

*He sendeth the springs into the valleys,
which run among the hills.
They give drink to every beast of the field:
The wild asses quench their thirst.
By them shall the fowls of the heaven
have their habitation,
which sing among the branches
He watereth the hills from his chambers:
The earth is satisfied with the fruit of thy works.
— Psalm 104: 10-13*

A traveler in Palestine today can see, as did travelers and pilgrims of long ago, the vineyards, olive trees and citrus groves of land worked for generations. The trees and the farmers who carefully tend them depend on the rain so beautifully described by the poets and prophets of the ancient Middle East.

Rains from the sea bring life to Palestine, as all major water resources of the land come from the groundwater that the rains replenish. After a hot, dry summer, moisture moving inland from the Mediterranean turns to rain when it reaches the cold upper heights of the hills around Jerusalem. An average of 24-28 inches falls from November until April, leaving in its trace a fragile crop of purple, red and yellow wildflowers.

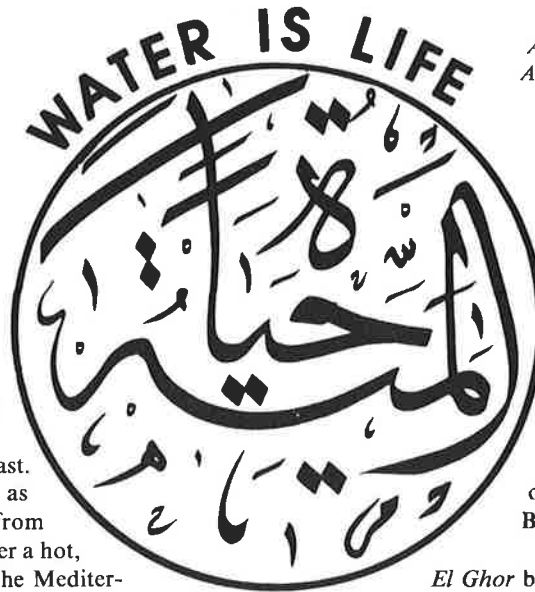
Most of the rain is absorbed naturally by the layers of soft, porous limestone and dolomite which make up the hills. The rain seeps through the rock to flow as groundwater in 10 large natural basins. From the lower altitudes of the hills, the rainwater reappears in rivers and springs that flow both east and west. Apart from 3 or 4 small rivers, however, none of them flow all year. Whether from the surface or from below the ground, most of the water drains west towards the sea, contributing to the moisture of the fertile coastal plain.

A traveler wandering in the hills might see one or two of the many cisterns, some dating to Roman times, built to catch the rain for livestock, farming and domestic use. And an earlier traveler, 100 years before him, might have read this description of houses in his 1876 edition of the Baedeker guide to "Syria and Palestine":

As Jerusalem possesses no springs, the inhabitants obtain their supply of water from cisterns, the roofs of the houses and every available open space being made to contribute the rain that falls upon them...The court with its cistern forms the central point of each group of rooms.

Even with the rain and the cisterns, a traveler might wonder, how can anything be grown amongst the thousands upon thousands of rocks in these hills beyond Jerusalem? Rounding a bend in the road, he comes upon a cultivated valley; a farm village surrounded by small terraced fields of olive trees, vines and grain climbing the slopes. Here the rocks have been laboriously cleared by hand and piled into terrace walls to prevent the red Mediterranean soil, called "terra rossa", from washing down in the rain.

The village farmers, their heads protected from the sun by red and white scarves called *keffiyehs*, are pruning branches, plowing their fields, or watering their crops from a well, a cistern or a small spring. The traveler pauses for a moment to watch the women returning home



*And it is He who sendeth down rain from heaven;
And we bring forth by it the buds of all the plants,
And from them bring we forth the green foliage,
And the close-growing grain,
And palm trees with sheaths of clustering dates,
And gardens of grapes,
And the olive and the pomegranate.
— Qur'an, Sura VI*

along the road with clay water pots on their heads, white gauze scarves and embroidered black dresses flapping in a slight breeze. Continuing eastward, he notices that the hills became dryer and are cut by steep gorges with dry river beds, called *wadis*. He might catch sight of a cluster of brown goatskin Bedouin tents or a young Bedouin boy tending sheep. He stops to gaze down into the Jordan Valley below, called

El Ghor by the Arabs, meaning hollow or depression.

He is excited by the thought that he is looking into a small section of the Syrian-East Africa Rift, one of the longest and deepest scars in the earth's crust. It cuts 4,000 miles from the lakes of East Africa, up through the Red Sea, the Gulf of Aqaba, the Jordan Valley and north through Lebanon.

The long Rift is flanked by two parallel ribbons of hills and mountains, created during the most recent phase of mountain-building in the earth's past. He is standing on the western flank, and through the haze, he can see the outline of the eastern flank rising in Jordan.

As he descends into the Valley, he is bothered by the pressure in his ears. The Valley, with its salty, land-locked bodies of water, is far below sea level. The Jordan River, neither chilly nor wide, pours its waters into the Dead Sea, the *Bahr Mayyit* to the Arabs. Here, at 1300 feet below sea level, the water escapes only by evaporation. A low annual rainfall of 2-4 inches also quickly evaporates in the heat.

Following the Jordan River north towards the Sea of Galilee, he notices the dense vegetation close to the banks, and remembers, with a slight shudder, that long ago lions and crocodiles hid in these bushes. He doesn't know that 1500 years before him, another traveler, an early Christian pilgrim, stood on these banks, awaiting the privilege of being baptised in the River. The pilgrim would have seen a wooden cross in the middle of the stream and marble pavements on both banks. After watching a priest bless the water, he would have waded in to be baptised, wearing a linen robe. He would have carefully saved the robe until his death, when it would be used as his shroud.

Our modern traveler passes on and stops to talk to the farmers of the Jordan Valley, wondering how citrus trees, tomatoes, eggplants and watermelons can be grown in an area of so little rainfall. They show him the springs of fresh water and their irrigation channels, explaining that without irrigation, cultivation would be impossible. With it, their valley can be quite fertile.

On his return journey to the coast, he travels south from the upper part of the plain, where 20-24 inches of rain each winter and the red,

(continued on back page)



The Arab Middle East is primarily a dryland farming region; an area where rainfall is low and erratic, and crops depend on minimal moisture stored in the soil. Dryland crops are typically grains and legumes, such as chickpeas and fava beans. Interspersed with crop land is grazing land for sheep and goats, livestock that the farmers depend on for income in fallow years.

In the hills of the West Bank, crops are also primarily the kind that do not require irrigation — olive orchards, grain and some vegetables. Wells and cisterns supply water for animals and the small number of irrigated fields.

Three years ago, ANERA's first irrigation project helped to rescue and increase cultivation in a rocky valley near the West Bank village of Nazla Sharkiyeh. Many villagers were separated from most of their land by the 1948 border, and they planted their remaining land with olive trees. Sheep and cattle brought additional income. In 1966, farmers formed a co-operative in order to sink a well for irrigation. The water made it possible for them to plant citrus trees and vegetables.

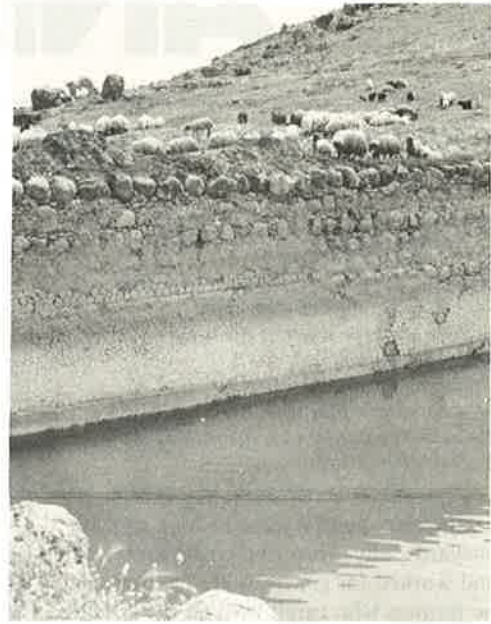
Because the well had been drilled crooked, however, the shaft broke 24 times in 12 years, at a very high cost to the farmers. In one year without water, they lost 80% of their income from failed crops. ANERA helped the co-operative install a new submersible pump in the well, and today the farmers have a dependable water supply with which they are doubling the amount of cultivated land.

In the dry Jordan Valley, irrigated farming is the only type possible for producing high-value oranges, lemons, tomatoes, cucumbers and eggplants. The use of irrigation in the Valley extends far back in time. At Jericho, archeologists uncovered one of the earliest known sites in the Middle East where irrigation was used—a walled settlement of 2-3,000 people dating back to 8,000 BC.

The traditional method of irrigation is still the most widely-used in the Middle East. Called surface or flood irrigation, it consists of open channels of water running from a spring or a well to furrows dug between the crop rows. Farmers must spend much time digging and maintaining the furrows, and up to 50% of the water can be lost by evaporation and seepage before it reaches the crops.

To conserve water and labor, a new method of irrigation is beginning to supplement the open channels and furrows of Jordan Valley farms. Called drip irrigation, it is highly economical in its use of water and very efficient in placing water in the fields.

Water from a spring or well is power-pumped into a control head with a meter to check the volume of in-coming water. The water is then fed into distribution lines, and from these lines into rubbery dripper pipes laid along the crop rows. Tiny holes in the dripper pipes allow a small and precisely-controlled seepage of water to moisten the roots of the plants, and little water is wasted. Crops irrigated in this way have yielded four times the amount produced from surface irrigation. With help from the Mennonite Central Committee, increasing numbers of Jordan Valley farmers are adopting drip irrigation.



Sara Gentry

Old Roman cistern in the West Bank



Dagny Svien

8th century mosaic of citrus tree

Sea water presents another problem. When groundwater is overpumped, salt water seeps in to replace it. The highest level of salt in water that plants can tolerate is 250 mg/liter. In the Gaza Strip, the salt content of the water is already 2-4 times higher than that amount, a level harmful to both plants and humans.

ANERA proposes to help remedy these problems with two large projects designed to inject water back into the ground, using: **Rainwater.** During the winter, rainwater stands unabsorbed in low-lying parts of Gaza City, causing property damage and health hazards. Rather than channeling the standing water to the sea, it will be carried to an artificial lake. There it will be purified and injected into the ground, raising the water table and reducing the salt content. This water will be used directly for irrigating citrus orchards.

Recycled Sewage Water. This project will help the City of Gaza purify its sewage water and inject it into the ground. The recycled water could irrigate an additional 10,000 dunums of land nearby, benefitting a farm population of 50,000. The price of irrigation water would fall to only 10% of the total value of their crops. Both projects will also reduce the salt content of the water, which will improve drinking water in the area.

Irrigated citrus groves and date palms fill the countryside around the city of Gaza. Farther south along the coast, however, runs a string of low sand dunes, called *sowafi* in Arabic. Surprisingly, sweet groundwater lies not far below the sand. For generations, Gaza farmers have used a unique method of cultivation to reach the water and to make the sand "bloom."

The farmers first dig through the dunes until they find a denser white sand. They then estimate the depth of the water below. If it lies ½-1 yard deep, they clear the sand from one-acre patches called *mowasi*. The farmers then fertilize and plant the *mowasi* with potatoes, tomatoes, beans and cabbage. The roots are watered naturally from below, and crops are usually bountiful.

The sand, however, is always a problem. Lacking modern equipment, the farmers must remove by hand the sand that blows in later, or add extra sand when rain falls to prevent the *mowasi* from becoming swamps.

An ANERA project proposes to aid these farmers who work in the sand. The project will help re-activate one of the oldest and most effective Palestinian co-operatives, the Khan Younis Co-operative, established in 1944. ANERA will help the co-operative buy bulldozers for a land reclamation machinery unit to clear the *mowasi* and adjust *mowasi* elevation when necessary. The unit will benefit 21,000 farmers, and 3,000 acres will be affected, either plots already under cultivation or new land to be cleared.

Apart from the fertile *mowasi*, people of the Gaza Strip face serious water problems. Due to low rainfall, farmers are dependent on pumped groundwater to irrigate their citrus groves. At present, the current sources of water are being pumped at 100% of their capacity for renewal. No new land can be brought under cultivation, and the cost of irrigation water averages 33% of the total value of farmers' crops.

WATER AND DISEASE



... AND WATER FOR PEOPLE



SEWERS FOR GAZA

80% of all man's diseases are water-related. In 1979 alone, 6 million of the world's children under the age of six died of water-borne diseases. Last fall, the United Nations Drinking Water Supply and Sanitation Decade began, with the goal of providing clean water and good sanitation throughout the world by 1990.

ANERA and its sister organizations working in the Middle East share in the world-wide concern and efforts to help developing countries combat the dangers of unsafe water.

Dr. Vicken Kalbian, ANERA's Medical Committee Chairman, practiced medicine in Jerusalem for many years before coming to the U.S. In the following article, he explains water-related health problems of the Middle East.

Water is a vital constituent of the human body and a primary necessity of life.

Its main uses are for drinking, cooking, washing, personal hygiene and irrigation. All of the uses are of public health concern because in the Middle East water is still an important link in the transmission and spread of disease.

Drinking water, if polluted, may harbor pathogenic organisms such as bacteria (typhoid and dysentery), viruses (hepatitis), protozoa (amebiasis) and ova of parasites (worm infestations). Throughout history, water-borne epidemics have threatened armies and civilizations. Palestine was no exception, and, as recently as World War I, both the British and Turkish armies paid a high toll from epidemics of malaria, bacillary dysentery, amebiasis, and typhoid.

Irrigation water may become a vehicle in the spread of disease in several ways. Contaminated water may deposit germs on vegetables and fruits, which, if eaten unwashed, may cause an infection. Irrigation canals may harbor specific intermediate hosts, vital for the life cycles of certain pathogenic parasites (snails and schistosomiasis in neighboring Egypt).

In the West Bank, the main source for domestic water has been from the rain. It was collected from rooftops and stored in cisterns built under every house in the highlands. Although these were relatively sealed off and clean, they were at the root of endemic malaria. Anopheles mosquitoes need water for breeding. A female mosquito must lay its impregnated eggs on stagnant water (rain puddles, ponds, swamps, cisterns). The mosquito thus found a man-made breeding nest under each house.

Early in the 1920s it became evident that spreading an oil in the cisterns to form a floating layer would suffocate the mosquito larvae. Malaria was finally eradicated in the early 1960s.

The problem of water supply is a public health problem. In the past three decades, there have been no major outbreaks of water-borne disease in the West Bank due to the public health efforts of UNRWA as well as the government health services. However, rural villages and refugee camps remain areas where such outbreaks may occur if water supplies are curtailed.

For three years, ANERA has assisted the Gaza Municipality in a self-help project to provide poor neighborhoods with sewers. In these neighborhoods, foul-smelling open sewage water stood in the middle of the streets. Children were exposed to serious health hazards when they played in these streets, as were the older people running errands or sitting outside their houses to chat.

In a three-way effort to install sewers in 16 neighborhoods (benefitting up to 8,000 people), the Municipality provided technical expertise, ANERA bought sewer pipes, and each neighborhood provided free labor.

On a tour of a neighborhood with new sewers, the writer was impressed by the enthusiasm of people who came running to tell the project engineer how happy they were to have clean streets.



Dagny Svien

Open sewage in Gaza street



Dagny Svien

Gaza street with new sewer

WATER IS LIFE (continued from page 1)

clay-covered soil, called *hamra* in Arabic, add to its fertility. When he reaches the farmland around Gaza City, he is told that annual rainfall there is only 12 inches, and that the citrus groves must therefore be irrigated.

Leaving the orange and lemon trees behind, he notices that the *hamra* soil gives way to a wide belt of moving sand dunes, where only 4 inches of rain falls in a year. He is surprised to see farmers at work even here. They use a unique method of cultivation, developed generations ago, for reaching the sweet water lying below the dunes in order to grow vegetables.

The traveler prepares for his journey home, thinking of all he has seen and feeling the echoes of Palestine's fascinating past. He leaves, however, saddened by the reminders of a 20th century tragedy.

Tucked away between the hills, or crowded along the beach, the camps of thousands of landless refugees could not escape his notice. Old men, who once proudly farmed their own land, sit in front of their shacks, their faces aged with lines of hardship and bitterness. They watch the women carry buckets to the water well provided by the United Nations, and see their sons and grandsons go off to work as unskilled laborers, now ignorant of how to irrigate, plant, prune and harvest.

Yet the Palestinians know how to survive, the traveler thinks as he looks down from his window seat in the plane. In a difficult climate and through a turbulent history, they have long known how to use the gift of water to make their dry land bloom.

WATER FOR A BETHLEHEM FAMILY



Khalil Barhoum

Like many Palestinians, Khalil is a refugee twice over. His family left Jerusalem in 1948 because of the war and resettled in Bethlehem. Once again in 1967 because of war, Khalil and his family left the West Bank to settle in Jordan.

Where I grew up in the Bethlehem area, people relied exclusively on the rain for their drinking water, their herds and for the irrigation of their crops. Rainwater was stored in cisterns which varied in size and depth from house to house. Water was channeled from the roofs of the houses into the wells through cement or metal pipes.

Sometimes when there was little or no water available in the cistern at home because of a dry season, people used to go to the public well—usually built near a spring—and carry back jerry cans full of water from as far away as one and a half miles. Like the rest of the neighborhood women, my mother found it easier to balance the heavy can on her head, often in a slanting position. She used to wrap a large towel and place it like a cake on her head before mounting the big can on top. My brothers and I went along to help her as well as to fill our own cans with extra supplies of water. Frequently this trip had to be made twice a day provided the well was still open. Under these circumstances, our consumption of water was confined to the most basic needs, which meant taking baths only on Fridays, to my great joy and relief since I hated water anyway!

It was not until the late fifties or early sixties that we heard of piped water and started using it. Even then, as is the case now, water consumption was often restricted because of its limited availability and its relatively high cost.



UNRWA

IN MEMORIAM

In ANERA's fiscal year 1981, donations were received in memory of:

- Art Anderson
- Christine Ayars
- Anna Saba Christy
- Noura Doumar Cressaty
- Theodore H. Fisher
- A. Willard Jones
- Anna P. Oieinikoff

Enclosed is a special gift for ANERA's water projects in the West Bank and Gaza.

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Contributions to ANERA are tax-deductible and should be sent with this form to the ANERA office. Thank you for your help.

This issue of the ANERA Newsletter was written by Dagny Svien, ANERA Executive Assistant; Arabic calligraphy by Khalil Barhoum.

WATER IS LIFE

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