Greening the desert: the Mideast's potential for water development

by Marcia Merry

The best way that nations can respond to the imperious demands by President Bush and Secretary of State James Baker for soldiers, arms, and money in the Middle East, is to forge ahead with the array of infrastructure development programs for the region that would be the basis for peace and prosperity.

For decades, designs and even engineering blueprints have existed for water, power, agricultural, and related development programs. Besides the Israeli, Arab, Turkish, Egyptian, and other specialists involved in these designs, there are teams of French, German, Japanese, and U.S. engineers who are ready and able to be deployed to get the job done.

Amid the war cries from London and Washington, D.C. come voices of reason. In a statement in early September, Michel Vauzelle, a confidant of French President François Mitterrand, and a deputy of the French Socialist Party, called for a "vast plan for economic development for all the Mediterranean," including the Middle East region. Vauzelle said that what is needed now is a conference on "security and cooperation in the Mediterranean." This would be crucial for France and other European nations, he stressed. Vauzelle insisted that European policy not be a caricature of the main protagonists in the current policy, but be independent.

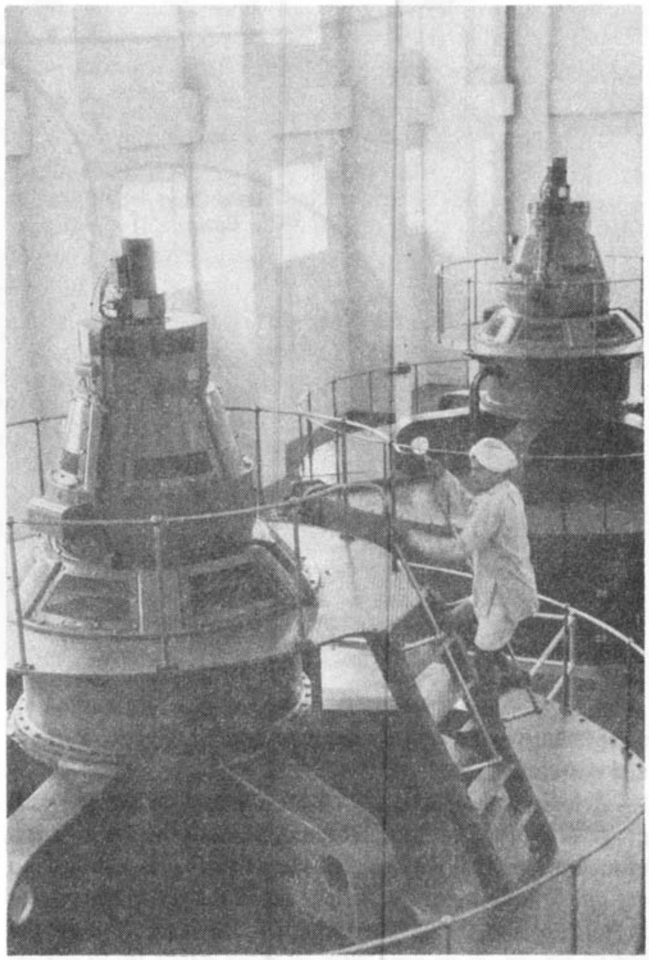
At the center of the question of development, is the issue of water supplies.

On Aug. 29, the *Jerusalem Post* ran an editorial on how cooperation in developing water resources in the Mideast could contribute to the basis for political cooperation. The editorial stated, "The struggle for water could sooner or later trigger hostilities in the region. . . . There is a steadily worsening water shortfall. . . . Israel, Jordan, and Egypt are expected to reach 30% water deficit by the end of the decade, while Iraq and Syria are expecting a gap of 60% by then."

"Since the issue is vital to all of the peoples of the region," the editorial continued, "a concerted effort to solve the water problem—a Herculean but by no means impossible task—is imperative.

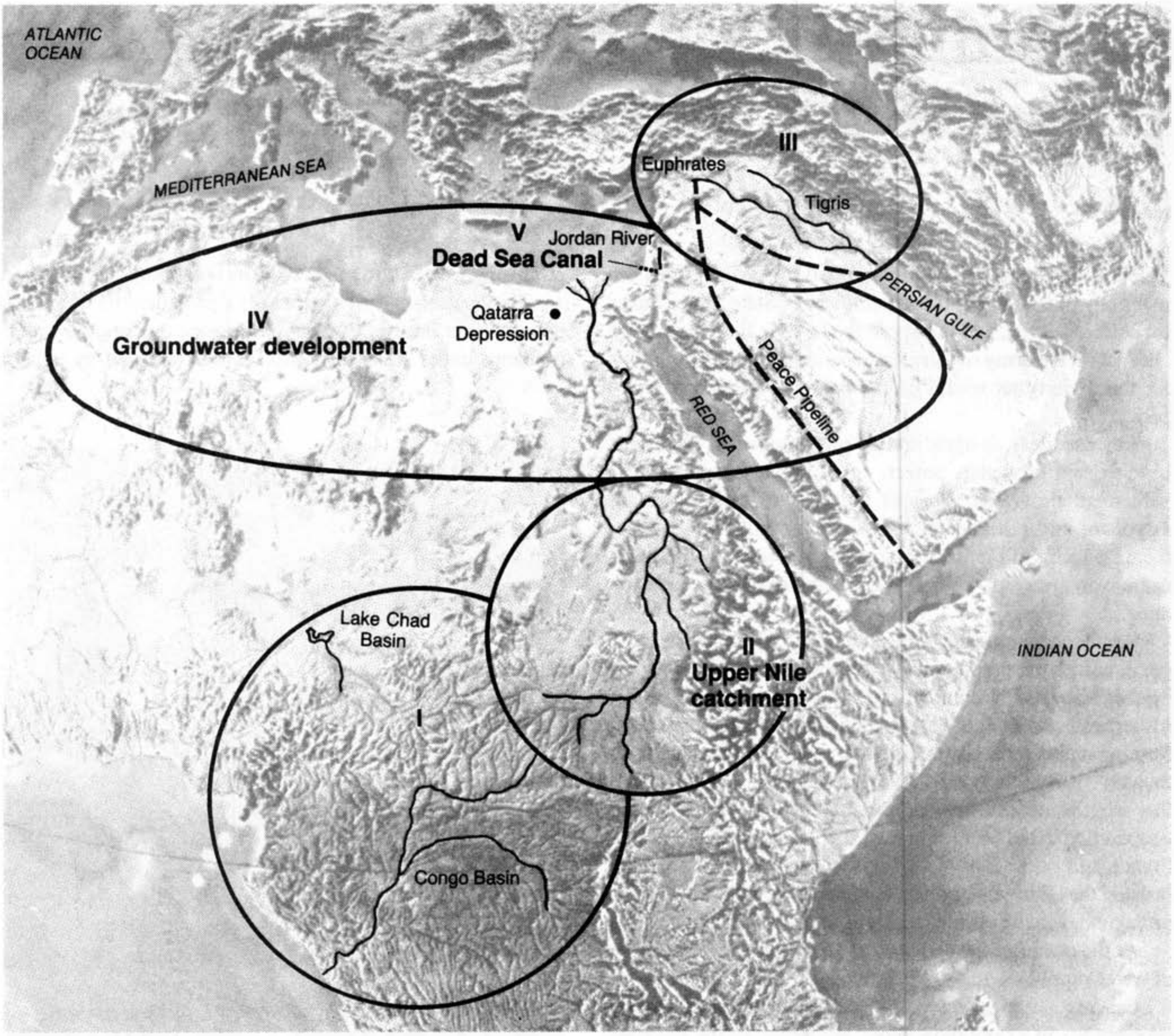
"Such an effort cannot await the resolution of political conflicts, but it most certainly can improve its prospects. Indeed, cooperation on the water problem may be the most promising way to bring Israel and its neighbors closer."

The *Jerusalem Post* also recalls a precedent for cooperation on water issues. "A 1987 conference on regional water problems under American auspices was attended by Israeli



From North Africa to the Indian Desert, extends an area without close exposure to ocean-related rainstorm patterns. Whoever brings water here, brings life. Pictured here are hydroelectric generators at the Tilaiya Dam in India's Damodar River valley. In the dry Middle East, technology can truly make the deserts bloom.

FIGURE 1
Major water development projects



representatives as well as those of Jordan, Egypt, Turkey, and even Iraq."

A look at the globe shows the features of the physical geography of the region that have, without the intervention of modern technology, created the world's greatest dryland region. The vast expanse from east of the Atlas Mountains in North Africa, extending through Southwestern Asia to the Indian Desert, is an area without close exposure to ocean-related rainstorm patterns. When you visualize a desert, you think of the Sahara, or the Arabian Desert, bounded by the Mediterranean Sea, the Red Sea, the Arabian Sea and the other lesser bodies of water.

However, there is no necessity to perpetuate vast, uninhabitable tracts of sand dunes. Rivers and lakes can be created by man. Much of the Sahara, the Arabian, and other legendary desert lands are as fertile as California's Imperial Valley, or the test plots on Israel's Negev Desert. The accompanying map (**Figure 1**), and the descriptions of "great water projects" in the following article, show the means by which the process of "greening the deserts" can take place.

In this dry region, the same as the world over, water resources can come from three sources: precipitation and surface water, ground water, and desalination of briny water.

As indicated by the stylized mountains and river basins

TABLE 1

Volume of water for direct use by consumers, drawn from net precipitation and from rivers

Nation and year	Per capita per year cubic meters	Per capita daily liters
A. Eastern Mediterranean and Persian Gulf		
Iran, 1975	40.9	114
Iraq, 1970	91.5	250
Turkey, 1985	76.1	208
Syria, 1976	26.9	76
Lebanon, 1975	35.2	98
Jordan, 1975	5.2	15
Israel, 1986	71.5	197
B. Arabian Peninsula		
Saudi Arabia, 1975	115.6	318
Yemen, Dem., 1975	11.7	34
Oman, 1975	11.2	30
U.A.E., 1980	38.6	106
Qatar, 1975	77.2	212
Bahrain, 1975	73.5	201
C. United States, 1985	259.2	712

1 cubic meter=1,000 liters=264.2 gallons

TABLE 2

Millions without reasonable access to community water supply services, 1970

	Percent of population not supplied		Number of persons not supplied (thousands)
	Urban	Rural	
A. Eastern Mediterranean and Persian Gulf			
Iran	18%	88%	17,594
Iraq	2%	94%	5,065
Kuwait	4%	—	341
Turkey	35%	34%	13,292
Syria	2%	50%	1,815
Lebanon	5%	15%	257
Jordan	2%	41%	544
Total, this group			38,908
B. Arabian Peninsula			
Saudi Arabia	3%	66%	3,986
Yemen	55%	98%	6,120
Qatar	2%	60%	16
Bahrain	2%	n.a.	4
Total, this group			10,126

Source: World Health Organization, 1970

shown on the map, there are three locations where significant amounts of surplus surface water can be mobilized for use in the dry lands of North Africa and the Middle East:

I. The tropical rain forest basin of the Congo River;

II. The marshy Sudd area of the headwaters of the White Nile;

III. The runoff from the Taurus and other mountains in the Anatolian Peninsula in Turkey, through the arc of highlands into Iran.

Large quantities of ground water also exist, and remain largely untapped, in vast areas of the region, shown on the map as section **IV.**

And finally, the design for a Dead Sea Canal (**V** on the map) includes the proposal of desalination of seawater, which can also be dramatically increased at many other points on the map.

The water gap

The large water deficiencies cited by the *Jerusalem Post* have been in the making for decades, and should have been reversed long ago by modern technologies. **Table 1** shows the per capita water supplies per day withdrawn from mostly surface water sources (net precipitation and rivers) for personal and public use, in nations of the Eastern Mediterranean, Persian Gulf, and Arabian Peninsula.

From 76 to 114 liters (19-30 gallons) per person is the amount withdrawn from available water, for domestic uses including drinking water, sanitation, cooking, laundering, and for "public" uses (fountains, swimming pools and public baths, personal needs at worksites, etc.).

Compare the 76-114 liters with the average daily amount of 712 liters available to a person in the United States. Since this 76-114 liters is an average, this indicates that there are many residents who are today short of water for health in the Middle Eastern nations shown. According to a World Health Organization (WHO) survey in 1970, there were over 40 million people in this region without reasonable access to community water supply services (**Table 2**). Twenty years later, there are still millions unsupplied, though the estimates of personal water use are not updated for the region.

The same water gap also exists for per capita water supplies available for industrial uses and agriculture uses. For most areas of the hot, dry region, most available water goes for agriculture. This shows that there is no "leeway" for improvement in people's living standards, nor for population expansion.

The lack of potable water is the direct result of deliberate policy decisions by the WHO, among others, that the cost of the required infrastructure is "prohibitive." This is coherent with the decision of the 1978 Alma Ata conference of the WHO not to invest in medical infrastructure, but to rely on "primary care" provided by local witch doctors and other "indigenous healers." This approach to medical care and its accompanying "clean your own latrine" approach to sanitation and water management, is now taking its predictible toll in the deserts of Jordan.

As of early September, doctors in the refugee camps created by the U.S.-British standoff with Iraq, reported that there was only one liter, or about one quart *a day* available for some of the displaced persons. This is a death sentence: Death by dehydration is automatic under these conditions. In the event of cholera, a person in a dehydrated condition can die within 15 minutes. In contrast, the U.S. soldier on desert duty in Saudi Arabia is assigned 6 gallons a day for drinking, hygiene, and personal needs.

Water supplies

There are four sources of water which must be assayed for availability, and developed to meet the continuing needs: 1) net precipitation (snow and rainfall, minus evaporation—which varies under the temperature regimes in the locale); 2) ground water stocks; 3) rivers and other water from outside the political boundaries of the countries concerned; and 4) desalination.

Hydrologists have calculated the estimated net precipitation for most parts of the Earth. The world total amount of annual water availability is calculated to come from the equation of 110,305 square kilometers of precipitation minus 71,475 cubic km of evapotranspiration, which gives an overall annual runoff of 38,830 cubic km from rivers, 26,945 cubic km from surface runoff (floods), and 11,885 cubic km of stable base water.

Rivers can be developed for maximum use. Floodwaters are difficult to utilize, but ground water is potentially a major water resource. However, there are no handy guides to ground water availability—aquifers, underground rivers, and natural tanks. Many nations keep ground water locations and data secret, for security reasons. Moreover, the radical ecology movements regard ground water as "non-renewable," and therefore, not a resource to be utilized or measured. This assertion is false. Much ground water can be recharged with infusions of water of various types (rainfall, wastewater, or desalinated seawater) to achieve a hydrological balance.

If nations are forced to forsake development of ground water and desalination, then they may be dependent on river flow from outside their national boundaries, and forced into strife over short supplies. Both the Tigris and Euphrates Rivers, on which Iraq depends, rise in Turkey. Egypt has a treaty arrangement with Sudan to share water from the upper Nile. However, there is no similar arrangement with Ethiopia, the location of much of the Nile headwaters.

Desalination processes have been dramatically improved over recent decades, and the critical cost question is the cost of energy to fuel the procedure. With the amount of natural gas "flared off," that is, burned for no result, in the Middle East oilfields, there is no validity to the anti-growth argument that desalination is too expensive (see box).

Table 3 shows various ways in which parts of the region make use of net precipitation, and river water available. Ground water analysis is not shown here, due to the paucity of data at present.

TABLE 3

Utilization of net precipitation and of river flow from other countries, for selected nations in the region

Nation and year	Water potentially available km³/year: Net precipitation per year	Water potentially available km³/year: River flows from other countries	Water withdrawn km³/year	Percent of available water withdrawn	Per capita m³/year: Net precipitation	Per capita m³/year: Amount of water withdrawn
A. Eastern Mediterranean and Persian Gulf						
Iraq, 1970	34	66	42.8	43%	1,870	4,575
Iran, 1975	117.5	—	45.4	39%	2,350	1,362
Turkey, 1985	196	7	15.6	8%	3,660	317
Syria, 1976	7.6	27.9	3.34	9%	620	449
Israel, 1986	1.7	.45	1.9	88%	370	447
Jordan, 1975	0.7	0.4	.45	41%	170	173
B. Arabian Peninsula						
Saudi Arabia, 1975	2.2	0	2.33	106%	160	321
C. Selected other nations						
United States, 1985	2,478	n.a.	467	19%	10,060	2,162
France, 1980	170	15	33.3	18%	3,070	606
Mexico, 1975	357	357	54	15%	4,110	901

Source: *World Resources, 1988-89*

TABLE 4
Utilization of annual per capita water by sector

Nation and year	Per capita surface water utilization per year* cubic meters	Per capita use (and percent of total) by sector, per year m³/year		
		Public use	Industry (self-supplied)	Irrigated agriculture
Iran, 1975	1,362	41 (3%)	— (0%)	1,321 (97%)
Iraq, 1970	4,575	92 (2%)	137 (3%)	4,346 (95%)
Turkey	317	76 (24%)	60 (19%)	183 (58%)
Syria	449	27 (6%)	— (0%)	422 (94%)
Israel	447	72 (16%)	22 (5%)	353 (79%)
Jordan	173	3 (public and industrial use combined)		97
United States	2,162	259 (12%)	995 (46%)	908 (42%)
West Germany	671	81 (12%)	584 (87%)	— (0%)
Mexico	370	67 (18%)	167 (45%)	137 (37%)
France	606	(17%)	(71%)	(12%)

*Total refers to the total of net precipitation and inflowing foreign river flow.
1 cubic meter=264.2 gallons

Turkey, with significant amounts of water from the rainfall in the highlands, makes only 8% use of net precipitation. In contrast, Israel uses fully 88% of the surface water available to it—which is very little. Likewise, Saudi Arabia is shown to use more than the net precipitation (indicating desalination and ground water utilization). In between, in Iraq, there is about 43% use of surface water. In the latter case, there appears to be a very large amount of water per capita from surface sources, and most all of this is taken up in agriculture. The amount of water used annually, or "withdrawn" from the precipitation and outside river flow, covers all types of water use (personal, public, and for agriculture, and industry) in that nation. This amount does not correlate with the living standards in the respective area, because all the water may go into agriculture, for example, with relatively little for industry and domestic use. This is the profile of use for most of the region shown (**Table 4**).

The figures in Tables 3 and 4, considered together, illustrate that much more water is required each year per capita overall, much more is required for per capita health use, and per capita industry, as well as for an expanding irrigated agriculture sector. The available water figures illustrate that by channeling the unused surface water in Turkey more efficiently within Turkey itself, as well as southward to the dry areas, and by developing a more extensive use of ground water and implementation of desalination, then the per capita supplies of water for personal, industrial, and agricultural needs can be raised to the levels required for higher living standards and productive output potential for millions of people.

Industrial and agricultural requirements

The amounts of water required per person for every kind of agriculture, industrial, and living standard level can be calculated, and the means determined to provide the quantities required. For illustration of water used in industrial processes, here are the gallons per unit required in Israel to produce a unit of the given product:

For milling one ton of wheat: 700-1,300 gallons;

For canning one ton of raw citrus: 1,050 gallons;

For processing one ton of dressed chicken: 33,000 gallons;

For brewing one kiloliter (264 gallons) of beer: 13,500 gallons;

For making one kiloliter (264 gallons) of wine: 500 gallons (very water efficient);

For dying and finishing one ton of cotton yarn: 60,000 to 180,000 gallons;

For dying and finishing one ton of woolen yarn: 70,000 to 140,000 gallons;

For mining one ton of copper: 3,100 gallons;

For quarrying one ton of gravel: 400 gallons.