BETWEEN THE GREAT RIVERS: WATER IN THE MIDDLE EAST AND NORTH AFRICA

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Summary

The nations of the Middle East and North Africa have always been short of water. What they face today is not so much a crisis over water as a chronic problem escalating to serious proportions because older problems are deepening at the same time as newer ones become evident. With a few exceptions, the nations in this region have already reached or are fast approaching the limits of their indigenous water supplies. Water quality is declining across the region as a result of casual disposal of wastewater, over-pumping of groundwater and disregard of ecological protection provided by leaving water in place. Though some forces, such as more pricing of water, and technological advances, particularly for wastewater and for use of groundwater, can mitigate their problems, others such a climate change , population growth and higher incomes will

exacerbate them. Except for those few nations with enough energy to run desalination plants or enough money to seek exploit distant sources, greater efficiency in water use and shifts of water from one sector to another are the only big options left. The former may be promoted (if only mildly) by existing institutions; the latter almost never are. However, given that most nations in the Middle East and North Africa continue to use 60 to 90% of their fresh water for irrigation, while their economies provide, in most cases less than 10% of their gross domestic product, they really have no alternative. Ironically but happily, the same policies that are required for more sustainable water management are also those needed for economic and social development in their increasingly urbanized nations. Governments in the region must shift from today's emphasis on technical ways to increase the supply of fresh water to socio-economic ways to reduce water demand through efficiency and to reallocate demand from agricultural to urban and industrial uses. Though policies to promote greater efficiency can be implemented quickly, policies to reallocate water must be implemented slowly, at least in those nations where large parts of the population remains dependent on agriculture for their livelihoods.

1. Introduction

Fresh water has been the key natural resource during the three millennia for which we have recorded history in the Middle East and North Africa (MENA). Some regions of the world are drier, and others have higher populations or larger economies, but no other region of the world embraces such a large area with so many people striving so hard for economic growth on the basis of so little water: MENA has 5% of the world’s population but only 1% of its fresh water. Excluding island and city states, there are only 20 nations with internal renewable fresh water availability below 1000 cubic metres per capita (a commonly used determinant of water stress); 15 of them are found in MENA. (The others are Hungary, South Africa and three countries in East Africa.)

Three Sources of Crisis

Throughout MENA, the origin of water stress stems from three interacting problems:

- **Quantity:** The demand for fresh water in the region exceeds the naturally occurring, renewable supply.
- **Quality:** Much of the region's limited water is polluted from growing volumes of human, industrial, and agricultural wastes.
- **Equity:** The same water is subject to competing political demands -- in some cases from different sectors within one nation; in others, between nations where the water flows across or along or under an international border.

If water scarcity has been a source of stress since history began, water quality is a new source but one that is coming to dominate the crisis in many parts of the world. And the politics of water is probably of greater concern in this region than anywhere else in the world.

2. Physical Sources of Stress

Water is the limiting resource for development in most countries of ~~the~~ MENA. According to common criteria for water availability: Iran, Iraq, Lebanon, Sudan, Syria and Turkey are fairly well endowed with water; Algeria, Egypt, Israel and Morocco form a middle group; and Jordan, Libya, Tunisia and countries of the Arabian peninsula are least well endowed. For Palestinians, the West Bank is relatively well off but the Gaza Strip is perennially short of water. However, all nations share one common characteristic: declining water availability per capita.

The Middle East and North Africa are highly varied in geography and climate. Coastal plains merge in a few kilometres to mountain ranges, which then plummet to rift valleys with the lowest land elevations on earth. Rainfall ranges from over 1000 mm per year to nil. The average is about 250 mm, but averages are highly misleading.

The dominant hydrological characteristic in MENA is the combination of aridity and uncertainty. Seasonal and spatial variations of rainfall are sharp but predictable. Most of the rain will fall in four winter months. The thin coastal strip of Lebanon gets nearly 2500 Mcm of rain per year; just 50 km to the east across the Lebanon Mountains, the Beka'a Valley, where most of the agriculture is located, gets less than 1000.

The most important and least predictable variations in rainfall are neither seasonal nor spatial but annual. Reliable flow (defined as what can be expected nine years out of ten) is less than 10%. As a result, extreme years in rainfall in the region must be treated as normal, not abnormal, and water planning and management must focus on risk minimization, not maximum utilization.

Global climate change will only make the current situation worse. Different scenarios imply different results for many parts of the world, but almost all models project higher temperatures, lower rainfall, and longer droughts for MENA. Even if such models remain highly uncertain in detail, it would be foolish to ignore their broad results.

3. Quantity: Economic Stress

Each of the states of the Arabian Peninsula is consuming more water than its annual renewable supply, as are Israel, Jordan, and Libya. Egypt, Syria, and the Sudan are fast approaching the same situation. Some projections for the Jordan River basin suggest that by 2025 household, urban and industrial uses will take every drop of fresh water available, leaving none for agriculture. The Arab region as a whole is already using three-fifths of its total renewable supply regardless of cost. All of these countries are in trouble; their water use is unsustainable, which implies that their economic growth is not sustainable.

3.1 Principal Sources of Water Supply

Rivers are the best known sources of water, and those in MENA include two of the greatest in the world, the Nile and the Tigris-Euphrates. (The Blue Nile, which carries the bulk of the flow, originates in Ethiopia, and the White Nile in Uganda; they join in Khartoum. Both the Tigris and the Euphrates originate in Turkey; they join near the southeastern corner of Iraq.) A few medium-sized rivers, such as the Jordan and the

Orontes, also occur, mainly in the nations to the east of the Mediterranean. As well many short or ephemeral streams occur, typically fed by springs in the mountains which flow down and then spill into the sea or seep into the desert.

Aquifers of various types are also common. Some are replenished regularly by rainfall and thus constitute renewable resources; others contain water buried in sediments eons ago and thus constitute nonrenewable resources. Some of these aquifers are truly huge, as with the Nubian Aquifer underlying parts of Chad, Egypt, Libya and the Sudan. Many of the large aquifers originated from sediments under the sea, and the contained water is too salty for direct use. However, others, as with the Mountain Aquifer the ridge separating Israel and Palestine, and the Disi Aquifer underlying parts of Jordan and Saudi Arabia, contain potable water. One remarkable set of aquifers emerges from the seabed off the coast of Lebanon, some with enough volume to yield fresh water "slicks" at the surface of the sea.

Over time, as surface sources have become fully committed and as technology has permitted deeper drilling, there has been a shift from surface to underground water. Even so, only about 10% of total supply for the region comes from underground sources. However, in Israel and Jordan, the share of underground water approaches 50%, and in the Arabian peninsula 100% (if desalination is put to one side). In a project dubbed the Great Manmade River, Libya is extracting 6.5 Mcm of nonrenewable water from the Nubian aquifer in the south of the country and moving it through a network of pipes to urban areas in the north.

Few opportunities remain for further development of major rivers in the countries under study, and the sources that are available will cost two or three times as much per unit of water. Indeed, further development is more likely in upstream countries, such as Ethiopia and Turkey, which would reduce flows downstream. Major fresh water aquifers remain to be developed (indeed, to be discovered), but they are deeper or lower in quality or further from points of consumption, any of which means higher costs. Nevertheless, the share of water drawn from aquifers is bound to grow, especially to supply urban areas, where consumers can pay higher prices than can farmers.

3.2 Recycling Water

The nutrient value of recycled sewage water is high, and, with appropriate controls, can be used by farmers. The use of treated sewage water for irrigating crops is accepted practice in countries such as Egypt, Israel, Jordan, Morocco and Tunisia. (In some countries, raw sewage continues to be used, which risks the spread of cholera and other diseases.) By early in the next century, many countries in MENA will use only recycled water for irrigation. In the nearer term, drainage water will come to be the main source of irrigation for grain crops, particularly wheat and barley, throughout the region. Depending on the degree of treatment, recycled water can be used for non-food or food crops. Only water that has received tertiary treatment, which implies marginal costs (above those of sewage collection) of at least $0.15/m3, can be used for food that is eaten raw. As well, there are growing concerns about the long-term effects on soils of continued recycling of waste water, and some Israeli scientists recommend desalination prior to reuse, a step that would add significantly to cost.

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Biographical Sketch

Dr. David B. Brooks is a natural resource economist whose main interests lie in the linkages between environmental protection, on the one hand, and the use of minerals, energy and water, on the other, as well as with options for moving toward sustainable development. Formerly the founding director of the Canadian Office of Energy Conservation, he subsequently worked for six years with two Canadian NGOs (non- governmental organizations), Energy Probe and Friends of the Earth, and for several years served as President of the Board for FoE. Then for five years Dr. Brooks was a principal with the firm of Marbek Resource Consultants, during which time he also served on the Board of Directors of Ontario Hydro. Between 1988 and 2002, Dr. Brooks worked with Canada's International Development Research Centre. (IDRC is a Canadian crown corporation that supports research on international development proposed and carried out by people in developing countries.) He held several positions including that of Acting Director of the Program for Environment & Natural Resources Management. After retiring from IDRC in May 2002, Dr. Brooks became Director of Research for Friends of the Earth - Canada on a part-time basis.

Dr. Brooks was educated in geology at MIT (SB 1955) and Cal Tech (MS 1956), and in economics at the University of Colorado (PhD 1963). He has worked in the United States and several developing countries as well as in Canada. Much of his research has focussed on "soft" alternatives for conventional energy and water policies. More recently, he has focussed his research on problems in the Middle East, and particularly in Israel and Palestine. Dr. Brooks is author of *Zero Energy Growth for Canada* (McClelland and Stewart 1981); he is co-author of *Life After Oil: Renewable Energy Policies for Canada* (Hurtig 1983); *Water: The Potential for Demand Management in Canada* (Science Council of Canada 1988); and *Watershed: The Role of Fresh Water in the Israeli- Palestinian Conflict* (IDRC Books 1994). He has also edited several books on resource issues and on water demand management including *Water Balances in the Eastern Mediterranean* (IDRC Books 2000). His latest book is *Water: Local-Level Management* (IDRC 2002). Dr. Brooks has been elected to The International Water Academy, based in Oslo, Norway.

Dr. Brooks lives in Ottawa, Canada, and is married with two grown children. His favourite non-professional activities involve canoeing in the summer, trail skiing in the winter, and Jewish religious studies when the weather does not encourage outdoor activities.