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# A center for new water thinking

**Alice Hackman**

In the rest of the Gulf region, the water crisis has been addressed by expensive seawater desalination plants but in Yemen, where oil and fast cash are less readily available, the key to ensuring adequate water supply is good management.

Drop irrigation, here in a vineyard in Bani Hoshaish, is less wasteful than the traditional flooding method, says the WEC. YT photo by Alice Hackman

Since 2000, the Water and Environment Center (WEC) at the University of Sana'a has been tackling Yemen's water shortage head-on to ensure available water is used wisely, before starting to tap into new resources such as surrounding coastal waters.

Set up with Dutch funding, the Yemeni center brings together academics from different water-related disciplines, to better address an issue that, in Yemen, not only has drastic repercussions on education and health, but also on overall development.

“It is now clear that the water crisis is not purely a technical problem, but a multi-faceted socio-economic problem that requires a multidisciplinary approach," said Dr. Abdulla Babaqi, the center's director.

Groundwater levels have plummeted and water springs have dried up, but still demand increases as the country's population grows at the rapid rate of 3.7 percent a year. And the population will double, if the United Nations' projections are accurate, by 2025.

Struggling far below the world water poverty line, Yemenis consume only 130 square meters of water per year, less than 3 percent of the global average, according to the WEC, and home-grown Yemeni expertise is crucial to manage the situation.

Babaqi describes the center as one of “new water-thinking," stressing the need to bring all parties involved in the water sector together to successfully address the water issue for the country's development, in integrated water resource management.

He and his colleagues argue that the water crisis is too complex a challenge for a simple, quick-fix solution such as drilling more wells. Instead, scientists and leaders from all walks of life must work together to address the issue from all angles.

“Water is limited and drilling more doesn't solve depletion," he said, stressing the need to take advantage of

indigenous water knowledge such as rainwater harvesting and terracing to make the best of four months of rain annually.

Arguing that water shortages and the environmental issues must be tackled hand-in-hand, the center conducts research, offers consultancy services, and trains promising graduates to become the water experts of the future. But it also directly consults with water users.

Brainstorming with users

Far from an inaccessible team of academics, the WEC is not afraid to get involved. Its experts works with all layers of Yemeni society, from the employees at the local water and sanitation corporations to the users themselves.

In Dhamar, Taiz and Hadramout, for example, the WEC has started up three pilot projects to directly involve water users in hands-on monitoring of their own community's water resources to avoid depletion.

New golden rules are introduced to the water user groups: The rate of water extraction from the local aquifer must not exceed its rate of recharge through rainfall, and in agriculture wasteful irrigation methods should be replaced.

Instead of the traditional technique of flooding a field with water, the more modern drip, sprinkler and bubbler irrigation methods should have priority, as they reduce wasted water by ensuring each crop receives no more than the water it requires.

Up to 90 percent of Yemen's annual water consumption goes to agriculture, according to the WEC, which means that farmers and cultivators should be key players in any user-led sustainable water management.

Farmers are further encouraged to stop random well drilling, replace qat with other crops, and use crop patterns suitable to each crop's water requirements, said Dr. Naif Abu-Lohom, research and studies department head at the center.

Active members of the community, such as school teachers, religious leaders, well-owners and local council members are directly involved in these small water user groups to ensure new knowledge is disseminated to all of its members.

But if awareness ensures sustainable development in the water sector, so do marketing skills. WEC-led training in marketing with farmers ensures that they not only reap “more crop per drop," but also collect the full economic benefits of their efforts.

“The farmers from the pilot areas of the Community Water Management project are suffering from poor marketing and storage of their products," explained Abu-Lohom. “These areas lack essential basic [facilities] to store their product when prices drop and keep it for another time."

Motivating water employees

Besides its pilot projects with water users, the WEC also conducts short confidence-boosting training courses with mechanics, electrical engineers, technicians and even the heads of local water and sanitation corporations.

“A lot of people are now taking responsibility in local corporations," said Dr. Fadhl Al-Nozaily, head of the training department, explaining that the training covers theoretical and practical, and aims to improve on what employees already know.

Field trips are organized to solve problems such as those in the design of a network, operation of a wastewater treatment plant or even groundwater pollution from a scientific point of view, explained Al-Nozaily.

Helping technicians run a smoother wastewater treatment plant, for example, is important because, in integrated water resource management, wastewater is a resource. Treated effectively, it can be used to irrigate crops, instead of dwindling groundwater.

“Wastewater is often a reliable water resource, with constant flows even in the dry season," wrote the World Health Organization in its 2006 publication, Wastewater in Agriculture.

“The use of wastewater in agriculture should figure more prominently in water resources management because it enables communities to reserve higher-quality water resources [like] groundwater or uncontaminated surface water for uses such as drinking-water supply," it said.

Even the sludge produced by the treatment can be used as a fertilizer, said Al-Nozaily, provided it is not issued from industries, and contains neither heavy metals nor toxic materials. When it is free of these, it is better than chemical fertilizer.

Home-grown water wizards

Yemen already has a handful of well-rounded water managers to oversee good water management, but if the water issue is to be addressed properly, Yemen needs to train a new generation of experts to continue what their mentors have started.

Ten years ago, no specialized institution existed for their education, apart from the university's Faculty of Engineering. But in 2006, the center welcomed its first class of students with relevant experience to its new diploma and master's program.

Its 2006, 2007 and 2008 the center enrolled students from backgrounds as varied as biology, geology, agriculture, irrigation and engineering. Some students already work in the different branches of Yemen's water sector, while others are yet to be employed.

“Anybody who graduates finds work, it's a real specialty in Arab countries," said Babaqi, explaining that until now only Jordan also offers a master's course in integrated water resource management, at the Water and Environment Research and Study Center at the University of Jordan.

The SFD aims to be the hub of a regional center to attract scientists from Sudan, Ethiopia and the rest of Africa.

Grey water from one house's kitchen and the local mosque has revived a small section of Maqshama Al-Wushali (top left), but the rest of the garden remains dry. YT photo by Alice Hackman

said Babaqi.

The integrated water resource management curriculum, compiled in cooperation with two Dutch universities and Cairo University in Egypt, aims to bring graduates with different specializations together to study for a general diploma. It then gives the students space to conduct their own research in the fourth semester.

Tuition for a master's degree in integrated water resource management costs USD 7,000 a year, but for bright students who excel in an interview, scholarships are available. Professors further assist by trying to involve the master's students in foreign projects, so that they can receive outside funding while they research.

Students have been involved in projects covering water quality in Sana'a, rainwater harvesting of school rooftops in Dhamar, and water filters in Amran, according to Dr. Bilkis Zabara, assistant head of the training department at the center.

New decision tools

The WEC also brings in experts to ensure they receive state-of-the-art training in the latest decision-making tools for water management. One of these is the Geographical Information System or GIS, a new method that processes data according to location.

“When you map something, you can see it visually," explained Zabara. “You can see the overexploitation of water, in which areas of Yemen. When you see it on a map, it's much easier to work out the links between the problems."

The GIS can be used to conduct an environmental impact assessment before or after a particular project. Armed with mapped-out data, students can visualize all aspects to solve water problems, said Zabara.

Grey drops could revive parched gardens in Old Sana'a

Ali Naji, head gardener of the Al-Wushali garden in Old Sana'a, outlined the plot of land his family has cultivated for generations.

Spanning from a wild berry tree in the garden's center to its rocky border guarded by two stray dogs, what was once a lush expanse of green, providing his family with food and a source of daily income, is now barren wasteland.

“There's not much left of it," he said flatly. “It's completely dry."

It was not always so. In a country where Muslims pray up to five times a day, the 45 gardens of Old Sana'a, called maqashim, were traditionally each attached to a mosque, using its ablution water to grow vegetables, flowers and fragrant herbs.

Entrusted to the care of several families, the maqashim were awqaf [endowments] but benefited all, in times of peace and war. In 1905, when the city was under siege, goes local folklore, the gardens saved half of its inhabitants from starvation.

Since the 16th century, water was extracted from the local well, mostly using animals such as a bull or donkeys, and used in the mosque's bathrooms, before being returned to the gardens. The system was a precursor to today's grey water recycling.

Grey water is usually water from washing in the kitchen or bathroom. Like the more polluted wastewater, it is today an important alternative source of irrigation water when groundwater in running out.

“Since the wells attached to the mosques dried up, and ablution water was deviated into the sewage network, about 93 percent of the gardens are not cultivated," said Abdulkhaliq Al-Aqwa, member of the local council in Old Sana'a.

“They renovated Al-Sayla [road running through Old Sana'a] and so it doesn't store any rainwater," added Maji, saying that this other traditional water resource for the gardens used to store water for up to six days.

Grey water re-introduced

In 2007, Wadi MENA, an international water project in the Middle East and North Africa, and the WEC stepped in to save Al-Wushali, the garden where Maji's family once grew vegetables.

They showed gardeners how household water, like the traditionally-used ablution water, could also be used to revive their land.

Today, grey water from one house's kitchen and ablution water from the mosque are piped down to a specially-adapted sand filter that cleans it of organic matter. Once treated, it is pumped into a drop irrigation system that nourishes a small corner of the garden. In this verdant patch, grow marigolds, mushgur [aromatic leaves used for decoration], green peppers, and basil.

But still the rest of the garden remains a field of dust, dotted only with litter.

Only one family benefits from the filter and irrigation system, growing vegetables and aromatic herbs in this small section of their land, but none of the three other families -including Naji's- sow anything. The fight against drought is still not won.

“Before the project, the garden was dry, and now the garden is still dry, because the project was only implemented from one house," said Naji.

“If [the grey water] came from five to six houses, it would be better," he continued. “We invited the people from the other houses to attend a meeting, but they didn't come. There is no awareness."

“People are resigned to their fate, so when the government doesn't respond, they don't bang on the next door," he explained.

The solution to activate the community, said Naji, is women. If they move from house to house explaining about the drought, with each woman in turn talking to her father and brothers, awareness will spread and the community might take action.

In the gardener's hands

“It was a pilot project," explained Dr Fadhl Al-Nozaily from the WEC, who helped set up the filter. “There was a long list of different gardens, but Al-Wushali was the most in need."

Wadi MENA and the WEC chose the garden because its well had dried up and the whole area was dry, said Al-Nozaily, but a further extension of the project is up to the gardeners.

“We sat with them, discussed with them - there was awareness, training," he said. “Now it is up to them, they have to do for themselves."

“We are looking for funds for replication," he added, but stressed that a new project would target a different garden.

In the meantime, the local council fights for the gardens' survival against drought, litter and determined real estate developers.

A new project to set up a rainwater collection system in Al-Sayla and encourage it to infiltrate into the groundwater has been forwarded to the cabinet, said local council member Al-Aqwa.

Before, the land brought food home, said Naji. You could feed your children, marry and even buy a bull, but now he has to work as a soldier to support his family.

“Now, if I tried to live from agriculture, I would die," he laughed.

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