HYDROLOGY

Jordan tests ways to save water

As strains on the desert nation's supply increase, scientists collaborate on projects to keep water flowing.

BY AMY MAXMEN, UMM EL-JIMAL, JORDAN

For centuries, the land now called Jordan has been one of the world's driest places. Today, the nation's water supply is more constrained than ever: wells are running dry, groundwater is increasingly polluted and precious water leaks from old pipes. Waves of refugees are stretching resources even thinner: Jordan's population has swelled from 5.9 million in 2006 to 9.5 million in 2016.

The average amount of water available annually per person is less than 150 cubic metres — one-sixtieth the amount that is available to a person in the United States. Researchers, who expect the situation to worsen as temperatures rise and precipitation levels drop with climate change, are coming to Jordan to collaborate on water-technology research and development.

"If we can build systems that work in Jordan, they will work everywhere."

Samer Talozi, a water expert at the Jordan University of Science and Technology in Irbid, says that the country has become an international test bed because of the environmental, structural and social challenges to its water supply. "If we can build systems that work in Jordan," he says, "they will work everywhere."

But not all technologies evolving in Jordan are new. In August, Hassan Fahad al-Rhaibeh, the mayor of the Jordanian town of Umm el-Jimal, was re-elected after pledging to restore reservoirs built by Arabs as early as AD 90. Winter rains and run-off from mountains in Syria — 10 kilometres to the north — once streamed through canals and into basalt-block reservoirs, which stored the water throughout parched summers. People maintained the system for 800 years, through the Roman, Byzantine and Islamic eras, until the town was abandoned around AD 900. Today, those living around the ruins rely almost entirely on deep wells drilled after 1990. They complain that the well water smells and tastes salty.

Mayor al-Rhaibeh recalls an evening in November 2015, after archaeologists and engineers had restored the first of the original reservoirs — a rectangular basin the size of four Olympic swimming pools. "About one hour before midnight," he says, "water began streaming into the reservoir, and I stayed up late into the night to watch it."

The project continued this summer under the watch of Bert de Vries, an archaeologist at Calvin College in Grand Rapids, Michigan. Engineers from the college's Clean Water Institute mapped which canals channel the most run-off. al-Rhaibeh expects that, once completed, the system will provide 10% of the supply needed to support about 4,000 people in the community surrounding the ruins. "It's becoming apparent that if people don't return to some reliance on surface water, they will run out and farms will dry up," de Vries says.

In 2012, a report from US intelligence agencies predicted that water scarcity, coupled with poverty, social tensions and weak political institutions, could lead to conflict in the Middle East. It was not the first such warning. The US Agency for International Development has invested more than US$700 million since 2000 to develop water technology in Jordan, as a way of preventing that outcome.

Researchers are choosing to work in Jordan,

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NEIL BRANDVOLD FOR *NATURE*

Bert de Vries heads a project to restore an ancient water system near the town of Umm el-Jimal, Jordan.

as opposed to other arid nations, because of its geopolitical stability and support from the Jordanian government. Talozi spent this summer teaching officials and private-sector staff how to use modelling software from the Jordan Water Project, an international consortium of researchers based at Stanford University in California. The software takes into account an array of factors, including urban growth and water prices, to guide decisions about repairing or replacing water infrastructure and siting developments that might pollute groundwater, such as a refugee camp or a landfill. "Previously, there was software for the management of water according to physical parameters like precipitation, surface run-off and the efficiencies of the system," Talozi says, "but we wanted software that not only recognizes physical elements, but institutional behaviours that govern those systems, and considers economics."

He is also collaborating with scientists at the Massachusetts Institute of Technology in Cambridge on a low-pressure 'drip' irrigation technology that's thrifty with water and requires about half the energy of standard drip irrigation. The team has tested its technology in olive, citrus and pomegranate farms this summer, and plans a version in the next two years that will be powered by solar energy.

And the Helmholtz Centre for Environmental Research in Leipzig, Germany, is collaborating with the Jordanian government to test small, soil-filtered waste-treatment facilities that could lessen the leakage and inefficiencies seen in large plants, which can pollute nearby groundwater. Securing Jordan's water supply would also benefit Germany, says Roland Müller, a biotechnologist at Helmholtz. "The flow of Syrian refugees to Germany more or less started when camps in Jordan could not support them."

Talozi says the country might take its cue from ancient systems in Petra and Umm el-Jimal and store more rain — although these conduits alone cannot support today's population. Migrants are not the only cause of shortages, he says. "Jordanians want to go to the grocery store and buy apples and tomatoes and lettuce year round, not just eat wheat and barley."

But to de Vries, the resurrection of ruins in Umm el-Jimal serves as a hopeful reminder that people have survived harsh conditions by ingenuity. "As civilizations rotated through this land, one constant over time is the reuse and reliance of the water system," he says. "People in antiquity were not backwards; they were clever and thought of a technology we can revive." ■

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EQUALITY

UK gender-equality scheme spreads across the world

The United States is set to trial a version that will also cover race and disability.

BY ELIZABETH GIBNEY

A programme that grades UK universities on gender equality in science is going global. Versions of the rating scheme have started up in the past two years in Australia and Ireland, and a small-scale pilot begins next month in the United States.

The British programme, Athena SWAN (Scientific Women's Academic Network), launched at ten universities in 2005 and has since spread to more than 140 UK institutions. The voluntary scheme relies on universities supplying self-assessments to the Equality Challenge Unit, a non-profit organization that judges the institutions on their inclusiveness and equality in hiring, promoting and retaining female staff.

In addition to gender equality, the US project — called STEM Equity Achievement Change (SEA Change) — will assess inclusiveness with regards to race, ethnicity, sexual orientation, disability, socioeconomic status and other marginalized groups, says Shirley Malcom, who directs the education and human-resources programmes at the American Association for the Advancement of Science (AAAS) in Washington DC, which will oversee the project. The US effort will assess the experiences of both students and university staff. "We've had a lot of intervention programmes and it's not moving the needle," says Malcom. "We are exploring this strategy in order to try something that's better."

Around eight or nine currently unnamed US institutions will participate in the pilot scheme, which uses Athena SWAN as a model. Over a period of 12 to 18 months, individual departments or institutions as a whole will gather data on equality and identify problem areas. They are then expected to set plans and targets, such as boosting student diversity, closing pay gaps or making the campus climate more supportive. An AAAS panel will assess the submitted reviews and issue a bronze, silver or gold award accordingly.

Most higher-education institutions in ▶