January 2016
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Water resources

Optimising fog water harvesting in South Africa

A Water Research Commission (WRC) study investigated ways to optimise fog water harvesting in South Africa as an alternative water source.

Background

It is only relatively recently that fog water has been collected for domestic consumption. In South Africa too, research has been ongoing since 1995 to determine whether fog water harvesting would be feasible, and if so, where the optimal sites for such endeavours would be located and how much water could be collected.

Preliminary research indicated that fog water collection could be viable in the mountainous regions of the country and along the West Coast where fog occurred frequently. To test these findings, two large operational fog harvesting systems were erected – one at Tshanowa School in the Soutpansberg mountains in Limpopo and the other at Lepelfontein on the West Coast.

Both systems consisted of a 70 m^2 collecting screen composed of nets made from a locally produced material or shade cloth. These nets were attached to a 6 m-high vertical poles and gutters suspended to their lower ends.

During rainy or foggy conditions, droplets intercepted by the nets coalesced and trickled down towards the gutters.

The results proved to be promising, but a number of problems were experienced, which the latest WRC project aimed to overcome.

Study sites

Two sites were selected for experimentation. These were on the farms Swallows Nest in the Zonderberg Mountains near Avontuur, in the Western Cape, and Steenbokfontein near Lamberts Bay on the West Coast. Both sites receive fog frequently.

Various fog water collection systems were tested. These included a triangular system comprising three 3 m x 10 m panels arranged in the shape of an equilateral triangle. It was assumed that such a design would be more robust than the conventional flat structure and that such an arrangement of nets would be able to collect water, irrespective of the direction of fog-bearing winds.

Loggers allowed for remote access of data through a GPRS signal, thus enabling real-time monitoring and regular (one-hourly) archiving of data.

The triangular fog water collection system.

Main results

The results showed that the triangular structure was indeed very strong and sturdy, withstanding severe storms and gale force winds. However, water collection rates were very low.

Research was also conducted to test the water collection efficiency of 12 different materials. These included a number of locally-made and imported materials. The materials obtained from Germany proved to be the most efficient fog water collectors, collecting more than double the volume of water than the locally produced share cloth.

Numerous factors affect the water harvesting potential of fog water collection systems. Geographic factors appear to be the most important of these, especially altitude, since this influences both the liquid water content of the air and the wind speed.

However, topographic factors such as aspect, steepness of slope and the presence of large topographic obstructions in the vicinity of a site may also impact on water harvesting potential. The most suitable sites have high elevation and are located on seaward-facing terrain so as to be exposed to moisture-laden winds.

The liquid water content of the air and wind speeds are the most important climatic controls, with the latter controlling the volume of moist air passing through the nets. Highest water collection occurs during rain events.

The type of material used as fog collectors and the design of the system can thus influence the amount of water collected. Fortunately, these can be controlled and water harvesting potential increased using appropriate design and materials.

The quality of the water collected at the two experimental sites was extremely good and suitable for human and animal consumption.

Novel devices developed

During the course of this project a novel device was developed to measure fog water collection rates. This low flow meter was based on a conventional tipping bucket, but was designed to measure low and intermittent flows from large collecting surfaces. Testing showed the meters to be efficient and reliable.

Another novel device developed during the project was the so-called Whirly. This device comprises a freely rotating central axis to which three fog water collection panels are attached. Small gutters are attached to the lower ends of the panels.

When conditions are suitable, a battery operated motor switches on the system, causing the Whirly to rotate slowly. The system can also switch off automatically. The battery is charged by means of a solar panel.

The Whirley proved much more effective than the triangular system in that it recorded an average of 0.27 litres/m^2 a day. This is still very low and, due to its small collecting surface area (1.38 m^2), the actual volume of water collected was negligible.

Conclusion

This project again confirmed that fog water harvesting is a viable method to provide potable water to isolated mountain communities and, in conjunction with rainwater collection, could provide water security in a water-stressed environment.

Further reading:
To obtain the report, *Optimising fog water harvesting in South Africa* (**WRC Report No. TT 632/15**), contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.