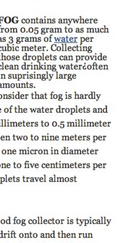
Fog for a Thirsty Planet

Fog could prove to be an unexpected source of drinking water for many remote regions of the world

By Harald Franzen



FOG contains anywhere from 0.05 gram to as much as 3 grams of water per cubic meter. Collecting those droplets can provide clean drinking water¿often in suprisingly large amounts.

To most people, fog is a bad thing. It delays flights, endangers drivers, runs ships aground, ruins the view from mountaintops and generally makes for gray, damp weather. But to some communities in the developing world, fog could mean getting enough clean water to drink. Indeed, a small group of scientists and researchers is creating techniques for wringing the water from fog. And their success suggests that fog collection may be among the simplest, cheapest and most environmentally friendly solutions to the water supply problems in certain remote regions.

Collecting fog may sound a bit like trying to grab actual fistfuls of air. But the task is far less daunting when you consider that fog is hardly different from rain. What differentiates the two is the size of the water droplets and the speed at which they fall. Raindrops range from five millimeters to 0.5 millimeter in diameter and shoot toward the ground at speeds between two to nine meters per second. Fog droplets, on the other hand, are a mere 40 to one micron in diameter (1,000 microns are 1 millimeter); they fall at only about one to five centimeters per second. Because they are so light and drop slowly, fog droplets travel almost horizontally, even in the lightest breeze.

Consequently, you can't catch fog in a bucket. Instead a good fog collector is typically a vertical or almost vertical surface that fog droplets can drift onto and then run down. Following this basic design, trees, in fact, make great natural fog collectors. "There is a history in the southeastern part of the Arabian peninsula, where some people had built sort of mud walls around the trunk of a tree so that the fog that was collected by the tree would be restrained around the trunk when it dripped down in bigger drops," explains Robert Schemenauer, a fog collection consultant in Canada. "You would expect that in any arid part of the world. Trees were collecting fog water and as it was dripping down, people would look at it and say, 'Hey, I need water,' and they would stick a skin underneath or a gourd or a piece of cloth to get the water."

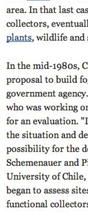


Image: KEITH MAC QUARRIE

MESH collects fog when water droplets land on it and run down to a container.

Scientists in Chile have experimented with man-made fog collectors for several decades. The northern coastal areas of the country are extremely dry but get a lot of fog at the same time. One such place is the fishing village Chungungo, home of one of the first fog water projects and still the largest project to date. "There are extensive layers of low clouds over the ocean, so if you're standing in Chungungo, you look up and there is the bottom of a cloud and it's a few hundred meters above your head," Schemenauer says, describing the site. "The wind pushes that cloud against these coastal hills. So where the cloud is touching the hill, you have fog. And that fog will flow through passes in the hills, it may cover the hilltops or it may just push against the hillside."

Despite all that fog, the land gets virtually no precipitation. The water droplets in the fog are carried over the slope by the wind, and eventually evaporate farther inland. "You loose the droplets unless you have something sticking up from the ground that's an efficient collector of the fog droplets," Schemenauer explains. "That could be vegetation, but the problem is that there is no vegetation to start with, so you can't get enough water on the ground to irrigate whatever seeds might be there."

Enter artificial fog collectors. Taking the fog-gathering technique of trees a step further, the artificial kind use large, vertical mesh panels. As the fog drifts through the mesh, some of the droplets hit the weave, run down the panel and are collected. This water can then be used for human consumption or agriculture or to reforest the area. In that last case, the resulting vegetation can then function as natural fog collectors, eventually passing part of the gathered water on to the soil, feeding other plants, wildlife and small streams that humans can use.

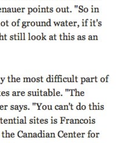


Image: JANA OLIVIER

SIMPLE DESIGN. Because local materials are used to build the device, construction costs are kept low.

In the mid-1980s, Chilean researchers submitted a proposal to build fog collectors to a Canadian government agency. The agency turned to Schemenauer, who was working on unrelated fog research at the time, for an evaluation. "I met with the Chileans and looked at the situation and decided that this really was a realistic possibility for the deserts of the north," he says. Schemenauer and Pilar Cereceda of the Catholic University of Chile, along with other Chilean scientists, began to assess sites and eventually built an array of big, functional collectors on the coastal ridgeline above Chungungo. It turned out that they could build the collectors from basic, cheap materials and¿if built in the right location¿these collectors yielded impressive amounts of high-quality drinking water.

How much water a fog collector can net varies, depending on the frequency of fog and its thickness. The amount of water in a cubic meter of fog ranges from 0.05 gram to as much as 3 grams. In the case of Chungungo, the fog collectors gathered an average of 3 liters of water per square meter of collecting surface per day. In the initial configuration, 50 large collectors of 48 square meters each produced a daily average of about 11,000 liters of water. This provided 33 liters of drinking water per day to each of the 330 villagers. The number of collectors has since doubled. Before the fog collectors were built in Chungungo, water had to be brought to the town by truck at considerable cost to both the residents and the municipality, which had subsidized the water price. The villagers had less than half as much water.

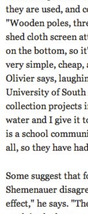


Image: KEITH MAC QUARRIE

FEASIBILITY STUDIES. Scientists first use small fog collectors to assess whether or not a site has potential.

The success of this project and others in South America sparked interest in other parts of the world, and projects are now in various stages of development in many countries, including South Africa, the Dominican Republic, Israel, the Cape Verde and Canary Islands, and Nepal. Fog collectors can be useful not only in arid climates but also in areas where water shortage becomes a problem during a certain time of year. They have even proved valuable in some areas where water is abundant: "It has a big advantage in that the water that's collected is not contaminated with bacteria," Schemenauer points out. "So in some places where there might be a lot of ground water, if it's contaminated with bacteria, you might still look at this as an alternative way to provide water."

Still, fog collection is not feasible everywhere, and possibly the most difficult part of establishing a new collection system is evaluating what sites are suitable. "The science goes into choosing the right location," Schemenauer says. "You can't do this just anywhere." One person familiar with investigating potential sites is Francois Vitez, who worked on a fog collection project in Nepal for the Canadian Center for International Studies and Cooperation (CECI): "I set up a series of small collectors in various places around Nepal to see what the potential was there." Vitez set up sampling meters that measured the fog collection over extensive periods of time. "You have to monitor twice a day how much water you get from the fog collector." This job is usually taken over by a local person, who measures and records the results¿and then sends them to the scientist for evaluation.

"The main difference between Nepal and South America is that in South America you have more large-scale phenomena," Vitez explains. "In Nepal in the Himalayas, what you get is a bit different. There are microclimates, microenvironment conditions, so depending on where you are in a valley and where the valley is from east to west makes a difference whether you get fog or not, so the technique of evaluating a site really needed to be developed there." In all, he sees potential in Nepal: "There are a lot of communities perched up high in the mountains and there isn't always a stream that can supply them with water." The alternative would be to pump the water up the mountain, which would require electricity¿which often just isn't available.

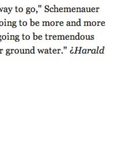


Image: ROBBIE SANDROCK, courtesy: JANA OLIVIER

DRINKING WATER from this fog collector benefits a remote school in South Africa.

Part of what makes this technology very appealing is the fact that only simple materials are needed. Thus, most or all components can be made in the countries where they are used, and construction costs remain low. "Wooden poles, three of them, and then we've got this shed cloth screen attached to these poles with a gutter on the bottom, so it's very sort of third world, you know, very simple, cheap, and it works fantastically," Jana Olivier says, laughing. Olivier, a professor at the University of South Africa, has started two successful fog collection projects in South Africa. "Basically, I collect water and I give it to communities that don't have water," she explains. "One of them is a school community¿there are about 200 kids at school and there is no water at all, so they have had enough water now for two years for the first time."

Some suggest that fog collecting takes water out of delicate ecosystems, but Shemenauer disagrees. "We take such a tiny amount of fog water out that it has no effect," he says. "The fog is maybe 200 meters thick going over the ridgeline, and we work in the bottom four or five meters, so 196 meters of fog goes by above our collectors." Of the part that actually passes through the collectors, only half is retained, so he estimates that less than 1 percent of the total fog water passing over the hill is caught. He also points out that the fog water is used close to where it is collected and thus doesn't really leave the ecosystem.

"In places like California I don't think it's going to be the way to go," Schemenauer adds about the future potential of fog water. "I think it's going to be more and more widely used in developing countries because there is just going to be tremendous need for it with growing populations and more demand for ground water." *¿Harald Franzen*

Image: PERCY JIM¿NEZ

A COMPLETE SYSTEM. The fog collectors in the background gather fog water which is led into a trench-shaped tank, dug into the ground (foreground).