and project evaluation, the sourcing and implementation of local materials, and a close working relationship with the community, NEWAH strives to ensure that its projects are sustainable at the community level. A new technology, NEWAH uses the learning process to guide technological design and institutional development of fog water collection to continually improve upon sustainability.

Megma, Ilam

The students of Saraswati Primary School in Megma are amazed that water comes from fog. The School Master is proud. Since the completion of the fog collection system in 2003, he has noticed an incredible change in the health and hygiene practices of students and community members alike.

Complimented by a new tap stand and two new toilets, students in Megma no longer have to defecate in open areas around the school and there is plenty of water for hand washing and drinking. The community is hoping to expand the system in the future, starting with a larger storage tank.

Fog Collection: An Unconventional Source of Water

Alongside rain-water harvesting, fog water collection has emerged as an innovative and highly suitable technology for hill and ridge communities without access to traditional sources. Still largely in a state of development, much remains to be explored concerning its further development and application. The climatic conditions and social context exist, though initial experiences warn us to be critical and thorough as we go forward.

Challenges

Despite the success of fog water projects to date, several challenges and issues have emerged.

- ◆ In Nepal, fog is a seasonal source, meaning that water has to be stored in large quantities for dry season use.
- ◆ If not properly maintained, water quality becomes an issue during low-flow periods.

In Nepal ideal conditions are identified in the eastern part of the country, where hills and ridgelines between 1,500 and 3,500 metres are shrouded by frequent fog episodes during the months of May through September. Within five or six districts, prevailing winds from the Bay of Bengal carry warm air inland, which intercepts the eastern hills, rises and cools, creating fog. The potential to harvest fog is greatest on these hills ridgelines.





- ◆ Fog water collection requires specific environmental conditions, limiting its application to specific regions.
- ◆ Procurement and transportation of materials is hindered by remote locations and steep terrain.
- ◆ Strong winds and snow fall can result in structural failure during the winter season.
- ◆ Water yield is difficult to predict, requiring feasibility studies prior to large scale implementation

Easing the Burden of a Pilgrim's Journey

Pathivara Temple in remote Taplejung district greets between 800 -1000 pilgrims per day during the summer months. Pilgrims believe that the temple's god will fulfill their wishes. Previously, Pilgrims has to make a five hour round trip journey to retrieve water from a seasonal source located steeply down hill from the temple site.

In 2004, NEWAH worked with regional partner Alternative Group for Community Development to implement a fog water collection system for the temple. Completed that same year, the fog collectors now produce nearly 900 litres of water per day during the summer months. Collecting water takes only five minutes roundtrip, greatly reducing the burden of devotees to the temple.

Looking Forward

Based on previous success, NEWAH will continue to utilise fog water collection to supply rural hill and ridge communities. As the fog water program continues to expand and develop, priority will be placed on the following issues:

- ◆ Effectively networking with communities and local NGOs over a larger geographic area to expand the institutional reach of the fog water programme.
- ◆ Finding and employing local materials to reduce construction costs and improve upon sustainability. Of particular need is a local alternative to the imported fog water collection mesh.
- ◆ Improving upon storage facilities to allow more water to be collected and stored over a longer period of time.
- ◆ A reassessment of caretaker training and capability.
- ◆ Increased documentation and dissemination of the fog water experience with partner organisations working in the rural water and sanitation sector in Nepal.

Fog water collection is certainly a non-conventional source of water, but not unproven. Projects to date have exemplified the potential for this technology to increase access to water and sanitation where no realised alternative exists. As such, NEWAH continues to innovate and develop this technology to improve quality of life in hill regions.

SFC Feasibility Study Sites

- ◆ Khumjung, Solukhumbu
- ◆ Goth Bhanjyang, Lalitpur
- ◆ Ranimatta, Surkhet
- ◆ Naya Bazar, Ilam
- ◆ Kalpokhari, Ilam
- ◆ Dhoje Danda, Dhankuta
- ◆ Bhadaure, Ilam
- ◆ Megma, Ilam
- ◆ Pathivara, Taplejung
- ◆ Tinjure, Terathum
- ◆ Chitre, Dhankuta

LFC Installation Sites

- ◆ Kalpokhari, Ilam
- ◆ Dhoje Danda, Dhankuta
- ◆ Megma, Ilam
- ◆ Pathivara, Taplejung



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