A TASTE OF SALT

Dakar, the bustling capital of Senegal situated on the western-most tip of continental Africa, is running out of fresh water. Part of the problem is its location — it sits on a cape that juts out into the Atlantic Ocean. Known originally as "Cap Vert," or "Green Cape," the area round Dakar has gradually become dry and desolate.

As fresh water is rapidly pumped from local wells, the natural underground veins of water-bearing sand and rocks are slowly being contaminated by saltwater intruding from the neighbouring ocean.

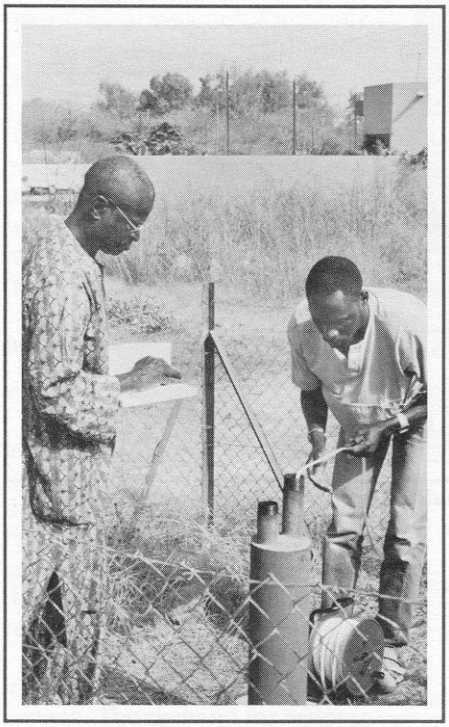
The 1.5 million people of Dakar get 80% of their drinking water from these aquifers. The rest is drawn and transported from Lake Guiers, some 300 km away — at great expense.

Water consumption has increased with population growth and industrialization in Dakar, and the severe Sahelian drought of the early 1980s has slowed the replenishment of the aquifers. Researchers predict that if the aquifers continue to be tapped at the current rate, Dakar's wells will be entirely contaminated with salt water in about 50 years.

Two Senegalese geologists, professors Cheikh B. Gaye and Abdoulaye Faye of Dakar's Cheikh Anta Diop University, decided to find out more about underground water salinization and what could be done to halt or even reverse it. They were joined in the IDRC-funded project by Pierre Gelinas and his research associates from the Université de Laval in Canada.

The scientists studied the underground structure of the five aquifers in Dakar and along the Cap Vert peninsula monitoring some 100 wells.

Over a 2-year period, the Senegalese geologists and their Canadian colleagues have used these test wells to monitor critical factors such as water levels, electrical conductivity (an indication of salt content), temperature, acidity, and the concentration of chemical ions. All data were processed by computer, relying strongly on the expertise of the Canadian scientists. Through mathematical simulations they determined how fast the sea water was moving in.



Each month, researchers evaluate the level and quality of water in the aquifers of the Dakar area.

Inland 800 metres

They came to some startling conclusions. Already, salt water pollution has penetrated inland some 800 m — to the head of the peninsula in Dakar. Their first trial calculations indicate that the advancing saltwater is contaminating the aquifers at an average rate of 40m a year, depending on the amount of rainfall and the amount of water pumped out of wells.

Given the difficulty of reducing water consumption, there are few options for stopping or reversing the process. One measure is to close down a contaminated well for a few days, until rainwater seepages restore it to its former water quality. But such a closure is felt immediately in the distribution system: water pressure drops or the supply is actually cut for a few hours or even days in parts of the city. For this approach to work, scientists believe that wells should be closed for months or years. The effect on Dakar would be staggering.

Irreversible Contamination

In the long run, the process of groundwater salinization and contamination could be irreversible.

Other options are to reduce the rates of pumping or to skim the top freshwater layer of the aquifers with several shallow wells — a practice followed in other countries.

Another approach is to increase the water supply. Senegal plans to build a canal (Canal du Cayor) that will bring additional fresh water from Lake Guiers to the city. But the canal will not be completed until 1995.

The Senegalese geologists are looking at ways of improving the management of the aquifers by adjusting pumping rates at selected well sites, without reducing the total output. This would allow some of the fresh water in the aquifer to flow toward the sea and, in effect, to push salt water back.

In all of these options, the new computer model — designed by the Canadian researchers to analyze water salinization — will prove a valuable instrument to SONEES (Société Nationale d'Exploitation des Eaux du Sénégal). The state-owned body, responsible for the distribution of water, will look seriously at the proposals of the Dakar and Canadian researchers.

By André Potworowski, a consultant in management of technology in Ottawa.

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