# THE MIDDLE EAST IN THE 1990's

## HEARING

BEFORE THE

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EUROPE AND THE MIDDLE EAST

OF THE

COMMITTEE ON FOREIGN AFFAIRS
HOUSE OF REPRESENTATIVES

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## NOTES AND CHART ON THE INCREASING DEPLETION OF THE EUPHRATES WATERS (SUBMITTED BY JOHN KOLARS)

### Notes to Figure 11.1

This figure summarizes the analysis described in the text. Each value has been carefully derived. The timing is the events is more speculative than the data and represents, at best, informed opinion and not fact. Nevertheless, the combination of data, analysis and opinion presented in Figure 11.1 gives a unique view of the impact of the developments proposed and underway along the Euphrates River in both Turkey and Syria.

The graphic presentation may be considered predictive in two ways. The increasing depletion of the Euphrates' waters can be read from left to right on the diagram. In addition, the cubic-meters-per-second measure on the ladder at the left edge of the figure shows, in conjunction with the graph lines representing removals, what year certain levels of flow may be reached. If 500 cms entering either Syria or Iraq from its upstream neighbor is taken as the minimum flow acceptable to either country, then it is seen that under the circumstances postulated here Syria should not be shorted by Turkey. (It should be kept in mind, however, that the pattern of flow--i.e. by the mainstream or via the Urfa Tunnels and tributaries--will have much to do with whether or not this would still be felicitous for Syria.) On the other hand, Iraq may feel the pinch as early as 2005, if the Aleppo project without return flows were to occur, or sometime around 2010 if only the main valley and Khabur projects are realized.

Values relating to the Aleppo Project need further explanation at this point. As mentioned in this chapter, hectarages between 180,000 and 212,000 have recently been proposed for the area north and south of Aleppo. (This new development has not been considered in detail in the preceding chapters but is included here for the sake of completeness.) Water for these fields would be taken from Lake Assad. For simplicity, a round number of 200,000 hectares has been used to compute depletion and return flow from this project were it to be fully implemented. Depletion of 12,545 cubic meters per hectare as well as 6,755 cubic meters per hectare return flow are based upon values computed for similar areas nearby and used elsewhere in this text. Such removals and returns are assumed to



begin about 1991 and to increase steadily until the full 200,000 hectares are under irrigation in the year 2010.

Two graph lines are used to depict such a situation. The one showing depletions amounting to 9,405 Mcm per year represents what would happen if return flow from these fields reaches the main stream of the Euphrates--thus restoring some of the water removed. That this may happen is uncertain. The area around Aleppo is essentially a basin of interior drainage which might trap drainage preventing its return to the main stream. In this case, the return flow lost to evaporation or seepage would be a net loss to the Euphrates system, which along with regular evapotranspiration losses would amount to about 10,756 Mcm per year as shown by the lowest of the three graph lines depicting Syrian removals. It should be further noted that Syria removals are expected to stabilize about the year 2010 with no increase or decrease thereafter. (This overlooks possible future losses of land resulting from poor drainage and soil salination.)

It is unlikely that the worst case scenario shown for the year 2040 will ever be reached. But if it were realized, Iraq might expect less than 200 cubic meters per second to enter across its border from Syria.

These speculations are, of course, highly conjectural.

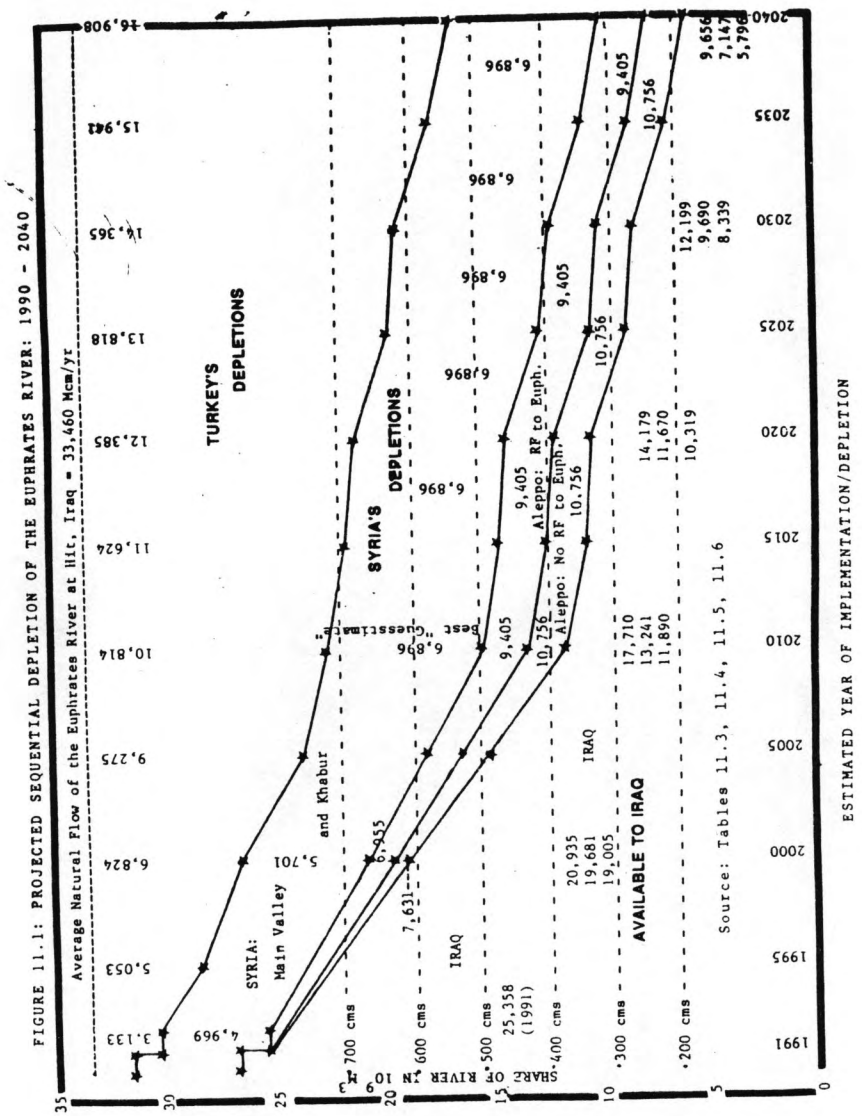


FIGURE 11.1: PROJECTED SEQUENTIAL DEPLETION OF THE EUPHRATES RIVER: 1990 - 2040

## APPENDIX 3

## MIDDLE EAST EXECUTIVE REPORTS ARTICLE ENTITLED: THE SOUTHEAST ANATOLIA PROJECT: WILL IT MAKE TURKEY A MAJOR FOOD SUPPLIER TO THE MIDEAST, DATED SEPTEMBER 1986 (SUBMITTED BY JOHN KOLARS)

Turkey alone of all the Middle Eastern and North African countries is in a position to achieve agricultural self-sufficiency and possibly surpluses to sell to the growing regional market for food. To become a major food supplier for the Middle East, however, Turkey will have to realize its ambitious plans for the Southeast Anatolia development project.

For years, Turkey has had an unfavorable balance of payments, largely the result of a $4-billion annual bill for imported petroleum. Even with today's low prices, imported energy may cost the Turks more than half that amount. Turkey's need for energy has led to projects for the development of hydroelectric resources countrywide.[1] Foremost among these is the Southeast Anatolia Project (Güneydoğu Anadolu Projesi—GAP), which will produce large amounts of hydroelectric power and irrigate at least 760,000 hectares (1.88 million acres) and possibly as much as 1.8 million hectares (4.45 million acres) in the Euphrates and Tigris River basins.[2]

Premier Turgut Özal and other officials have repeatedly said they hope these soon-to-be irrigated lands—once devoted either to a sparse wheat crop or to extensive grazing—will provide export crops that will make southeast Turkey a garden supplying the needs of Arab neighbors to the south. Thus Turkey, long described as a "have not" country because of its scanty petroleum resources, now promises to become a "have" nation in terms of land and irrigation water. Can it take advantage of this situation? This is a multibillion dollar question, and the answer will involve both Turkey's agricultural potential and the regional market for food.

### Demand For Food

Population growth and agricultural self-sufficiency throughout the Middle East in large part determine the market for food. The demand for food at reasonably high nutritional levels in all Middle Eastern countries tends to be inelastic—only in Sudan and the two Yemens have nutritional levels declined in recent years. As populations grow, ways must be found to maintain this standard. The alternative is increasing hardship and unacceptable political destabilization.

*(Continued on page 19)*

*John Kolars is Professor of Geography and Near East Studies, Department of Near Eastern Studies, University of Michigan, Ann Arbor.*

**Demography Of The Market**

A review of 16 countries in the region indicates that between now and 2000, agricultural conditions must inevitably deteriorate or at best fail to keep pace with increasing populations in all but Turkey. All 16 countries will experience significant population growth. The six nations with the highest gross national product per capita (more than $5,000)—U.A.E., Saudi Arabia, Oman, Kuwait, Libya, and Israel—together will increase by 16 million people between 1983 and 2000. (Lebanon, for which data are at present uncertain, also would fall in this category.) Five countries with per-capita incomes between $1,000 and $2,000—Iran, Iraq, Jordan, Syria, and Turkey—will increase by a total of nearly 68 million people over the same period. Population in the four poorest countries, with per-capita incomes of less than $800—Egypt, Sudan, and the two Yemens—will increase by 35 million altogether. By the year 2000, an estimated 336 million people will be living in these 16 countries, a 55 percent increase over their 1983 populations.[3]

Fluctuations in the price of oil and the unrealistic stimulation of the agricultural sector in countries like Saudi Arabia and Israel (to be discussed below) make short-term speculation regarding agriculture hazardous at best. If the year 2000 may be considered long term, however, certain patterns of development can be reasonably predicted.

- There is little doubt that populations will grow as anticipated.
- The wealthiest countries, with the exception of Libya, will retain their ability to import food, although it may be at the expense of development projects.
- Few, if any, of the current large agricultural projects in the six wealthiest countries have long-term viability.
- The poorest nations are engaged in a Red Queen's race (that is, running as fast as they can just to stay in the same place) and will need massive subsidies to meet their growing needs.
- The middle-income countries, with the exception of Jordan, should be able to sustain their own populations, but only Turkey can expect an exportable agricultural surplus.
- In almost every case, water and its management will be the key in these patterns.[4]

**Food Crop Production Potentials**

***U.A.E. and Kuwait.*** The U.A.E. and Kuwait have largely urban populations living in small, extremely arid territories. Desalination can provide adequate water for domestic purposes, but aside from some greenhouse vegetables, little local production of staples—grains, sugar, starches, and meat—can be anticipated. Moreover, rapid pumping of groundwater has resulted in saltwater intrusions and a deterioration of underground water quality and quantity.

***Oman.*** Oman is in much the same situation as far as water availability is concerned. As a recent entrant into modern agriculture, its agricultural field staff is largely untrained and new state-run farms are inefficient. Increasing amounts of food are being imported at this time. Also, Oman's recently formed Public Authority for Water Resources, while aware of the fragile and exhaustible nature of the country's water supplies, is under pressure to increase pumping at the expense of sustained yield use of the limited aquifers.

***Libya.*** Libya presents an even more complicated picture. In the oil boom year of 1972, for example, agricultural imports totaled LD 53 million while exports in the same category were only LD 24,000. The Libyans, in their search for self-sufficiency, have made expensive efforts to upgrade farming in the Jebel Akhdar east of Benghazi and on the Gefara Plain south of Tripoli. Scant rainfall and urban competition for limited groundwater supplies prevents significant expansion from these areas of natural precipitation, which make up only 2.5 percent of the country's total area.

Great hope was placed on the Kufrah Production Project in the Saharan Southeast. Begun in 1968, this project originally consisted of 100 100-hectare fields (10,000 ha, or 24,700 acres), which received irrigation water pumped from the Nubian sandstone aquifer 500 meters below the surface. Overpumping of the aquifer soon after the project began was only one of the problems. It was hard to persuade laborers to live in such a remote location, and high per-unit commodity production costs and exorbitant transportation rates discouraged further attempts to farm the Sahara.

The lure of the water remained, however, and Libya is now engaged in building its Great Manmade River (GMR), intended to bring two million cubic meters of water a day from the aquifers in the southeastern desert via nearly 1,900 km of pipeline to areas near Benghazi and Sirte on the Mediterranean coast. A second phase is planned to connect water wells in the southwestern Fezzan with Tripoli. This massive project, under contract with the South Korean Dong Ah Consortium, will cost $3.3 billion for the first phase and $1.8 billion for the second. A third phase is being considered, and ultimately as much as $25 billion may be spent on the total scheme.

The GMR is intended to irrigate as much as 180,000 additional hectares of coastal farmland, but Libya's economic hard times resulting from the drop in oil prices do not promise well for the project. Of equal concern is the amount of water recoverable from the desert—and many observers are skeptical that there is enough. If the Kufrah experience holds true, aquifers may be dried up long before the project has paid for itself. In any event, Libya will remain dependent on foreign sources of food for the near future and will not become an exporter even if the GMR succeeds.

***Saudi Arabia.*** Saudi Arabia has attracted much attention with its recent success in producing wheat, chickens, eggs, and dairy products. This success, however, was accomplished by the government subsidizing purchases of locally produced grain at five to six times the world market rate. In addition, the water for the farms is being pumped from aquifers that—according to a survey conducted by the French Bureau de la Recherche Géologique et Minière—are already being depleted. Reports of failing surface wells and springs geologically upslope on the same strata in eastern North Yemen further suggest that this is the case.

If Saudi aquifers fail, desalination of seawater can scarcely make up the deficit. Desalinized water is being used successfully on the Peninsula for domestic and industrial purposes, but such usage requires only about one-tenth to one-twentieth the water needed for agriculture. Also, water purified at sea level would have to be lifted between 1,500 and 4,500 feet and pumped more than 300 miles to reach farms in the high interior. Thus, it may well

be that Saudi agricultural success will be fleeting or that production will satisfy only part of home consumption in years to come.

*Jordan and Israel*. Israel and Jordan share much the same agricultural problems.

In Israel, agriculture consumes about 75 percent of the water available. Israel's technical skills in growing, packaging and merchandising make its citrus crop competitive on the European market and its vegetable production locally sufficient. Nevertheless, water is in increasingly short supply, and Israel will soon find itself in the same situation as the state of Arizona—where, for the first time, domestic-industrial demands for water are closing down irrigation projects.

Despite the symbolic importance of farming to Israel, water there flows to the highest bidder. Agricultural production inevitably will decline and serve only the needs of local populations. Nor can schemes like the Med-Dead Canal, which if implemented would generate power by pouring Mediterranean seawater into the Dead Sea depression, match growing urban demands for water and energy. Currently, about 20 percent of Israel's energy budget is used to raise water from Lake Kinneret (the Sea of Galilee and the holding pond for the waters of the Yarmouk and Jordan Rivers) to the National Water Carrier.

Jordan competes agriculturally with Israel for the waters of the Jordan River. The expanding metropolis of Amman is increasingly dependent upon springs that cannot be expected to provide all the water necessary for future use. A plan to pipe water over 600 miles from the Euphrates River in Iraq has been found unfeasible, and Jordan, like Israel, will be hard pressed to meet domestic needs as well as feed its own people at present nutritional standards without remaining a net importer of food.

*Iran and Iraq*. Iran and Iraq both have viable amounts of land and water. Although their individual problems of utilizing such resources differ, they share the debilitating effects of a prolonged war. Both remain importers of staple foods, and neither can be expected to solve its agricultural production problems easily. Iran must husband the limited waters of the Elburz Mountains in the North and those of the Zagros Mountains in the West. At the same time, the replacement of traditional gravity-flow underground irrigation tunnels (*qanats*) by tube wells and gasoline pumps has placed new burdens on groundwater supplies with dangers of overpumping. Serious mismanagement of water resources is intensifying Iran's need to import foodstuffs.

Iraq needs better management of on-farm waters. Inadequate drainage and overirrigation have led through salination to losses of farmland and to diminished yields. Iraq is also in the unenviable position of being the farthest downstream recipient of Euphrates River water. Removals and pollution by Turkey and Syria jeopardize the security of that major source of water. In a similar vein, Tigris River waters are in large part derived from the mountains of Turkey and Iran, although full development of that river by the latter countries won't come until sometime in the 21st century. Meanwhile, the northern region of Iraq, in which rainfall grain agriculture is practiced, is disrupted by Kurdish separatism.

Both Iran and Iraq are unlikely to actively compete for regional agricultural markets. Even Iraqi date palm production in the threatened South may suffer. By the same token, both countries will have to continue to import large amounts of staple crops.

*Egypt*. Egypt maintains a precarious balance between its production of cotton for export and much needed grains for home consumption. While water from the High Dam now allows double and triple cropping, little new land has actually been added to Egypt's intensively cultivated fields, all of which are irrigated. Domestic consumption of water is relatively minor in terms of the Nile's flow, but urban development continues to remove valuable farmland from production. Population growth shows no immediate promise of abating. In the final analysis, Egypt will remain a net importer of foodstuffs.

*North and South Yemen*. South Yemen, in a mountainous, arid region, will have to feed new population with imports of food. The better watered but no less rugged North Yemen should be able to meet its basic food requirements through rainfall agriculture supplemented by limited irrigation. The amount of drawdown on Yemeni aquifers by Saudi deep-well pumping is difficult to assess but remains a worrisome factor.

*Sudan*. Sudan's rich potential of soil and water cannot be developed rapidly. The country's lack of infrastructure—roads, railroads, a power grid—and an educated cadre of extension workers will delay increasing export production. Cotton can survive the abusive rail trip to Port Sudan, but production continues to suffer from poor field conditions and inefficient management. Separatist activities in the South have delayed and may have indefinitely postponed completion of the Jonglei Canal on the Nile. This project is intended to increase the flow of river water available for agriculture.

Egypt continues to dominate international negotiations on the division of Nile waters, but the issue, now relatively quiescent, may well erupt as Sudan brings more irrigation projects on line. Meanwhile, Sudan's transition to a new government makes the procurement of foreign aid for development more problematic. Sudan is unlikely to increase its role in the world agricultural market during the period discussed in this article.

*Turkey*. Turkey's location provides an excellent environment for agriculture. Its more northern latitude means lower summer temperatures and reduced crop needs for water. Its mountains attract rain and snow and are the source of numerous rivers. A wide variety of climates exist because of the rugged topography, and yet there are large tracts of arable land throughout the country.

With the exception of tiny Lebanon, Turkey is the only country in the region with no true desert. Over 30 percent of its total area is arable (25.4 million ha), with slightly more than eight million hectares of that fallow and two million hectares (8.2 percent) irrigated.[5] Six percent of these irrigated fields (122,000 ha) are in the Turkish part of the Euphrates River basin. When the Euphrates section of the Southeast Anatolia Project--Güneydoğu Anadolu Projesi (GAP)—is completed, another 760,000 hectares will enter production there, increasing the total irrigated farmland in Turkey by 38 percent. Another 400,000 hectares eventually to be added in the Tigris basin in Turkey will mean a total increase of 57.5 percent in the country's irrigated land. If this goal is realized, Turkey will have over 12 percent more irrigated land than all of Egypt (Egypt in 1981 had 2.86 million ha). When production from this land is combined





with the yield from Turkey's additional 21 million hectares of rainfed cropland, the country's agricultural output will be impressive. The GAP is key to such an increase.

### The Southeast Anatolia Project

The GAP is the Turks' most ambitious effort to reduce their energy deficit by substituting hydroelectric power for expensive fossil fuels. They also hope the GAP will raise the standard of living in the six provinces encompassing the project and thus ameliorate local underdevelopment, one of the causes of Kurdish insurgency in the area. Increased agricultural productivity through irrigation is additional serendipity associated with the scheme.

### Plans And Progress

The Euphrates and Tigris Rivers have a combined potential generating capacity of 7.7 billion kW (46 percent of Turkey's total hydroelectric potential). Seven subprojects on the Euphrates River and six on the Tigris will eventually produce 14 hydroelectric generating stations, 15 dams, and 19 irrigation projects.

*Euphrates River*. Work is well along on the Euphrates portion. The Keban Dam, farthest upstream, came on line in 1974. The next dam downstream is the Karakaya, and its reservoir began to fill in June this year. Both of these dams are solely for hydroelectric production.

Still farther downstream is the site of the Ataturk Dam and reservoir. Work on this project began in October 1981 (the official beginning was November 3, 1983) under the direction of Ata-Inşaat, a Turkish consortium. When completed sometime between 1990 and 1993, this dam will be the largest in Turkey and the third or fourth largest earth-filled dam in the world. Its reservoir will have a volume of 30.5 km³—official announcements claim that is enough water to irrigate up to 900,000 hectares and grow crops with an estimated value of $5 billion a year. In addition, six Francis turbines will have a generating capacity of 2,400 MW.

Water from the Ataturk reservoir will be diverted southeastward to fields near the Syrian border through two major canals.

- The first is a gravity-flow system that will pass through the Urfa Tunnel—two parallel tubes, each 7.5 meters in diameter and over 26 km in length. This unit will be completed in 1986 and will eventually irrigate 300,000 hectares from Urfa east to the town of Ceylanpinar.
- The second system will pump water 107 vertical meters to the Hilvan Canal, from where it will irrigate 400,000 hectares, some as far east as Nusaybin. An additional 60,000 hectares will be irrigated with water pumped from deep wells near the Syrian border.

Two smaller dams downstream from the Ataturk are scheduled to generate more power.

*Tigris River*. Dams and irrigation projects on the Tigris River (600,000 ha and 2,200 MW installed capacity) are in the planning stage and will not come on line until after the year 2000.

### The Human Factor

There is little doubt that the dams and canals of the Euphrates phase of GAP will be completed in the next decade, although some observers are skeptical. But water alone is not enough to assure that GAP's goals and market potential will be realized. The human factor is important. For example, the provinces of Adiyaman, Mardin and Sanliurfa have suitable agricultural land (1.5 million ha) that will be served by the Ataturk reservoir. But detailed soil surveys are not yet completed. Some first-class land will be lost to reservoir flooding, and as a result, as many as 60,000 villagers must be relocated. On-farm preparations have yet to be carried out, and land leveling, tertiary ditching, and possible sprinkler systems have not yet been put in place.

*Land Tenure and the Kurds*. Of all the regions in Turkey, the Southeast has the most inequitable pattern of land tenure. Less than one percent of the population owns one fourth of the arable land. Nearly an additional 25 percent of the farmland is controlled by another six percent of the population. Just over 60 percent of the population owns a total of only 10 percent of the land.

Such an imbalance has encouraged both heavy-handed control by conservative sheiks and opposition to them by local groups on the extreme left. This is exacerbated by local Kurdish-speaking majorities whose irredentist activities persist despite major attempts by the military to quash them. Literacy is low. The Kurds claim (and the Turks deny) that their educational facilities have been slighted for ethnic reasons. The upshot is that it may be easier to deliver water to the farms than it will be to get the farmers to use the new water supply and the modern farming techniques it calls for.

*Dangers in Fieldwork*. During a recent study of on-farm water management in southwest Turkey, agricultural extension workers and hydraulic engineers told this author of the dangers fieldwork involved.[6] The danger was not from insurgents but from possible traffic accidents going to and from field locations. These workers considered it preferable to sit in the office and write reports than to risk their lives on the highway. In the Southeast, the dangers will be many times greater.

### Penetrating The Market

Even if the farmers accept new ways, there remain problems of quality control and preservation of perishable crops, such as fruits and vegetables. Turkish farms have not yet completely solved these problems. Currently, Turkish agriculture's greatest needs are packing, shipping and marketing skills. It is certainly an area open to entrepreneurs.[7]

*Difficult European Market*. The European market has been difficult for Middle Eastern exporters to penetrate. Only Israel has successfully met West European standards of quality and timing for market acceptability. Turkey wishes to become a full member of the EC, but Turkish agricultural production would conflict in part with the parallel specialized crops of the EC's Mediterranean members. Turkish tobacco, raisins, figs and nuts will always sell in the West, but in small quantities. Recently, Europeans have purchased cereals and meat products from Turkey in larger amounts, but the demand is unpredictable. Turkey therefore anticipates finding a market nearer home.

*Middle Eastern Market*. Will Turkey's products be competitive in the Middle East markets? These markets will continue to seek grains, sugar and some meat products. But as per-capita incomes decline with sagging oil prices, the markets will not be seeking fruits and vegetables trans-

ported at high costs from faraway places. As a nearby overland shipper, Turkey has a decided competitive advantage in this situation. Grains, though, must compete on the world market, and no country can long indulge in subsidizing to the extent Saudi Arabia is. Turkey must keep production costs of grains low, since it will be competing not only with the great wheat suppliers—Canada, the United States, Australia and Argentina—but also with EC members such as France.

The United States has several trade weapons at its disposal, namely its Export Enhancement Program (EEP), which mingles free government surplus stocks with commercial exports to provide a salable price on a given package for export. Also, in the months ahead, its new General Sales Manager (GSM) 103 program will offer credit guarantees of up to 10 years' duration to Middle Eastern buyers. Turkey cannot afford to offer its customers such arrangements. Nevertheless, the American share of the $30-billion Middle East agricultural import market slipped by about four percent in 1985. Better local growing conditions may account in part for this drop, but in the long run, population growth is expected to outstrip such positive local crop fluctuations and the region—except for Turkey—will be an increasingly large importer. With determination and some luck, Turkey may cash in on this situation.

### International Implications Of GAP Water Use

A further complication may influence Turkey's agricultural plans for GAP. When completed and at full storage capacity, the three major reservoirs on the Euphrates and a host of smaller ones on its tributaries will have a combined surface area of slightly more than 2,000 $km^2$. Evaporation from an area of that size is estimated at 2.96 $km^3$ a year. In addition, evaporation and transpiration necessary for healthy plant growth demands about one cubic meter of water for every square meter of cropland. At the same time, not every drop of water removed from a reservoir reaches the plants for which it is intended. As much as another meter (depth) of water can be lost through spills, seepage, and evaporation on the way to the plants. Thus, the conservative and predictable figure of 700,000 hectares to be irrigated with Euphrates water could require the removal and loss of 14 $km^3$ of water from the annual flow of the river. Evaporation losses combined with those from irrigation could possibly total 17 $km^3$ per year.

### How Deep Is The River?

Long-term flow records (1937 to 1963) for the Euphrates at Birecik near the Syrian border indicate an average annual flow of 28.7 $km^3$. Other measurements taken at Karkamiş—closer to the border—based on a shorter time period indicate a volume of 31.4 $km^3$ a year. Another 1.8 $km^3$ of water is added in Syria from that country's major tributary, the Khabur River. A total "natural flow" (before any removals for irrigation) at Hit inside Iraq has been estimated at slightly more than 33 $km^3$. (This latter figure can be considered generous.)

Syria has its own major hydroelectric and irrigation projects. Most important of these is the Tabqa (Ath-Thawra) Dam and Asad Reservoir (628 $km^2$) which became functional the same year as the Keban Dam. This reservoir loses at least another cubic kilometer of water from evaporation. Estimates of the land Syria hopes to irrigate along the Euphrates range as high as 600,000 hectares, but this may be too optimistic. Irrigating just half that amount of land would eventually remove 6 $km^3$ of water from the river.

Together, then, Turkey and Syria could use up more than 24 $km^3$, leaving Iraq as little as 9 $km^3$, part of which would have to remain in the streambed in order to carry off dissolved salts from irrigated fields. Iraq already has over one million hectares under irrigation. Obviously, something or someone will have to give way.

### Tensions And Negotiations

The above scenario is only one of many possibilities on the sharing of the Euphrates waters by the three riparian users. It is neither the most optimistic nor the most pessimistic. But tensions have already built among the three nations. Confrontations over reduced flows of Euphrates waters across the Syrian border with Iraq when the Keban and Tabqa reservoirs were originally filled and again in July 1984 were resolved only with difficulty.

In the spring of this year, Syria's Prime Minister Abdul Kassem made an unsuccessful visit to Ankara in order to negotiate a guaranteed flow of water into his country from Turkey. Negotiations apparently stalled over questions of Syria's alleged role in terrorist infiltration across Turkey's border with Syria. Meanwhile, Iraq's poor diplomatic relations with Syria further complicate the issue. No tripartite meeting to discuss the equitable sharing of these waters has yet been announced.

### World Opinion

In any event, although Turkey is in a strong position—it controls the source of the river and is militarily the strongest of the three countries—world opinion may pressure Turkey to reduce the amount of water it removes from the rivers. So, the Turks may have to give up some part of the area they have been counting on for export crops. But even if they do, that wouldn't mean the end of their ambitious agricultural goals for the GAP. Dramatic changes in the Turkish economy over the last two decades indicate that the Turks may well be able to realize their ambitious plans for the Southeast Anatolia Project and become a major food supplier for the Middle East.

### Footnotes

[1]A review of Turkey's energy needs and sources is found in: John Kolars, "The Hydro-imperative of Turkey's Search for Energy," *The Middle East Journal*, Vol. 40, No. 1 (Winter, 1986), pp. 53-67.

[2]No easily available source exists for detailed Turkish materials. A good review of irrigation and land may be found in "Turkey," *Irrigation and Drainage in the World—A Global Review*, K.K. Framji, B.C. Garg, and S.D.L. Luthra, Vol. III, International Commission on Irrigation & Drainage (New Delhi: 1983), 3rd ed., pp. 1369-1397. The figures cited in this article are drawn from a number of Turkish technical reports, primary among which is: Government of Turkey, Ministry of Energy and Natural Resources, General Directorate, State Hydraulic Works, *Güneydoğu Anadolu Projesi* (Ankara: 1980).

The assessment of agriculture in the Middle East and North Africa is neatly summarized in: Peter Beaumont and Keith McLachlan, *Agricultural Development in the Middle East* (20 authors), John Wiley and Sons (New York: 1985), and Marion Clawson, H.H. Landsberg, L.T. Alexander, *The Agricultural Potential of the Middle East*, American Elsevier Publishing Co., Inc. (New York: 1971). The latter work is of particular value for the flow data it contains.

[3]All population, per-capita income, and other related data are drawn





## FOOTNOTES (Continued)

from: The World Bank, *World Development Report—1985*, Oxford University Press (New York: 1986).

[4]The single comprehensive source on water problems in the Middle East is: Thomas Naff and Ruth C. Matson, eds., *Water in the Middle East—Conflict or Cooperation?*, Westview Press (Boulder and London: 1984). This book contains valuable historical summaries, technical data, and bibliographies for the major water problem areas of the region.

[5]A number of varying reports exist in which different totals are cited for hectarages, hydroelectric production and potential, etc. This report has used the *Güneydoğu Anadolu Projesi* report cited in note 2 above wherever possible. Space does not allow a complete discussion of the reasons for selecting certain figures or their possible alternatives.

[6]T.W. Casstevens, John F. Kolars, J.D. Wilson, *On-farm Water Management in Aegean Turkey, 1968-1974*, AID Project Impact Evaluation No. 50, U.S. AID (Washington, D.C.: December 1983).

[7]For more information on the Turkish food processing and packaging industry and foreign sales opportunities in that market, see June 1986 MEER, p. 8.

## APPENDIX 4

## STATEMENT ON TURKEY AND THE MIDDLE EAST PAX AQUARUM (SUBMITTED BY JOHN KOLARS)

A paper presented at the 1987 Annual Meeting
of the Middle East Studies Association

It is safe to say that a new paradigm is developng in southwest Asia. In the past, there were "have" nations graced with ample petroleum resources, and "have not" nations which were petroleum barren or petroleum poor. The nations of the Peninsula were essentially the "haves" as well as Iran and Iraq, while Turkey, Syria, Lebanon, Jordan and Israel were "have nots." But times change and new circumstances -- as well as some very old ones -- now present us with a new paradigm in which food production and security based on ample supplies of water are beginning to weigh as heavily as petroleum profits in the international scales. What I hope to establish is that Turkey is the only possible source of surplus water in southwest Asia, that population pressure in the region is forcing this fact to the fore, and that ongoing development of Turkish and other hydrologic resources will make this the critical issue for diplomacy in the near future of the area.

It is not my intention to linger on the demography of the region. Suffice it to say that in the Middle East (excluding the Maghreb) fifty per cent of the population depends upon surface waters that cross an international boundary from some other country and that ninety per cent of the Arabic speaking world depends upon water from non-Arab sources.

Specifically, the population of the fourteen nations (including the UAE as one unit) in southwest Asia in 1983 totaled 145.7 million. By the year 2000 they are expected to increase (by conservative estimate) to 234 million, about 61 per cent (Table I). (It should be noted that the Sudan and Egypt, while included in the accompanying illustrations, have been omitted from this discussion because the Nile basin countries represent a separate set of conditions and problems. What I speak of here is that which is found east of Suez.)

Attention is called in Figure I to the group of countries with no surface water. With the exception of Iraq and Iran, these are the "have"



nations of the original paradigm. We see to their right on the diagram a second group not actually part of this discussion, which may be considered "dependent" nations, for although they are amply supplied with water, that water comes from across international borders. Jordan also falls within this group for its two streams, the Yarmouk and the Jordan, are shared with neighbors. Next we encounter Israel, Syria and Iraq which have some supplies directly under their control -- due to orographic rainfall in the hills and mountains of the Levant and the Zagros and Elburz Mountains. However, a major proportion of their supplies flows from outside their political boundaries. Lebanon and Iran may be considered independent as far as water is concerned. (I am not referring to speculation as to where their water may eventually end up.) Properly managed, those countries have sufficient water to meet their projected future needs. At the far end of the graph is Turkey, independent and blessed with an abundant surplus of water all from catchments within its own borders. (There are three caveats to this last statement, namely the Orontes /Âsi/, the Çoruh, and the Meriç, but they are of relatively slight importance.)

Figure I also depicts the growth of population as I have described it. Figure II shows the distribution of surplus water throughout the region. The comments regarding self sufficiency made above should be apparent.

A note on sources of water other then international rivers is in order. Underground aquifers at present provide spectacular results in Saudi Arabia and the promise of such in Libya with its GMR. This cannot and will not last. Just as the United States is on the verge of exhausting one of the world's largest aquifers, the Oglalla sandstone of the Great Plains, so too there are ominous signs that water tables are dropping rapidly wherever they are being tapped throughout the Middle East. The Azraq Oasis in Jordan is a minor but significant example of this already having happened. Such underground supplies are not a solution to the problem.

By the same token, desalination of sea water would have to be accomplished at a fraction of current costs to justify its use. This works well for domestic purposes, particularly where ample supplies of energy exist as in the Emirates, Kuwait, and Saudi Arabia, but desalinized water for agriculture requires ten to twleve times the quantities required by cities and industry. Moreover, seawater is at sea level but is used on fields at

much higher elevations. In the case of Saudi Arabia many of the agricultural areas now in place and producing are 4000 to 5000 feet high. Pumping costs can become prohibitive under these conditions. In Israel the cost of raising water from Lake Kinneret to the National Water Carrier was in the past estimated at about 20 per cent of all the energy used in that country. At present, the figure is smaller due to increases in energy use in other sectors although the absolute amount of energy thus consumed does not appear to have lessened.

We now come to what I believe is the central development in this complex picture. I refer to Turkey's Southeaast Anatolia Development Project (Guneydoğu Anadolu Projesi: GAP). This gigantic project is now frequently described in the international press. I quote in part one of the most recent items.

> "The SEAP (i.e. GAP) scheme was initially proposed 20 years ago, and the first dam, the Keban, was inaugurated in 1974. Construction of the second, the Karakaya, began in 1976 and reached completion in July of this year. (I.e. 1987) Building work on the biggest dam proposed, the Ataturk, started in 1983, and is expected to be complete by 1992. In all, the SEAP scheme will let Turkey develop two million hectares of irrigated and partially irrigated land, of which nearly 1.5 million will be watered by the Euphrates."
>
> Alan George, The Middle East, Oct. 1987, p. 27.

The location of GAP on the headwaters of the Euphrates and Tigris Rivers in Turkey is shown in Figure III. Downstream developments and the vulnerability of Syria and Iraq are apparent. Typical of the sub-projects scheduled for completion in Turkey are those south of Urfa on the Harran Plain and to the east along the Syrian border near Ceylanpinar and Mardin (Figure IV). If every project listed by Turkey and scheduled for completion within the next thirty years for GAP were to come through, according to my calculations their impact upon the flow of the Euphrates would be dramatic. In turn, as Syria's plans for irrigation and hydro-power come on line, additional depletions will take place from the Euphrates. Figure V gives some indication of this although I do not have time to describe its many details. It does, however, represent a less then worst but not best case scenario.



Figure VI tells the story graphically and step by step. Assuming an average natural flow of 33,730 million cubic meters per year entering Iraq at Hit, upstream depletions by 1995 may possibly reduce that amount by 24,350 million $m^3$ to 9,380 million $m^3$. By sometime after the year 2000 the amount of flow entering Iraq might by reduced to as little as 4,960 million $m^3$ per year.

This is not to say that that will actually happen. Nor is it my purpose to be a doomsayer. One might take the easy way out, however, and I quote J.A. Allan, Reader in Geography at London University's School of Oriental and African Studies, as quoted in the above mentioned article:

> "Like all such grand development fantasies, it will never be fully implemented."

Maybe not to the last dotted "i" and crossed "t," but to me such an attitude smacks of the usual "Turkey bashing" so prevalent in western Europe. The fact is, that while there are enormous problems and headaches ahead for GAP, the Turks are completely capable of accomplishing what they have set out to do. This means that GAP will continue to put increasing strain upon the Euphrates and Tigris Rivers, two of the major sources of international waters in southwest Asia.

So, given increasing populations, lowering water tables, and GAP, what can be done? What is being done? I have now arrived at the heart of my presentation.

Negotiations between the riparian users of the Euphrates have encountered some difficulties. At first, Syria and Turkey had little to say to each other as the result of old disagreements. That situation has changed significantly in the last year as, I believe, Syria has become increasingly aware of the implications which GAP holds for it. Prime Minister Ozal in July visited Damascus and upon his return announced the signing of a protocol with Syria guaranteeing a minimum flow of the Euphrates of 500 cubic meters per second across the border at Birecik into Syria. This amounts to nearly 16 billion $m^3$ per year, well within the range demanded by Syria in earlier negotiations. On the other hand, this is the same amount demanded by Iraq in 1967. Syrian use will fall somewhere between four and twelve billion $m^3$ annually. If the larger figure is approached then Iraq

will be left in very short supply. Thus, a further solution to the problem must be found. This is affirmed by Syrian Ambassador to Turkey, Abdulaziz el-Rifal's 1986 statement to the Turkish press, "Two neighbors do not struggle for water."

Early in 1987 Prime Minister Ozal suggested an answer to both the demands made by GAP upon the flow of the Euphrates and to the escalating water shortages of countries to Turkey's south. This is his "Peace Pipeline" which could carry water from the Seyhan and Ceyhan Rivers as far south as Medina and Mecca in the west, and from the Tigris River in Turkey to the U.A.E. in the east. The international contractors Root and Brown have already presented a prolegomenon to a feasability study of this project. Their initial presentation suggests 3.5 million cubic meters per day (1.28 billion $m^3$/yr) of water flowing south in the western pipeline (Figure VII) and 2.5 million cubic meters per day (.91 billion $m^3$/yr) in the east (Figure VIII). Various reports give the combined cost of these ventures at between 17 and 20 billion dollars. Technologically feasible, these seemingly expensive lines could deliver water -- according to Brown and Root -- at one-third the cost of a similar desalinized quantity.

I should add that while Premier Ozal has not mentioned compensating for GAP's depletions, if and when they occur, similar inter-basin transfers originating in Turkey could solve in a reasonable way the problem GAP presents. Figure IX shows the distribution of surplus waters throughout Turkey. This is based on calculations drawn from DSI publications as well as further analysis of my own. Each symbol indicates the total amount of surplus after evapotranspiration and other natural losses have been subtracted from estimated precipitation. The empty portion at the top is the amount estimated that will be consumed by agriculture and domestic activities. Some river basins will need augmentation. The central, west and northwest parts of the country are already suffering water shortages. The south and east, however, have ample surplusses capable of satisfying both Turkey's needs and those of its southern neighbors. Some caution must be exercised even with this initial, and admittedly rough, estimate. This is indicated on Figure X which correlates the total surplus remaining in each basin after anticpated depletions with the total available run off before in-basin use.



The Euphrates and Tigris Rivers have sufficient surplusses, but they also are committed to downstream users, as is the Çoruh. Any basin falling within the "before and after" less-then-5-billion $m^3$ category will probably need some supplementation in the future. Those having original flows between five and ten billion $m^3$ can probably get by but have little to offer the others. It should be noted that the Seyhan and Ceyhan fall in this marginal category thus prompting the questioning of those two rivers as the best source for the Peace Pipeline, particularly in view of the water shortage that may develop in Hatay along the Orontes River. Much more hope can be attached to the Eastern Mediterranean and Eastern Black Sea Regions. But in any case, the fact remains that properly managed, the water resources of Turkey could alleviate much of the water shortage in the Levant and the Peninsula.

How real a possibility is the Peace Pipeline? Are the Turks serious, and what's in it for them? An unusual insight may be gained if we turn to the writings of Korkut Ozal, the younger brother of Turgut Ozal and co-author with him of a paper, "On the Principles and Methods of Hydroelectric Development Planning," although I refer now to an independent article by Korkut, "Development of the Euphrates Basin in Turkey -- a Case Study." Cannot we wonder if he had consulted his older brother before committing his ideas to print? He writes:

> Generally speaking, cooperation between the countries within an international river basin is indispensable to resolve conflicts and to increase economic efficiency of resource utlization. ... The settlement of international water disputes cannot be made according to international law. Such law does not and cannot exist. It becomes therefore the responsibility of the concerned countries to develop a solution to their own problems. This is usually a delicate task since it is an operation of finding a point of compromise for many diverging claims and demands which normally have their origin in controversies other than the one under discussion. These other controversies may even involve issues which may be regarded, by involved coutnries, as issues pertaining to national prestige. Under such difficult conditions speculative attempts to resolve all these conflicts in a single negotiation are bound

to completely fail. ... However, those failures should not be considered as indications of the impossibility of cooperation in international basins. The Turkish experience gained on its international rivers with the USSR and Greece suggests that by a carefully planned sequential approach to the problem, constructive and successful cooperation ban be achieved. ..."

There is a strong element of hope and rationality in these words.

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NB As of this rewriting (3 Feb. 1988) two other events reinforce the above point of view. A minister from Jordan (office unknown) has recently visited Ankara to discuss the Peace Pipeline. It also appears that Syria has also entered into some discussion of this scheme. Secondly, Ozal's negotiations with Papandriou at Geneva at the end of January began with a careful exchange of amenities and concessions but did not immediately confront the issues of Aegaean oil exploration or Cyprus... a slow and easy approach advocated above.

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And what's in all this for the Turks? By making life more secure for their southern neighbors they would be able to secure, in turn, their southern flank. This would make GAP and its ambitious goals more attainable as well as allowing more resources to be directed to domestic affairs. It might even mean that through closer relations with the Syrians and the Iraqis -- not to mention the Jordanians and the Saudis -- Turkey would be in a position to act as an intermediary between various interested groups, not excluding the Americans who would find it to their advantage toa accept a more quid pro quo relatioship with their NATO ally.

And could the Arab nations possibly accept being dependent upon the Turks? The Turks have long been dependent upon the Arabs for petroleum and for the loans to buy that much needed energy. Moreover, it is most unlikely that Turkey would be seen as having the same ambitious intent for the entire Middle East as might the Soviet Union or the United States.

I am rapidly advancing into the realm of political speculation in which I am the least experienced of tourists. However, given the growing thirst of the southern lands, the water to the north, and what I believe will become the increasingly undeniable need for cooperation among all the countries involved in such a Peace Pipeline, I think it quite conceivable that we will see in our lifetime a PAX AQUARUM in this part of the Middle East. One in which Turkey will play an important role.



Table I

POPULATION 1983 AND ESTIMATED POPULATION GROWTH TO 2000
In Middle Eastern and Northeast Africa Countries

| Country | Population 1983 $1 \times 10^6$ | Est. Population 2000 $1 \times 10^6$ | % Change |
|---|---|---|---|
| UAE | 1.2 | 2.0 | 67 |
| Kuwait | 1.7 | 3.0 | 76 |
| Saudi Arabia | 10.4 | 19.0 | 83 |
| Oman | 1.1 | 2.0 | 82 |
| Yemen AR | 7.6 | 12.0 | 58 |
| Yemen PDR | 2.0 | 3.0 | 50 |
| (Libya) | (3.4) | (7.0) | (106) |
| (Egypt) | (45.2) | (63.0) | (39) |
| (Sudan) | (20.8) | (33.0) | (59) |
| Jordan | 3.2 | 6.0 | 87 |
| Israel | 4.1 | 5.0 | 22 |
| Syria | 9.6 | 17.0 | 77 |
| Iraq | 14.7 | 26.0 | 77 |
| Lebanon | 2.6 | 3.0 | 15 |
| Iran | 42.5 | 71.0 | 67 |
| Turkey | 45.0 | 65.0 | 44 |
| Total (less L/E/S) | 145.7 | 234.0 | 60.6 |

Source: World Development Report
World Bank (Oxford U. Press, 1985)

| | | | |
|---|---|---|---|
| Total (including L/E/S) | 215.1 | 337.0 | 56.7 |

TABLE 1: THE TWENTY-SIX DRAINAGE BASINS OF TURKEY -- TOTAL RUNOFF AND SURPLUS RUNOFF: CA. 2000+

| No. | Name | Total Runoff $1 \times 10^9$ m$^3$ | Maximum Realizable[a] Irrigation Water Use (ha X 10,000m$^3$ = 1 m$^3$/m$^2$) $1 \times 10^6$ m$^3$ | Domestic Use $1 \times 10^6$ m$^3$ | Total Use $1 \times 10^9$ m$^3$ | Surplus Runoff $10^9$ m$^3$ | Surplus as a % of Total Runoff |
|---|---|---|---|---|---|---|---|
| 1 | Meriç | 1.25 | 631.64 | 60.0 | .6916 | .558 | 44.6 |
| 2 | Marmara | 7.62 | 500.23 | 829.0 | 1.3292 | 6.291 | 82.6 |
| 3 | Susurluk | 5.35 | 1704.74 | 147.2 | 1.8519 | 3.498 | 65.3 |
| 4 | Kuzey Ege (N. Aegean) | 2.20 | 839.39 | 18.0 | .8574 | 1.343 | 61.0 |
| 5 | Gediz | 1.81 | 1308.30 | 0.5 | 1.3088 | .501 | 27.7 |
| 6 | Küçük Menderes (Little M.) | 1.12 | 31.50 | 128.0 | .1595 | .961 | 85.8 |
| 7. | Buyuk Menderes (Big M.) | 2.95 | 2326.65 | --- | 2.3267 | .623 | 21.1 |
| 8. | Bati Akdeniz (W. Mediter.) | 7.76 | 1173.92 | --- | 1.1739 | 6.586 | 84.9 |
| 9 | Antalya | 11.24 | 1928.79 | --- | 1.9288 | 9.311 | 82.8 |
| 10 | Burdur | 0.31 | 312.16 | --- | .3122 | -0.002 | -00.6 |
| 11 | Akarçay | 0.45 | 748.3 | --- | .7483 | -0.298 | -66.2 |
| 12 | Sakarya | 6.03 | 2664.13 | 822.0 | 3.4861 | 2.544 | 42.2 |
| 13 | Bati Karadeniz (W. Black Sea) | 10.04 | 951.68 | 18.6 | .9703 | 9.070 | 90.3 |
| 14 | Yeşil Irmak | 5.54 | 3261.18 | 127.0 | 3.3890 | 2.151 | 38.8 |
| 15 | Kizil Irmak | 6.20 | 4973.20 | 96.0 | 5.0792 | 1.121 | 18.1 |
| 16 | Konya | 3.36 | 2439.24 | 123.9 | .2631 | 3.097 | 92.2 |
| 17 | Doğu Akdeniz (E. Mediter.) | 12.27 | 712.13 | 66.6 | .7787 | 11.491 | 93.7 |
| 18 | Seyhan | 7.06 | 3426.33 | --- | 3.4263 | 3.634 | 51.5 |
| 19 | Asi (Orontes) | 1.20 | 1165.76 | --- | 1.1658 | .034 | 02.8 |
| 20 | Ceyhan | 7.21 | 3615.48 | --- | 3.6155 | 3.594 | 49.8 |
| 21 | Firat (Euph) | 33.48 | 15068.67 | 82.5 | 15.1512 | 18.329 | 54.7 |

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THE TWENTY-SIX DRAINAGE BASINS OF TURKEY -- continued

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 22 | Doğu Karadeniz (Eastern Black Sea) | 14.00 | 9.24 | --- | .0092 | 13.991 | 99.9 |
| 23 | Çoruh | 6.46 | 364.17 | --- | .3642 | 6.096 | 94.4 |
| 24 | Aras | 5.54 | 2863.52 | --- | 2.8635 | 2.676 | 48.3 |
| 25 | Van | 2.59 | 676.41 | --- | .6764 | 1.914 | 73.7 |
| 26 | Dicle (Tigris) | 21.81 | 5253.36 | --- | 5.2534 | 16.557 | 75.9 |
| Total | | 184.93 | 59250.32 | 2520.1 | 61.7704 | 123.160 | 66.6 |

a The DSI source gives two figures for irrigable land. The smaller figure listed under "Benefits after development" has been used to compute the value in this column. An average water loss of 1 m$^3$/m$^2$ has been taken as the average depletion for Turkey. This figure is based on computations made for The Euphrates River Basin by this author.

Source: Devlet Su Işleri, 1983 Statistical Bulletin with Maps, Chap. 5. Values in columns 2, 4, 5, and 6 have been computed by Kolars.

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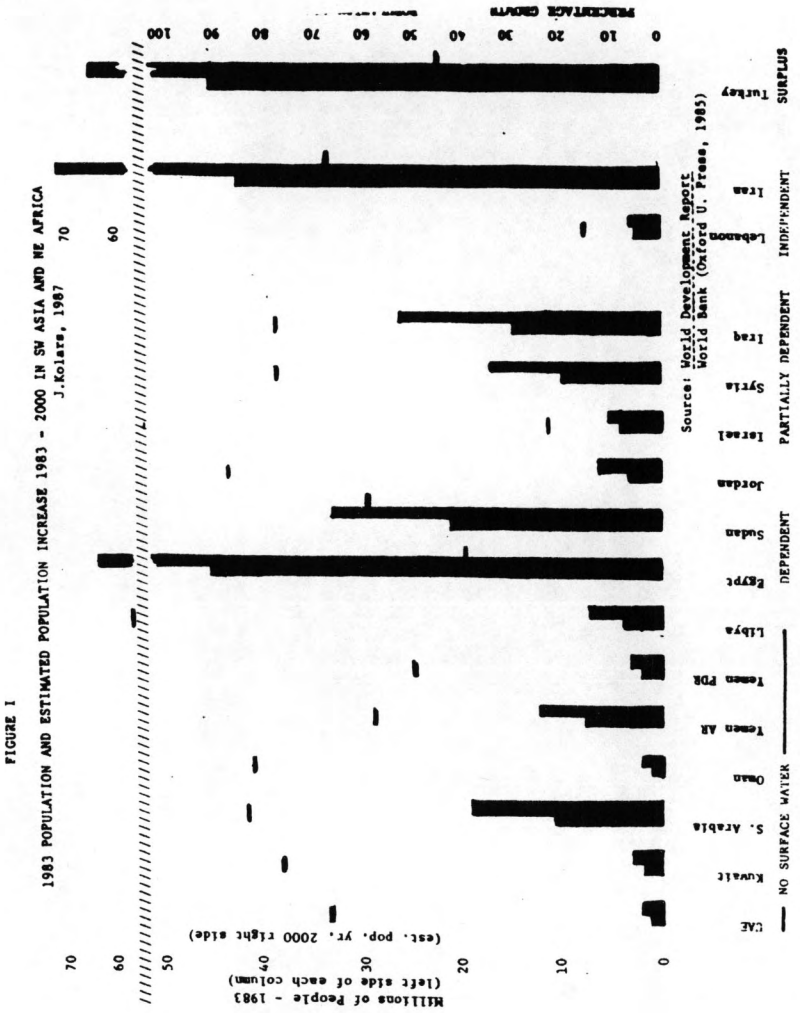


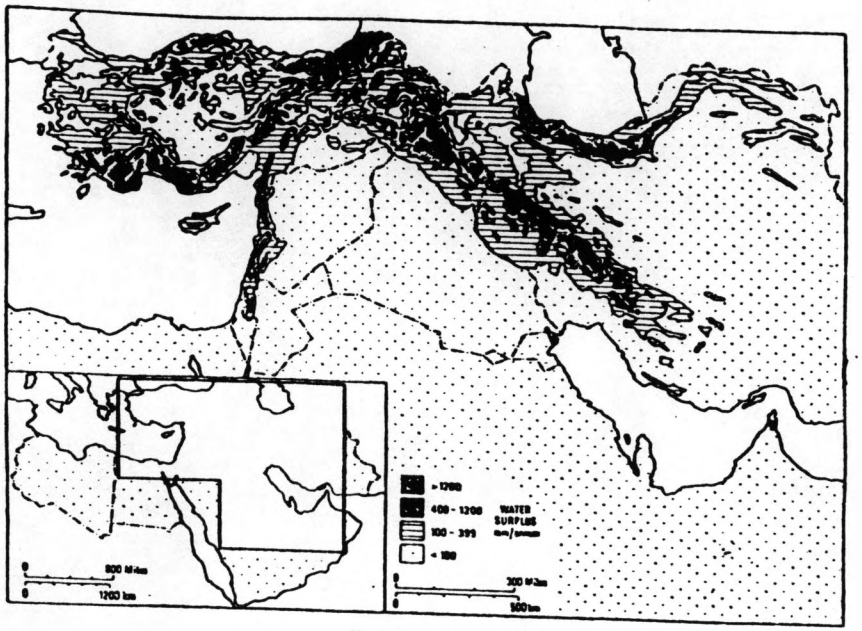

FIGURE I

1983 POPULATION AND ESTIMATED POPULATION INCREASE 1983 - 2000 IN SW ASIA AND NE AFRICA

J.Kolars, 1987



FIGURE II




Water surplus in the Middle East

Source: "The Agricultural Environment: an Overview," Peter Beaumont, in Agricultural Development in the Middle East, P. Beaumont and K. McLachlan, 1985 (John Wiley and Sons), p 17.

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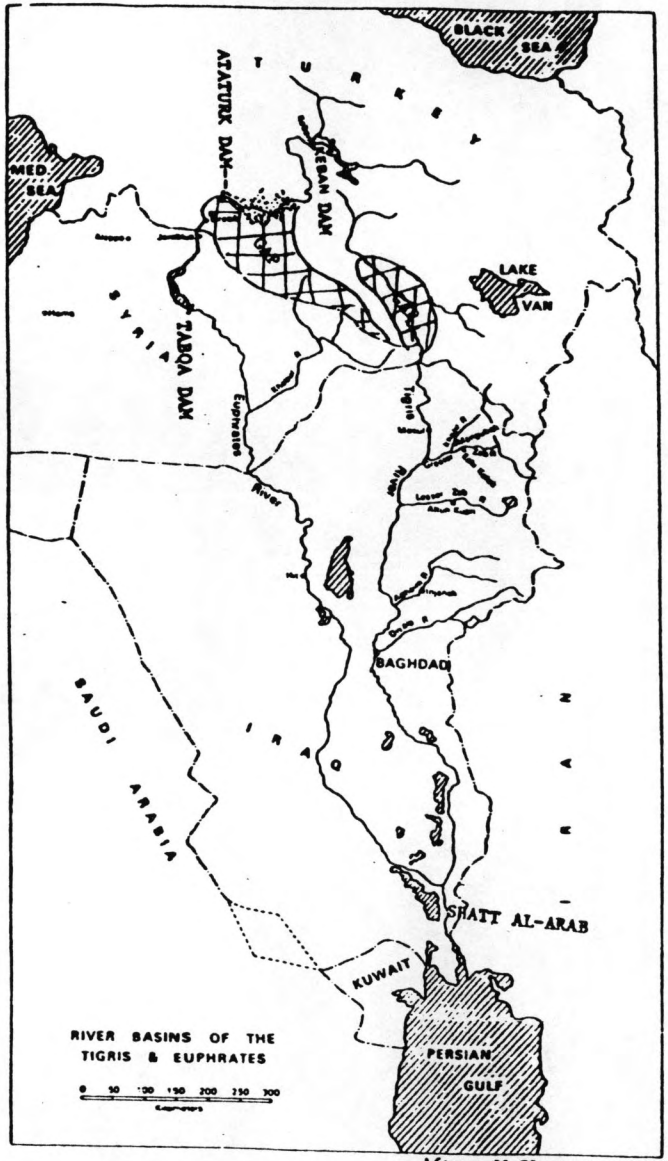
FIGURE III



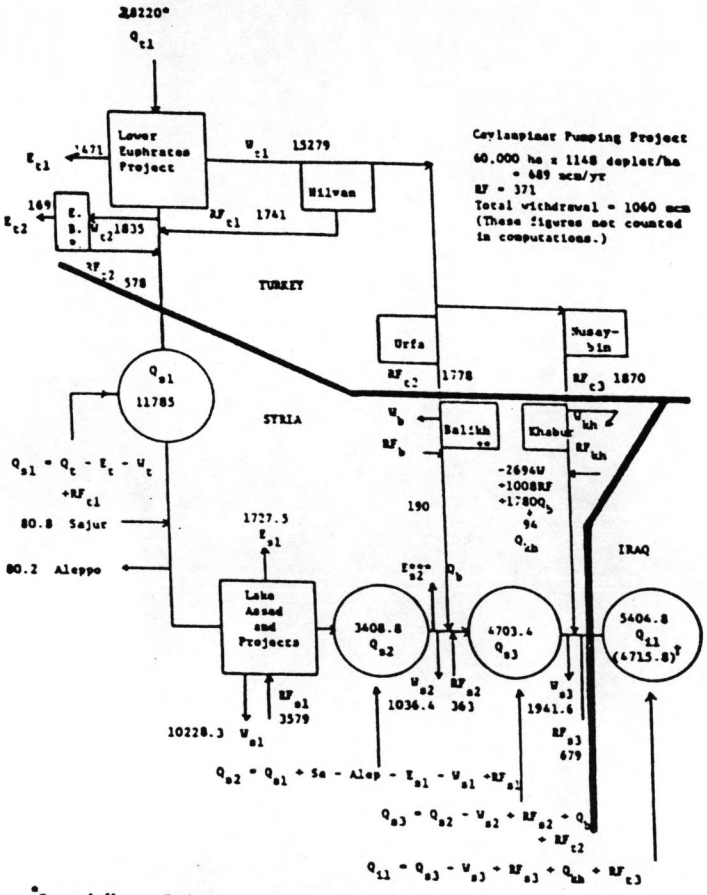

After: M.Clawson, et al, The Agricultural Potential of the Middle East, American Elsevier Pub. Co., Inc. (1971), p.203



FIGURE IV. GAP: THE HARRAN PLAIN AND THE CEYLANPINAR/MARDIN IRRGATION AREAS

Diagram V

Sequential Water Budget of the Euphrates River ca. 2000+




* Natural flow at Karkamis (Table EF 10, p.

** Balikh # 1 counted with Euphrates projects.

*** Reservoir size unknown and evaporation not included.

† Lower value includes depletion estimated for Ceylanpinar project.





FIGURE VI

WATER SUBTRACTIONS EUPHRATES RIVER: UPSTREAM USERS OPTIMUM SCENARIOS -- 1986-2000+
(Amounts in Mcm/yr)

Total Annual Natural Flow = 33,730 Mcm/yr

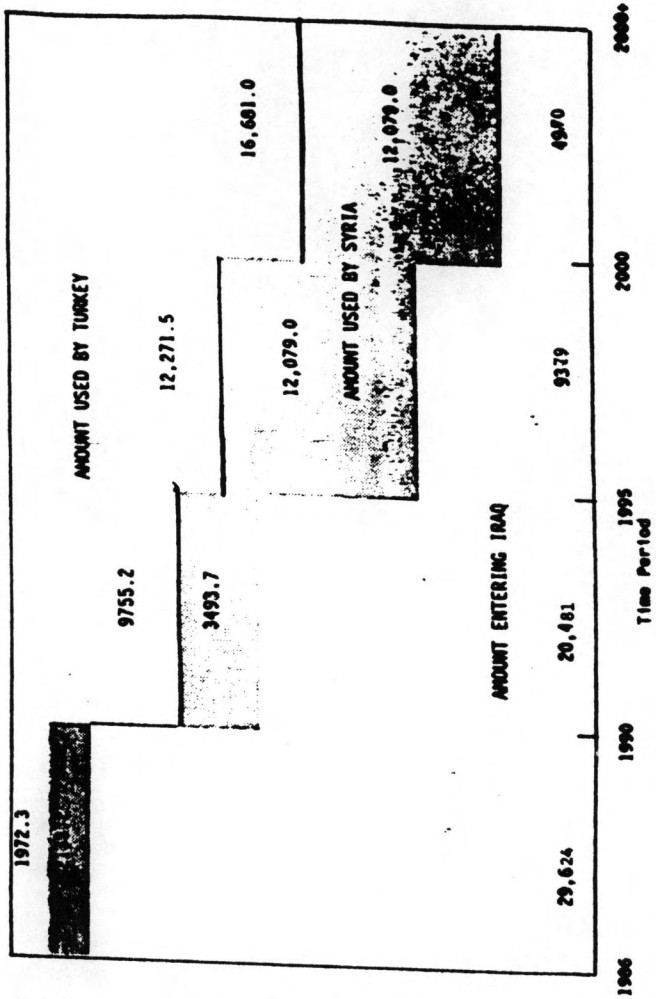


FIGURE VII

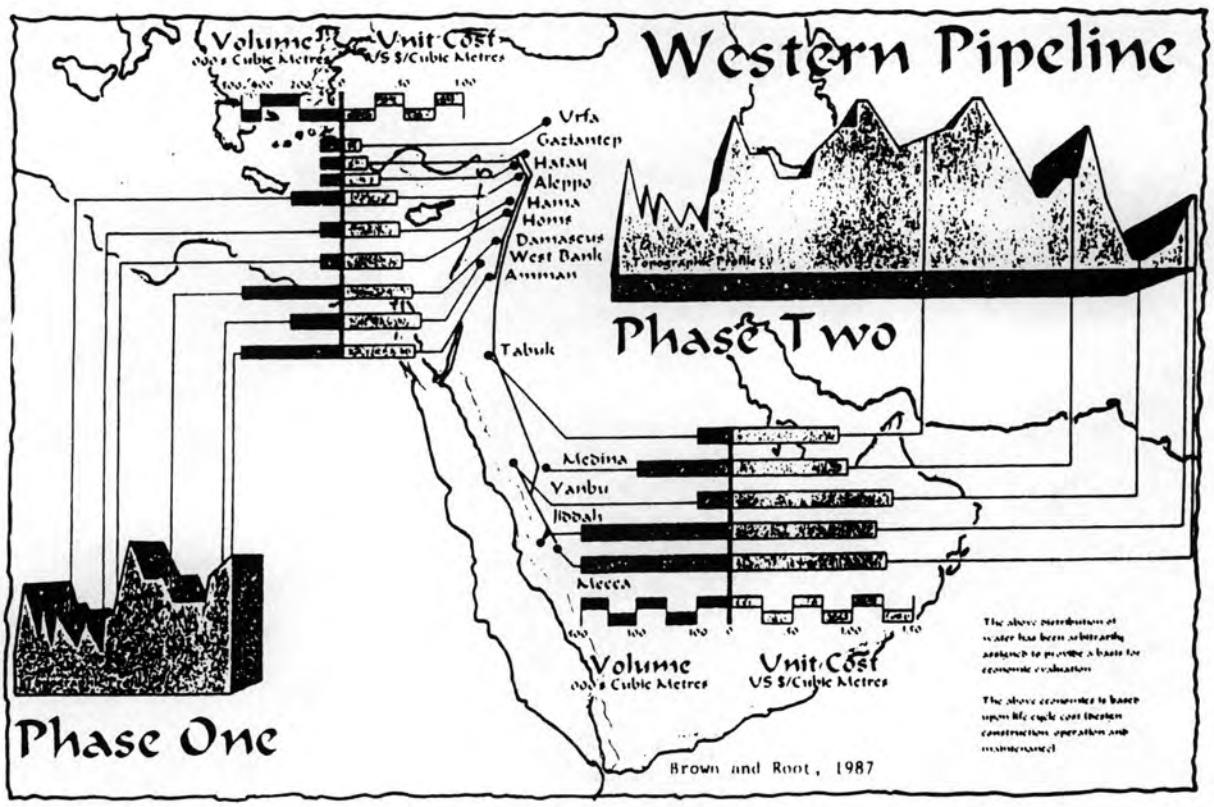



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FIGURE VIII

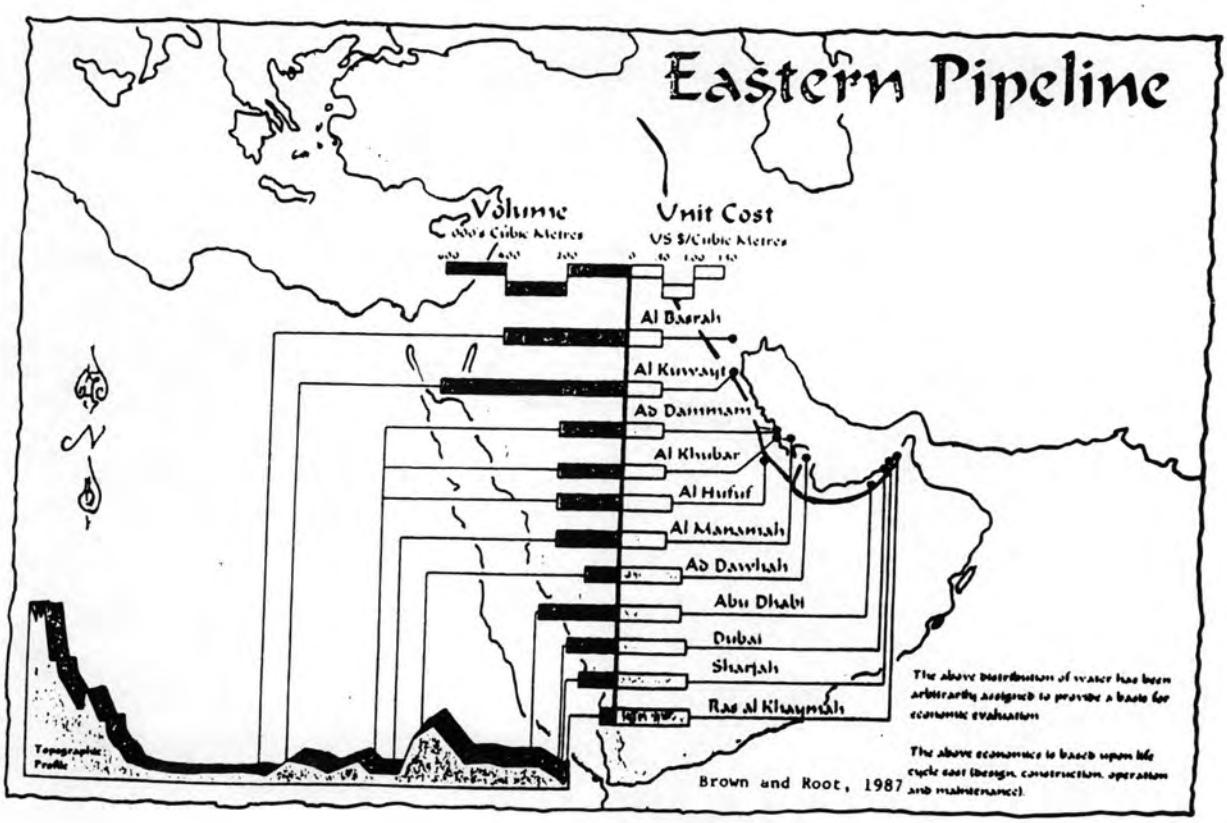


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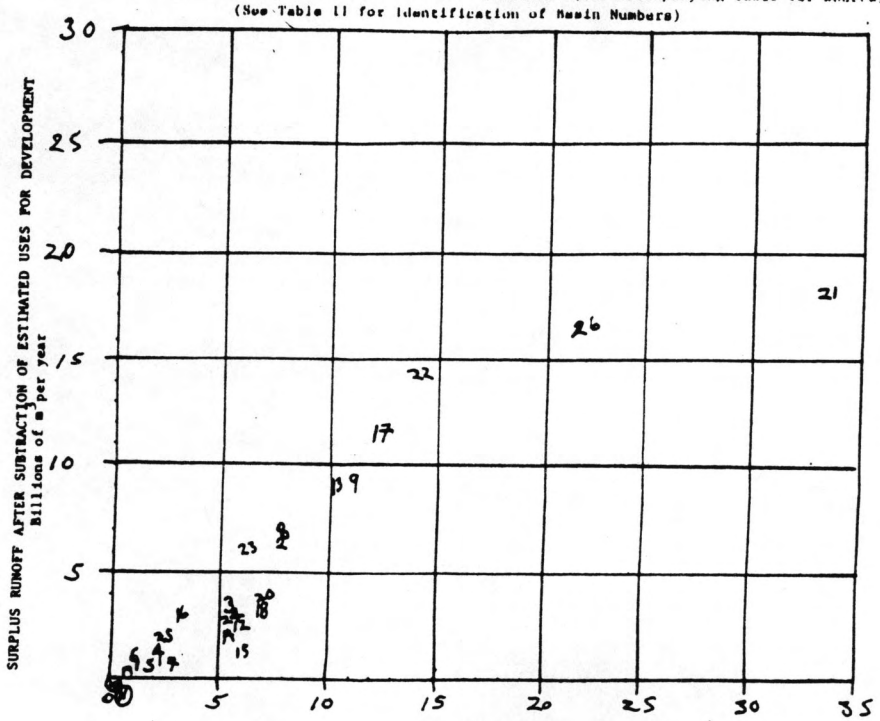
FIGURE A

THE TWNETY-SIX DRAINAGE BASINS OF TURKEY -- TOTAL RUNOFF AND SURPLUS RUNOFF

J.Kolars (see accompanying table for source)

(See Table II for Identification of Basin Numbers)





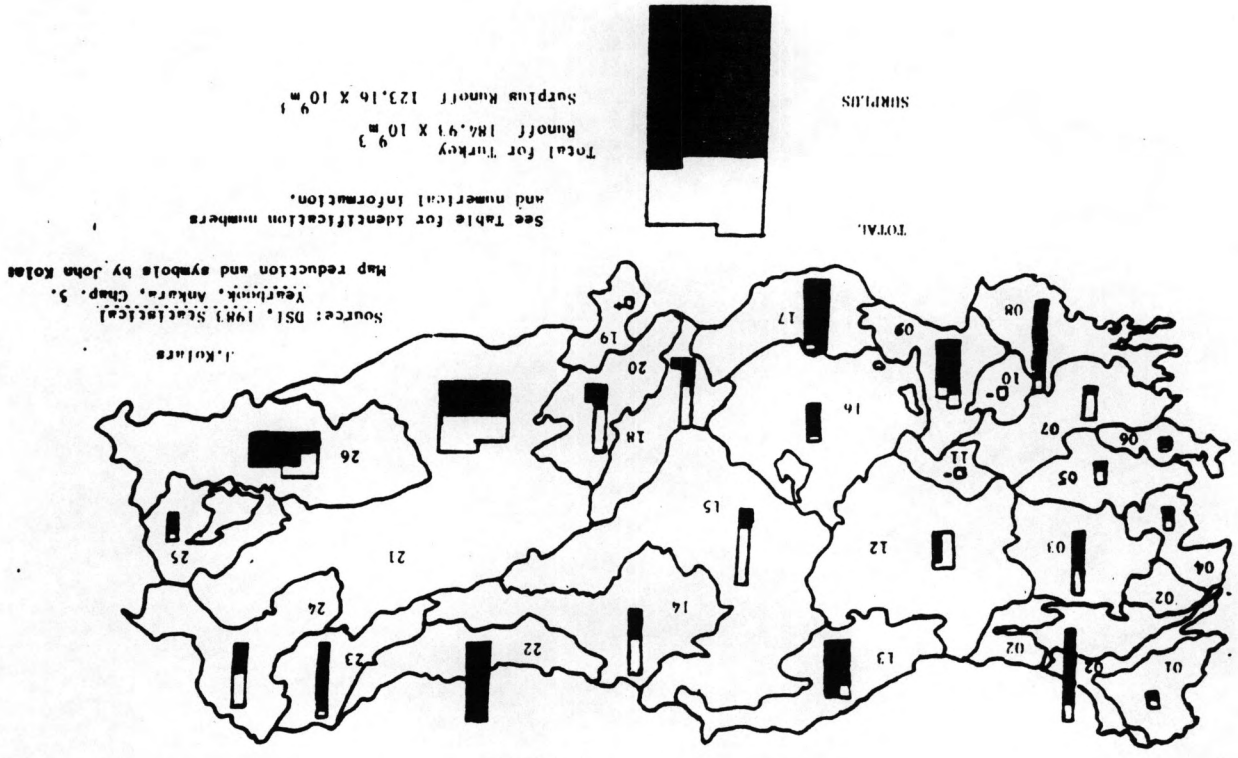




FIGURE IX THE TWENTY-SIX DRAINAGE BASINS OF TURKEY -- TOTAL RUNOFF AND SURPLUS RUNOFF -- C.A. 2000+

APPENDIX 5

# STATEMENT ON MIDDLE EAST WATER: SOURCE OF CONFLICT OR CATALYST FOR PEACE?

(SUBMITTED BY GEORGE E. GRUEN, ADJUNCT PROFESSOR OF INTERNATIONAL RELATIONS, SCHOOL OF INTERNATIONAL AND PUBLIC AFFAIRS, COLUMBIA UNIVERSITY)



"Water is a political sword with a double edge, it can be used to keep tensions high or to bring peace."

– Professor Arieh Issar, Director of Water Resource Center at Ben Gurion University of the Negev

"I cannot promise that sufficient water will prevent war, but poverty and scarcity of water will cause war-no doubt about that."

– Meir Ben Meir, former Israeli Water Commissioner

"Whiskey is for drinking, water is for fighting."

– Mark Twain

AUGUST 1990





CONTENTS

## INTRODUCTION

The Arab-Israeli conflict has historically been examined in geostrategic and political terms. While the issue of water resources in the Middle East has been a significant point of contention, the subject has received relatively little public attention. Since Biblical times, water has been a precious commodity in the Middle East and continues to be so today. In a region of limited rainfall, rapid population growth, increasing urbanization and industrialization, the need for water is greater than ever. Shortages of water in the region will either be an ingredient in the formula for peace or a contributing factor to conflict. Arnold Sofer, a geographer at Haifa University, stated that "nations that for millennia had water, sometimes sparse but always steady, now face severe shortage. . .Add to that exploding populations and what many geographers believe is a growing cycle of regional drought, and you have a formula for disaster".[1]

The sources of water in the Middle East are limited. As each day passes without any solution, these nations' shortages become more and more serious. Each country faces a crisis of different degrees. Each has attempted to solve its particular problems in the manner that best suits its available technologies, knowledge and financial resources. This failure to "pool the resources" of the nations in the Middle East has greatly exacerbated the problems faced by individual countries. Whereas the search for water could have been a catalyst for cooperation and peace, to date, it has been primarily a source of conflict and heightened tensions.

The available sources of water are being used up at an alarming rate. With no attempt to coordinate consumption, there has been serious waste, mismanagement and conflict over what supplies remain. Conflict over water resources was a major underlying reason for the war of 1967. Although some of the nations have been successful in finding and utilizing various technologies, these have only served to stave off the looming crisis, not solve the problem.

Estimating the amount of surface water and groundwater in the Middle East is very difficult. Israel, Jordan and Syria consider water to be an issue of national security, and are therefore unwilling to release government documents with detailed analyses of current consumption and availability. Using many previously published estimates on the amount of water to set parameters, we came up with our best estimate of current consumption and availability. These figures may differ from others, given the lack of complete and accurate information.

## I. SOURCES OF WATER IN THE MIDDLE EAST

[1] Richard Z. Chesnoff, "When Water Feeds Flames," U.S. News & World Report, 21 Nov. 1988: 47.





The failure, over the last 30 years to address and resolve the question of water rights in a regional and comprehensive manner, has forced each country to seek its own solutions.

Projected Water Consumption in Israel, Jordan, Egypt[2]

(In Millions of Cubic Meters)

| Year | Israel | Jordan | Egypt |
|---|---|---|---|
| 1990 | 1750 MCM | 870 MCM | 73,000 MCM |
| 2000 | 2500 MCM | 1000 MCM | [3] |
| Est. Yearly shortage | 800 MCM | 170 MCM | |

### ISRAEL

Approximately 95-99% of Israel's renewable water (sources which are replenished naturally) is being utilized. Predictions have placed Israel's future water needs at about 2,500 Million Cubic Meters (MCM) a year by the year 2000. Professor Thomas Naff, a leading water expert with Associates for Middle East Research Inc. of Philadelphia, recently noted that "somewhere between the turn of the century and the year 2010, they [the Israelis] are going to have to come up with between 500 and 600 million cubic meters annually of new water."[4]

Israel's current water use is approximately 1750 MCM, with thirty percent of her water needs coming from the Jordan River. An aquifer (a water-bearing stratum of permeable rock, sand, or gravel) in the West Bank, shared by both the Palestinians and Israelis, supplies between 25-40 percent, and the rest of Israel's water is derived from underground resources, waste water reclamation, catchments, saline springs and other sources.[5] Two aquifers located within the pre-1967 borders have been completely tapped. Demand for

[2] These are based on estimates from previously published figures.

[3] Data on Egypt's water consumption is sparse, this coupled with the rapid population growth make it very difficult to estimate future consumption.

[4] Andrew Alexander, "Water Wars/Crisis In The Middle East," The Atlanta Journal and Constitution, 19 March 1989: 8A.

[5] Frederick W. Frey and Thomas Naff, "Water: An Emerging Issue in the Middle East," The Annals of the American Academy of Political and Social Science, November 1985: 47.

water in Israel is so great that these aquifers have been overpumped, creating a nationwide cumulative deficit in replenishment of about 1.7 billion cubic meters (BCM) of water. This deficit, when compared to Israel's national annual water consumption of 1.8 BCM, highlights the gravity of the situation.

In addition, Israel's growing population, which has been projected to increase by one million, bringing it to a total of 5.5 million by the next century, will further aggravate the demand for water. It should be noted that this figure does not include the Palestinian population of the territories, nor does it include the unexpectedly high rate of Soviet immigrants in recent months. Should this wave of aliya continue at current rates, more than 100,000 new immigrants will arrive this year alone. Some projections of total Russian immigration, based on the number of outstanding exit requests, are as high as one million or more. While public attention has focussed on the urgent need to provide the new immigrants with housing and jobs, the necessity to supply them with adequate quantities of water both for residential use and for the new or expanded enterprises in which they will be employed, is obviously equally vital.

The issue is not only one of quantity but also of quality, especially for household use. According to a 1987 report by Israel's State Comptroler, half of the nation's primary coastal aquifer was polluted with high nitrate levels resulting from fertilizer and pesticide seepage. Due to overpumping, the water level drops below a certain level causing seawater to enter an aquifer and contaminate the remaining water. With this happening to other aquifers in Israel, there is reason for concern. Professor Naff has warned that "once you have destroyed an aquifer it can't be restored in just a few years."[6]

Water has become a highly politicized issue in Israel. The Likud and other right wing parties have used Israel's dependence on West Bank water as a justification for permanent control over the West Bank. "A Palestinian state on the West Bank would be like giving your drinking water to [Palestine Liberation Organization Chairman] Yasser Arafat," the ultra-nationalist Tsomet party said in a press release in October 1989.[7] Others argue that some or all of the territories can be given back, but they insist that any peace agreement would have to include arrangements for mutual controlled sharing of the aquifer. Whatever the political arrangements, some method of joint use between Israel and the Palestinians would have to be arranged, with strict regulations and monitoring.

Another important water-related issue in Israel is the role of agriculture in Israeli society. "We are dealing with national aspirations," said Hillel Shuval, an environmental scientist, "the Zionist dream to create a green hinterland in Palestine allows Jews to be farmers again...Nevertheless, the only way to assure

[6] Andrew Alexander, "Water Wars/Crisis in the Middle East," The Atlanta Journal and Constitution, 19 March 1989: 8A.

[7] Anton Ferreira, "Water as Thick as Blood in Israeli Conflict with Arabs," Newstab, 19 October 1989.





enough for future population growth and immigration is to reduce water allocation to agriculture."[8]

The Zionist movement's longstanding connection to pioneering and agricultural settlement transcends party lines. Although it is now agreed policy that domestic and industrial demands take precedence over agricultural ones, the power of the agricultural lobby will make further reduction of water allocations to agricultural settlements politically difficult. Currently, approximately 75% of Israel's annual water budget goes to agriculture.[9] Throughout the states's history, water has been used in greater proportion for the agricultural sector than for the domestic or industrial sectors. From 1964-1986 water usage by agricultural settlements increased dramatically when compared to the steady rise in water consumption by the domestic and industrial spheres in Israeli society. The drought in recent years has forced the authorities to begin to impose water use restrictions on certain crops, such as cotton.

GAZA

With about 650,000 Palestinians living in the Gaza Strip, the area has one of the heaviest population densities in the world. Gaza is currently suffering from severe water shortages. The aquifer beneath the Gaza Strip, which is the sole indigenous source of Gaza's water needs, has been overpumped for years. The people of Gaza are already thought to be consuming between 40-50% more water than the rainfed aquifer can replenish. Water abstraction (mostly for irrigation) presently amounts to 110 MCM/yr. compared to an available safe yield of only 50 MCM/yr.[10] The result has been a shortage of fresh water which has forced the residents increasingly to drink water that is more saline than desireable.[11]

By the year 2000, the Palestinian population in Gaza is expected to reach about 1 million. This means that an outside source of water will have to be found to meet the needs of the residents; Israel says it can not assume that burden. According to Israeli Water Commissioner Zemach Ishai, starting in the year 2000, Israel will refuse to pump water to Gaza residents for agricultural use, as she currently does, and will only provide the Palestinians there with water for personal use. (Ninety percent of the Gaza Strip's water consumption is used for agriculture, only 10% is for domestic and industrial use.) As already noted, water shortages within pre-1967 Israel, have resulted in cutbacks in allocations to farmers.

According to the West Bank Data Project, the 2,000 Jewish settlers in the Gaza Strip consume thirty

[8] Ibid.

[9] Joyce R. Starr and Kenneth P. Libre, "The Israeli Water Crisis," New Outlook, August 1988: 8.

[10] "An Eighteen Year Survey (1967-1985)," State of Israel, Ministry of Defence, 1985: p.77.

[11] Andrew Alexander, "Looming Water Crisis Threatens Mideast: Shortages Could Ignite Wars in Fragile Region," Austin American Statesman; 26 March 1989. p.H6.

times more water per capita than do the Palestinians. Although total consumption in Gaza is relatively small, this disparity heightens the existing tensions in the region. Accusations have been levelled by the Jewish settlers and the Palestinians against each other, each side blaming the other for the water shortage. Israeli authorities point out that the Palestinians, prior to 1967, dug too many wells and practiced overpumping; overusing the limited supply. Palestinian irrigation methods are also faulted for being ineffective and wasteful. The Palestinians blame the shortage of water on the disproportionate use by the Jewish settlers, although there is strong evidence indicating that the shortage predates the Israeli occupation.

The water in the Gaza Strip is currently contaminated by seawater and chemicals, including pesticides and fertilizers. A recent Israeli state comptroller report indicated that "if a solution is not expedited...the problem will cause greater damage, and the financial investment required will be much greater than it will be today."[12]

It has been estimated that Gaza needs new sewage facilities which would cost about $16 million dollars. Israel has not shown any interest in shouldering the burden for this. However, Prime Minister Yitzhak Shamir's peace initiative calls for international financing of an effort to improve the quality of life for Palestinians in the territories. This would include new housing, and other types of infrastructure improvements such as new sewage facilities. Greater public awareness of the water shortage has led the government to create a new Ministry of the Environment to concentrate Israeli efforts. Public support for the creation of the ministry was strong; it won unanimous Knesset approval. The Ministry is the last Ministry to be established.

WEST BANK

The largest of the three aquifers utilized by Israel is located in an area that falls both within pre-1967 Israel and the West Bank. According to the West Bank Data Project, this supplies Israel with more than 25% of her water. The two aquifers located totally inside of Israel are "fully tapped and are being depleted."[13] Therefore the aquifer on the West Bank is of enormous strategic value. "If the Israelis were to lose control over the West Bank, their overpumped water infrastructure would be in serious jeopardy."[14]

Water rights between the Israeli settlers and Palestinians have been a serious cause of friction between

[12] Joyce R. Starr and Daniel Stoll., U.S. Foreign Policy on Water Resources in the Middle East. (The Center for Strategic and International Studies: 1987) 8.

[13] Andrew Alexander, "Water Wars/Crisis in the Middle East," The Atlanta Journal and Constitution, 19 March 1989,: A8.

[14] Joyce R. Starr and Kenneth P.Libre, "The Israeli Water Crisis," New Outlook, August 1988: 8.





the two. Israel has forbidden Palestinian residents from drilling wells beyond those which existed in 1967. "While it safeguards the minimal drawing rights of Arab residents, as determined by the 1976 Water Census, Israel does not permit the drawing of additional water to meet the needs of Arab agricultural development in the area."[15] Although everyone needs a license to dig new wells, in practice the Jewish settlements have had no similar restrictions placed on them. The West Bank Data Project estimates that by 1990, Jewish settlers in the West Bank will consume at least seven times more water per capita than the Palestinians living there. The Israeli water supply company, Mekorot, has been forthcoming to the needs of the Israeli settlements and has allowed them to exceed their quotas by up to 36%.[16] (In 1982 Mekorot was given control over the West Bank water system which had been under the jurisdiction of military authorities since 1967. Mekorot plans to integrate the West Bank system into the Israeli network.) With about 70,000 Jewish settlers and 1 million Palestinians (including the Palestinian population of East Jerusalem) living in the West Bank, the possibility for further tension over water resources increases. Israel provides water to Jewish settlers at a cost that is 75% less than that paid by the Paslestinians.[17] The World Zionist Organization provides funds to help pay for this subsidy.[18]

Palestinian economist Ibrahim Matar believes Israel is "stealing" Palestinian water, which in turn hampers agricultural production. Meron Benvenisti, Director of the West Bank Data Project, also believes the current ratios of water distribution are unbalanced. The reality of Israeli dependence on West Bank water is acknowledged by Israeli leaders. Any peace settlement will have to take this factor into account. According to Ruth Matson, a colleague of Professor Naff, "Israel cannot afford to give up the West Bank [in a peace accord] without some kind of an arrangement or agreement on water use."[19]

THE NEIGHBORING COUNTRIES

JORDAN

[15] Ze'ev Schiff, "Security for Peace: Israel's Minimal Security Requirements in Negotiations with the Palestinians," The Washington Institute Policy Papers, Washington D.C.: 1989, p.18, Volume 15.

[16] Joyce R. Starr and Kenneth P. Libre, "The Israeli Water Crisis," New Outlook, August 1988: 8.

[17] Andrew Alexander, "Water Wars/Crisis In The Middle East," The Atlanta Journal and Constitution, 19 March 1989,: A8.

[18] Joyce R. Starr, and Kenneth P. Libre, ibid. p.8.

[19] Andrew Alexander "Water Wars/Crisis In The Middle East," The Atlanta Journal and Constitution, 19 March 1989,: A8.

Jordan is already suffering from severe water shortages. Only 5.7% of the land in Jordan is cultivable, with water for these needs coming primarily from the Jordan-Yarmuk River system. With the Upper Jordan fully exploited, a serious situation has developed. In 1985, Prof. Naff placed Jordan's annual water needs at about 870 MCM. Approximately 46% of this is derived from the Jordan River with the remaining 54% coming from reclamation, rain catchment, underground and out-of-basin transfers. Jordan now uses more than 100% of the renewable supplies available. Jordan's population, growing at a rate of 3.6%/year (making it the 5th highest in the world) and her burdened economy forecast future woes. By the year 2000, demand might exceed supply by as much as 20%, with Jordan requiring a total of 1000 MCM annually, leaving an annual deficit of 170-200 MCM.

As a result of evaporation through canals and broken water mains, a tremendous amount of Jordan's water is wasted. Elias Salameh, a water expert at the University of Jordan, explained that in some areas, losses of 52% have been recorded.[20]

Because of significant fluctuations in rainfall in the area, "it is clear that a wide range of uncertainty exists over the volume of annual water flow in the Jordan Valley."[21] The Jordan Valley, the nation's agricultural center, has also experienced the highest level of water waste. M. Bani Hani, the Secretary General of the Jordan Valley Authority, has revealed that 60% of the annual water flow into the Jordan Valley for crop use is lost through overuse, evaporation, and cracks in the East Ghor canal system that deliver the water to the fields. Jordan's economic difficulties have made the prospect of replacing these canals, many built in the 1960's, with modern pressurized pipes, impossible at this time.[22] A World Bank report advised Jordan to stop agricultural expansion in the Jordan Valley as demand for water for industrial and municipal use grows. Stopping agricultural expansion would adversely affect the Jordanian economy which relies on agriculture for about 20% of the nation's export earnings. Failure to capture water arising through winter flooding of the Yarmuk River before it enters the Dead Sea is an example of water resource underutilization.

The centerpiece of Jordanian planning is the proposed "Unity Dam" on the Yarmuk River, where the Jordanian and Syrian borders meet. This long delayed project would provide electricity for Syria and water

[20] Andrew Alexander, "Looming Water Crisis Threatens Middle East," Austin American Statesman, 26 March 1989,: H6.

[21] David Wishart, "An Economic Approach to Understanding Jordan Valley Water Disputes," Middle East Review, Summer 1989: p.46.

[22] For details of the technical details of the project, see George E. Gruen, "Jordan's East Ghor Irrigation Project," New Outlook, 7 June 1964,: 34-37. The international dimensions are examined in George E. Gruen, Water and Politics in the Middle East, The American Jewish Committee: New York, December 1965. Efforts to extend the system are described in George E. Gruen, "Report from Amman," Present Tense, Vol. 7, No. 1 (Autumn 1979): 22-24.





(about 150 MCM per year) for Jordan. This water would be used in the Jordan Valley for agricultural, industrial and municipal purposes. As currently planned, the dam would have a storage capacity of about 220 MCM. The water from this dam would help complete the irrigation of the Gohar region of Jordan. According to the agreement reached between the two parties, Syria agreed to limit her development in the Yarmuk basin. The United States and the World Bank have stated that they are willing to provide funds to finance the project, but the funds' availability is contingent on a prior agreement on water allocation among Syria, Jordan, and Israel. With no agreement between all three riparian states in sight, the "Unity Dam" project appears, for at least the immediate future, a shelved project. Because of the economic difficulties, neither Jordan nor Syria have the money to undertake such a large project at this time without substantial outside funding.

## EGYPT

Egypt is solely dependent on the Nile River for her water needs. With her population increasing at the rate of one million every nine months, drastic measures will have to take place in order for the Nile to continue to meet the needs of the Egyptian people. While family planning has been advocated, it has met resistance from the Moslem religious establishment and Egypt's more traditional citizens. Some Western experts say that Egypt will need to increase her conservation efficiency by 60% over the next 11 years in order to accommodate a population expected to reach 70 million by the year 2000. Ossama el-Baz, Chief of Staff to President Hosni Mubarak, feels that his country's water needs can be met by lowering the population growth rate to 1.5% (this is a rate comparable to Western nations), recycling irrigation water, conservation, and expanding farmlands. Egypt has begun to look at drip irrigation methods, crop rotation and substiting less water consuming crops in an attempt to save water.

More than 90% of the Nile's waters originate in Ethiopia. Of the 9 African nations through which the Nile flows, many are politically unstable. Seven of the states have formed an organization, UNDUGU (a Swahili word meaning brotherhood), made up of water experts and government officials to deal with the water crisis. Kenya and Ethiopia are not yet full members. According to Boutros Boutros-Ghali, Egyptian Minister of State for Foreign Affairs, Egypt also considered constructing several nuclear fueled electricity and desalination plants on its Mediterranean coast. These plans were shelved as opposition grew in the wake of the nuclear disaster at Chernobyl.[23] The lack of public awareness and of financial resources (Nile Basin

[23] Conversation with the author, 25 September 1989, Washington, D.C. See also Boutros Boutros Ghali, Address: "Water Supply and Quality Problems Threatening Peace in Africa and other Areas of the World," (unpublished) 25 September 1989.

countries have an $80 billion debt), make it difficult to implement resource control and management programs. There have been persistent rumors that Ethiopia and the Soviet Union will attempt to build a dam across a tributary of the Nile. "Earlier this year, Egypt temporarily blocked a loan to Ethiopia from the African Development Bank supposed to finance a project that Cairo feared could consume too much Nile water."[24] These facts help create an uncertain future for Egypt's reliance on the Nile River.

According to a 1959 water agreement with the Sudan, Egypt is permitted to use about 55.5 billion cubic meters (BCM) of water annually from the Nile. Last year, she used nearly her entire quota. John Waterbury of Princeton University predicts that Egypt's need for water in 1990 will be 73 BCM. Egypt's annual water supply is about 68.9 BCM, increasing the likelihood that the country will experience a critical water shortage by the end of the century. Increases in pollution aggravate this potential shortage. Sewage occasionally backs up into homes in the impoverished areas of Cairo, leading some experts to believe that it is already seeping into the water supply.

## SYRIA

With the absence of any United States or international development projects currently going on in Syria, it is difficult to determine the actual shortage of water that Syria faces. It is estimated that Syria will face an annual shortage of about one BCM by the year 2000 if the current rate of consumption is maintained. The shortage of water in Syria demonstrates the severity of the regional crisis. It had long been thought that Syria had enough resources to meet her own needs. This shortage resulted from reduced flow of the Euphrates River, and water contamination from salt, fertilizers, and pesticides. Water rationing is taking place in certain parts of Syria as it is in other Middle Eastern countries.

The development of Turkey's Southwest Anatolia Development Project (Guneydogu Anadolu Projesi, or GAP) is causing further problems for Syria and Iraq. The project calls for the development of thirteen irrigation and hydroelectric works on the upper Tigris and Euphrates Rivers. While the project will benefit Turkey, some experts have concluded that once the Anatolia project is completed, the flow of the Euphrates into Iraq could be reduced by almost two-thirds. The current polluted state of the Euphrates River has forced many residents of Iraqi villages to import drinking water by truck.[25]

There is growing evidence that the relationship between Syria and Turkey is severely strained. In response to what Turkey views as Syrian support for Armenian terrorists and a growing Kurdish rebellion,

[24] Alan Cowell, "Now, A Little Steam. Later, Maybe, A Water War." The New York Times, 7 February 1990: p.3.

[25] Andrew Gowers, "Crying Out for Water in the Desert," Financial Times, 29 February 1988.





she has increasingly regulated the waters flowing into the Assad Dam of Syria, one of the nation's largest hydroelectric facilities. Due to a drought in Turkey, the flow of the Euphrates was sharply reduced, causing protracted power failures in many Syrian cities, and water cuts throughout the summer of 1989. In December 1989, the government of Turkey announced that the flow of the Euphrates would be stopped for a month, beginning January 13, 1990, to fill the Ataturk Dam. Turkey agreed to supply electricity and increase the flow of water prior to January 13. "Should both Turkey and Syria continue diverting the river's water at current rates,...the enormous existing flow into Iraq would be reduced by half. The effects will be devastating for Iraq and probably considered intolerable."[26] Western diplomats and Turkish officials believe Syria aids the Armenian separatist movements in part to gain leverage over Turkey with regard to the waters of the Tigris and Euphrates Rivers.

A "Trilateral Commission" has been established between Syria, Iraq, and Turkey to settle issues surrounding the Euphrates River. As of October 1989, the commission had not met in four years. Syria is demanding that Turkey double the flow of water flowing south to the Euphrates. Turkey has stated that even if it were to increase the flow to Syria there is no guarantee that Iraq would receive her share. In discussing the Tigris and Euphrates, the basic problem is not the lack of flow, but rather, lack of storage available.

An article in the June 8, 1983 issue of the Washington Post reported that Syria would only pull out of Lebanon if she were guaranteed access to the waters of the Orontes River, which arises in Lebanon's Beka'a Valley. The Orontes River is critical to Syrian irrigation and electric power. The Syrians stated that any peace agreement or condition for troop withdrawal from Lebanon would have to provide guarantees that Lebanese and/or Syrian troops would be able to respond to an Israeli attempt to capture the Orontes.[27] Since Israel has never claimed the Orontes, observers in Jerusalem dismiss the Syrian statement as just another excuse for Damascus to maintain a military presence in Lebanon.

## LEBANON

The Litani River of Lebanon also arises in the Beka'a Valley. The Orontes flows north toward Syria while the Litani River flows south toward the Israeli frontier, before flowing into the Mediterranean at El Qasimiye. Both of these rivers have been sources of controversy. An aquifer, which is fed by seepage of the Litani and Hasbani Rivers and by underground streams in the Mount Hermon Range, is another valuable water

[26] Richard Z. Chesnoff, "When Water Feeds Flames," U.S. News & World Report, 21 November 1988: 47-48.

[27] John K. Cooley, "Sryia Links Pullout to Guaranteed Access to Water," The Washington Post, 8 June 1983.

source. Rainfall in Lebanon is abundant, but the natural storage facilities are scarce. Almost all the rain falls between October and April, and for three months each year there is no rainfall.

Preceding the establishment of the state of Israel, there were Zionist claims that the Litani River should become part of the soon to be established Jewish State. Israel's desire to incorporate the Litani River into her water plans have been noted. In 1964, a debate erupted in the Knesset over who the responsible party was for losing the Litani River in the first Arab-Israeli war. In 1982 during Israel's attack on P.L.O. bases in southern Lebanon, Israeli officers seized all PLO documents, among them technical documents and hydraulic charts pertaining to the Litani. There have also been charges, although no proof has ever been provided, that Israel has been siphoning water from Lebanon to her northern settlements in the Galilee since her incursion into Lebanon in 1978.

More recently, Yuval Neeman publicly admitted that Israel has long been interested in the Litani River. Neeman confirmed that Israel had begun seismic sounding and surveys at Deir Mimas, a gorge on the Litani. While it can be claimed that the water of the Litani River has long been an Israeli aspiration "there is no evidence that the Israelis have done anything to procure water from the Lebanese territory that they now occupy."[28] In fact, Israel had to pump water from within her own borders to Southern Lebanon to help ease the harsh water shortages affecting certain villages. This was further confirmed by Professor John Kolars of the University of Michigan at the MESA conference in November 1989. Prof. Kolars reported that according to UN Peacekeeping sources, there has been no evidence of Israeli diversion of Hasbani waters southward. He also pointed out that Israel's claim of providing water in South Lebanon is quite credible since the beneficiaries of such water are staunch Israeli allies.

## TECHNICAL INNOVATIONS TO INCREASE SUPPLY

The desire to avoid conflict and solve the water shortage, has led many countries to seek technological innovations. Whether it be desalinating sea water, finding new supplies or conserving what limited supplies remain, Israel has been a leader in these new innovations.

The settled areas of the Middle East, being heavily populated, produce a great amount of sewage. The disposal of these materials creates great problems. As noted before, in certain impoverished areas in Cairo sewage has backed up into people's homes. Sewage recycling is widely utilized in Israel; by 1984, about

[28] Frederic C. Hof, Galilee Divided, The Israel Lebanon Frontier, (Boulder: Westview Press, 1985) 39.





75% of the urban sewage flow was being recycled for agriculture or other uses.[29] The United States has made $30 million dollars available to the Israeli government in order to aid in the development of sewage recycling plants. The major subproject, the Dan project of Tel Aviv and the neighboring suburbs, required these areas to develop central sewage systems and a program for waste water treatment. This program was to be completed by December 1988. The longstanding and innovative national policy of waste water recycling in Israel has resulted in a significant contribution to Israel's water resources. However, this will not be enough to solve her growing water shortages. Intensive but closely controlled mining of ground water is advocated by some as a method to help alleviate the water shortage in Israel. "Israel has reached a stage in which the total of utilized natural water exceeds significantly the limits of renewable yields. As a result, attempts are being made to control the mining of ground water that would prevent salt water encroachment. This is necessary in order to prevent this irreversible process from taking place."[30] As the salinity of Israel's aquifers increases, efforts will have to be made to prevent damage lest existing water supplies be effected.

Beginning in the 1986-87 growing season water allocations to agricultural entities were sharply cut. During 1985-86 moshavim (cooperative communities made up of small farms) consumed 500 MCM of water, between 1986-87 they consumed only 376 MCM. Kibbutzim (collective farms) endured harder cutbacks since they were only allowed to consume 389 MCM as compared to 617 MCM the season before. These cutbacks are the result of conservation efforts by the Israeli government. Some experts have raised the possibility that if Israel were to relocate some of her crops (growing them in regions with greater accessibility to water), 250 MCM of water per year would be saved. As a result of shortages, some farmers in the Galilee region have decided to grow flowers since they require less water than certain crops, such as cotton, and result in higher profits. Israel is also trying to develop crops that survive in brackish water.

Connecting the Mediterranean to the Dead Sea has been considered for decades. On August 24, 1980 the Israeli government authorized construction of this link claiming that it would be vital to Israel's energy needs in the future. The project was to rely on gravity, with water flowing from the Mediterranean Sea about 70 miles down to the Dead Sea, turning four hydroelectric turbines and generating 600 megawatts of electricity. The project was also considered the only way of preventing the Dead Sea's level from decreasing. Evaporation and the current diversion projects by both Israel and Jordan have lowered its level.

Installing meters and exacting payment for the amount of water people use is almost universal in Israel. Home consumption can also be further reduced by imposing strict standards on maximum levels

[29] Conversation the author had with Hillel Shuval.

[30] Lea Spector, "Mid-east Waters Of Controversy: Implications For The Arab-Israel Peace Process," (Foreign Affairs Department: American Jewish Committee, 1980) 2.

of water used in flushing the toilet, water flow regulators on showerheads etc. Such measures were enacted in New York and other parts of the United States in response to the drought of 1988. Many experts feel that Israel should reduce the amount of the water subsidy to farmers, requiring them to pay more and thus provide them an incentive to use less. Today, farmers pay only some 30-50% of the costs of water, encouraging its uneconomical use. Agriculture contributes approximately 7% to the GNP of Israel. The Israeli government will have to invoke increasingly strict water conservation for the benefit of the nation. This broader perspective was signaled by the decision recently to transfer authority over water from the Ministry of Agriculture to the Environmental Protection Agency.

The Middle East is home to over 60% of the world's desalination plants. Saudi Arabia accounts for 30.2% of the world total, Kuwait 11.5%, and the United Arab Emirates, 11%. Despite the reduction in costs, desalination plants are still an expensive alternative. Current estimates indicate $4 per 1000 gallons or $1/m3 to be the realistic cost of desalinated water today. However some experts feel they may be the only long-term answer to Israel's water shortage. Desalination would commit Israel to the heavy burden of acquiring additional sources of energy to power the desalination efforts. Unlike the oil kingdons of the Gulf, Israel cannot fuel the desalination plants with natural gas that is the free byproduct of oil.

Israel as of late, has also been considering importing sweet water from Turkey. The water would be transported to Israel on barges that contain huge plastic bags holding the water. The bags would float, as the water is lighter than salt water.[31] Although the project would cost millions, it is still less expensive than the current costs of desalination units.

## II. WATER: ITS HISTORICAL ROLE IN THE ARAB-ISRAELI DISPUTE

1939-1967

Since 1939 both the Yishuv (the Jewish Community) in the land of Israel and the Arab states have been devising methods to utilize the existing water supply. In the 1940's, the possibility of Zionist and Lebanese collaboration over the use of the Litani was gaining momentum. The Arab-Israeli war of 1948 destroyed any hopes of cooperation. "The Lebanese government, built as it was upon the flimsy basis of local and confessional interests, could ill-afford to provoke Arab Nationalists -- both within and outside of

[31] Hugh Orgel, "Israel Floats Idea of Towing Sweet Water from Turkey," Jewish Telegraph Agency, 18 October 1989.





Lebanon -- by striking a quick bargain with the new Jewish state."[32] During the war of 1948, Israeli soldiers occupied a strip of land adjoining the Litani. After the General Armistice Agreement was signed in 1949, the troops pulled back, believing that Lebanon would be willing to sign a peace agreement, but this never happened.

The failure to strike a deal with Lebanon over use of the Litani prompted Israel to search elsewhere for water that could help irrigate the arid Negev. In 1953, Israel planned to divert the waters of the Jordan north of Lake Tiberias and channel it to the Negev. The diversion point lay in the demilitarized zone created by the 1949 Israeli-Syrian General Armistice Agreement. Syria protested and Israel was forced to stop work on the project after the Eisenhower Administration threatened to suspend economic aid to Israel.

In October 1953, President Dwight D. Eisenhower appointed Eric Johnston, his special Ambassador to negotiate an arrangement between Israel and the Arabs over use of the region's water resources. Johnston's proposals, based mainly on the work of Charles T. Main Inc. (a Boston consulting firm), called for a series of dams to be built on the Banyas, Dan, and Hasbani Rivers in Syria, Israel, and Lebanon which would direct water to a canal providing water for Israel to farm the Galilee. The plan also called for the draining of the Huleh swamps (eventually carried out by Israel) and for a high dam to be built on the Yarmuk. Other projects were to be built to irrigate both sides of the Jordan Valley. The Johnston plan was geared to uphold a fundamental principle: "Water within one catchment area should not be diverted outside that area - regardless of political boundaries -until all needs of those within the catchment area are satisfied. Since it was already clear the nothing would deter Israel from sending Jordan River water as far as the Negev Desert, U.S. negotiators focused on other ways of meeting the needs of both Arabs and Israelis in the catchment areas of Galilee, Southern Lebanon, and Western Syria."[33]

Immediate objections were raised by the Israelis and the Arab states over the proposals offered by Johnston. The Arab states wanted a larger share of water for Syria and international supervision over the allocation of the water resources in the area. The Arab nations also suspected that the real reason for the mission was political, namely to get at least implicit Arab recognition of Israel.

Michael Baker Inc. and the Harza Company, two American engineering firms working for the Jordanian government, concluded in 1955 that for Jordan to store the Yarmuk River efficiently and economically, partial use of Lake Tiberias would be required. The Baker-Harza Plan estimated the amount of cultivable land in Jordan was 6,000 acres less than had been determined by the U.N.'s TVA plan, and determined that the water required for irrigation was less than thought previously.

Israel objected to the plan, demanding a larger allocation of the water, and rejecting any Arab control

[32] Frederic C. Hof, "Galilee Divided, The Israel Lebanon Frontier," Boulder: Westview, 1985: p30.

[33] John K. Cooley, "The War Over Water," Foreign Policy, Spring 1984, p.10.

over Israeli water supplies. In addition, Israel demanded that the Litani River be incorporated for Israel's use and that water from the Jordan River be diverted to the coastal region and the Negev.

An Israeli counterproposal, known as the Cotton Plan was developed with the aid of John S. Cotton, an American engineer, in February 1954. The Cotton Plan envisioned Israel utilizing the Yarmuk, Jordan, and Litani Rivers. Israel needed a total of 1070 MCM of water, about 40%-50% of the water available from the Jordan-Yarmuk River system (670 MCM), and half of the Litani River's supply (400 MCM). Under the Cotton Plan, the coastal plain of Israel, the Negev, most of Jordan, and certain parts of Lebanon and Syria would be irrigated. Israel proposed that the surplus of the Litani be diverted to compensate the Jordan Valley for the water loss that it incurred. The U.N. report, the Israeli and Arab plans, and the Baker-Harza Survey formed the basis of the negotiations among the riparian states.

By 1955, the major technical aspects of the Johnston Plan had been resolved. Israel agreed to surrender it's demand for the Litani River after Johnston explained that he could not provide justification for the inclusion of the Litani, it being a national river flowing entirely within Lebanon. In addition, Israel accepted less water than she had wanted. Originally demanding 550 MCM per year from the Jordan River, Israel agreed to accept the residual supply of the Jordan River (estimated at about 400 MCM per year), after Jordan and Syria had drawn their share. Israel's quantity was guaranteed by the storage capacity of Lake Tiberias, which was within Israeli territory. By agreeing to accept a lesser percentage of water than she had originally requested, Israel hoped to gain future political acceptance from the Arabs.

Under the terms of the plan, Jordan was to receive the greatest amount of water from the Jordan-Yarmuk River system. This amount was in agreement with the revised estimates of the Baker-Harza paper. Syria, Lebanon, and Jordan were to receive a total of 60% of the water from the Jordan River system, with Israel receiving the remaining 40%. Syria would also receive power generated from dams on the Yarmuk in accordance with an agreement signed with Jordan in 1953.

By October of 1955, the Unified Water plan devised by Johnston had been approved by the Israeli government and the Arab Technical Committee and was to be discussed by the Political Committee of the Arab League. It was reported that the Committee was discussing a plan that would exclude Israel. Soon after, the Political Committee announced that experts were being ordered to conduct research and study the plan further.

In reality, the plan was cancelled by the Syrians. Endorsing the plan would acknowledge the existence of Israel as a state as well as her right to share the water. On October 19, 1958 the New York Times Magazine reported from an earlier conversation with Johnston that "...Syria objected to the project because it would benefit Israel as well as the Arab countries. Three years have passed and no agreement has been reached on developing the Jordan. Every year a billion cubic meters of precious water still roll





down the ancient stream, wasted, to the Dead Sea."[34]

The Arab League's rejection of the Johnston Plan destroyed an opportunity for a regional water plan that would have benefitted all the riparian nations'. Of greater significance, the failure to accept the plan prevented the Israelis and the Arab states from entering into a dialogue and starting a process that could have enabled them to avoid future conflicts, notably that of 1967. Despite the official Arab rejection of the Johnston Plan, Israel and Jordan continue to use essentially the amounts of water allocated to them under the proposal.

In a speech to the United Nations on August 13, 1958, President Eisenhower stated that the two fundamental problems affecting the Middle East were water and displaced populations. To solve the water crisis, he called for the construction of three nuclear plants to supply electrical energy and desalinate water. Two of these plants were to be located on the Mediterranean coast of Israel, and a smaller one was to be built on the Gulf of Aqaba, either in Jordan or in Israel.

Eisenhower's plan, unfortunately, never came to fruition. It had several features that were advantageous to the riparian states. The plants, two of which were to be located on the Mediterranean coast of Israel, would not have raised questions of sovereignty. Because the plants were to produce more fresh water than the Jordan River system, future competition over the use of the river system might not have arisen. Interestingly, Eisenhower's proposal to build nuclear plants for desalination parallels current Israeli efforts to build desalination facilities on Israel's Mediterranean coast. Eisenhower also deemed necessary an additional nuclear plant for desalination in the Gulf of Aqaba, either in Jordan or Israel. Today Israel operates a desalination facility in Eilat, on the Gulf of Aqaba.

## WATER AS A CONTRIBUTING FACTOR IN THE 1967 CONFLICT

Although rarely mentioned, the conflict over water was a major reason for the 1967 Mideast War. Actions taken by nations during the late 1950's and early 1960's resulted in political disputes that culminated in war.

In 1958 while discussions were going on, the Jordanian government began unilaterally diverting the Yarmuk River for it's East Ghor Project. Upon partial completion in 1961, Jordan was diverting 140 MCM annually from the Yarmuk. In addition, Syria was diverting the northern sources of the Jordan River for her

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[34] George E. Gruen, Water and Politics in the Middle East, An Analysis of Arab, Israel, and International Efforts to Develop the Jordan River System, New York: American Jewish Committee, December 1964, No. 5: 10.

own use. Israel felt that the diversion was not necessary but that Syria was merely doing so to decrease the supply of water to Israel.

Mekorot was founded in 1937 by the Jewish community in Palestine with the aim of developing a nationwide integrated water system. Development of the system was accelerated in the 1950's when the Israelis realized the Johnston Plan had little chance of success. By the 1950's Mekorot became an affirmation of the Jewish state's permanence and to the Arabs a symbol of Israel's economic viability. The National Water Carrier, started in 1964, connected previously developed water supply systems that ran throughout Israel. The individual systems were "expanded and linked up, incorporating storage and operational reservoirs, as well as pumping stations, in order to operate the country's water resources in a fully controlled manner, with proper regulation of supply and distribution."[35]

The main phase of the National Water Carrier was the Jordan-Negev Project. According to the plan, Lake Tiberias (also known as Lake Kinneret) was to serve as Israel's major surface water storage facility during wet seasons, as well as a pumping site to channel water to the Negev. Periodically, there were Arab sabotage efforts and military attempts to disrupt Israel's National Water Carrier. In 1953 Syrian artillery units opened fire on Israeli engineering and construction sites near the town and lake of Tiberias which prevented the Israelis from locating the main pumping site in that area. The first attack by Yasser Arafat's Damascus based Fatah military branch was an attempt to sabotage Israel's National Water Carrier on December 31, 1964.

"Arabs made the decision to begin the diversion works at the Arab Summit conference in 1964, after Israel had begun to transfer water from the Sea of Galilee to the Negev via the National Carrier. It was that summit conference which also established the joint Arab military command and founded the PLO."[36] When Syrian work began on diverting the Banyas, the Israelis responded with air strikes in March and May of 1965, and July 1966. Egyptian President Gamal Abdul Nasser called another Arab summit meeting in Cairo, where he acknowledged the Arab nations were unprepared to go to war against the Israelis. The diversion project by Syria and the air attacks on the sites by the Israeli air forces, led to the escalation of tensions, which culminated in war. Egypt was criticized by Syria and Jordan for "hiding behind the skirts" of the United Nations Emergency Forces [UNEF]. In response and with the ostensible aim of deterring an Israeli invasion of Syria, Nasser in May 1967 expelled the UNEF, mobilized Egyptian forces in Sinai and threatened Israel. On June 5, Israel launched a preemptive strike against Egypt, and later responded to Jordanian hostilities in Jerusalem.

[35] Modechai Yakobovich, "Israel National Water Carrier, 50 Years of Mekorot," Mekorot Public Relations Company, Naidat Press Ltd. Sept 1987: 2.

[36] Ze'ev Schiff, "Security for Peace: Israel's Minimum Security Requirements in Negotiations with the Palestinians," The Washington Institute Policy Papers, Washington D.C. 1989. p. 21.





In 1980, the Med-Dead Canal project provoked disputes because it was planned to begin in Israeli-occupied Gaza. Critics from the Israeli left were displeased with the project starting in Gaza, believing that it would increase Israel's stranglehold on the area. Similar objections were raised by Arab nations. The Jordanians claimed that the proposed project could affect the Jordanian potash and tourism industries, and change the chemical nature of the Dead Sea. The project director, Yuval Neeman, stated that Israeli planners had concluded that the project would not have any adverse effect on Jordanian industries. In response to the Israeli plan, the Jordanians announced their own plans to bring water across Jordan from the Red Sea in the south. The cost of the Med-Dead Canal, as well as the larger economic problems facing Israel led to its cancellation.

In 1987 controversy developed over a proposed Israeli plan to drill for water near Bethlehem, in Herodion. The project, to be developed by Moriah Energy and Technology Company, drew criticism from the Reagan Administration and from within Israel itself. The project, designed to carry water to Jerusalem and to Jewish settlements in the region, drew a strong reaction from Bethlehem mayor Elias Freij. The plan was eventually approved by the Israeli cabinet on condition that priority would be given to Arab needs in the region.

## WATER AS A CATALYST FOR COOPERATION

Recent seminars, studies, and U.S.-initiated and supported projects have served to underscore the widespread concern about insufficient water supplies. Various proposals raised throughout the years show the potential for cooperation over water.

In 1979, President Anwar Sadat offered Israel the opportunity to purchase Nile Water to irrigate the Negev in the hopes that Israel would engage in autonomy talks with Egypt over the status of Jerusalem. The proposal was quickly withdrawn when it was severely criticized by some Egyptians who objected to selling the "holy water" to foreigners and when Menachem Begin refused to link the status of Jerusalem to water issues. Boutros Boutros Ghali, the Egyptian Minister of State for Foreign Affairs, said in Washington in September 1989, that the severe shortage Egypt faces in meeting its own needs precludes any water for Sinai in the foreseeable future.[37]

Nevertheless, modest cooperation between the two nations over a wide array of issues, including water, has developed. Grants from the U.S. Department of Agriculture's Office of International Cooperation to the Egyptian Ministry of Agriculture and to the Faculty of Agriculture at Hebrew University, have facilitated joint projects. Through joint research, progress has been made with waste water recycling and cropping

[37] Conversation with the author, Washington D.C., 25 September 1989.

systems. "Timing of sowing, fertilization, irrigation, and different plowing/cultivation treatments have been precisely specified for a number of major crops, especially when used in double cropping." These efforts provide a strong basis for cooperation, help to fortify the peace treaty, and create productive relations.[38]

Under optimum conditions -- a comprehensive and lasting peace settlement -- water use arrangements would be feasible both politically and technically. Below are several potential projects that could be developed according to Elisha Kally's "A Middle East Water Plan Under Peace" (1986).[39]

One proposal calls for joint Israeli-Jordanian exploitation of the Yarmuk River. Although the Yarmuk flows through a region fraught with water shortage, the majority of the river is not utilized because it flows during winter flooding, and adequate storage facilities are not available. This excess water can only be utilized if seasonal storage were provided. The study examines two possible ways to store the water: using the Sea of Galilee (Lake Kinneret) for storage or constructing a series of dams upstream along the Yarmuk. Although both proposals are politically difficult to undertake, damming the waters poses even greater political problems. Because the Yarmuk is an international boundary and its banks lie in several countries, damming the river could raise issues of sovereignty. The southwest bank lies in Jordan and its northwestern bank lies partly in Syria or in the Golan Heights under Israeli rule, and yet another part is in Israel within the green line. The cost of damming the Yarmuk has been estimated at $1.5 billion. This would raise the price of water to $2-3 per cubic meter/year, which makes this an uneconomical option unless foreign aid was provided to Jordan and Syria to build them.

Diverting the Yarmuk's water to Israel's Sea of Galilee would be more feasible both economically and technically. The study estimates it would cost about $21 million to construct the necessary facilities at the Sea of Galilee. Although the present storage capacity of the Sea of Galilee stands at 500 MCM, there are plans to increase the storage capacity to 750 MCM. The Sea of Galilee would be able to capture some 180 MCM of the Yarmuk's flow. After cost and quantity are determined, it is estimated that Jordan would receive 100 MCM. Israel would benefit from this plan as well. This would help Israel reduce the growing salinity of the Sea of Galilee. The study suggests that Israel might be able to utilize the excess winter waters flowing into the Sea of Galilee by pumping them to the aquifer in the central part of Israel. This source can serve as an alternative water source for the West Bank.

The proximity of water resources to Israel and Jordan invites cooperation between the two nations. As the study states, both countries cooperate in the exploitation of surface water only. Without

[38] Many U.S. government agencies are currently involved in Middle Eastern Water efforts. Consult "U.S Foreign Policy on Water Resources in the Middle East," by Joyce R. Starr and Daniel C. Stoll for a comprehensive guide to these activities.

[39] For a more in depth and detailed analysis of these projects consult Elisha Kally's "A Middle East Water Plan under Peace," The Armand Hammer Fund for Economic Cooperation in the Middle East: Tel Aviv University, March 1986. Dr. Kally was director of long range water planning for Israel until his retirement.





comprehensive coordination between the nations, both nations could damage other water resources. There are certain factors that make cooperation possible. Israeli and Jordanian officials are known to cooperate on certain matters. They have worked together against locusts, to prevent aerial collisions and most notably against terrorism. The Jordanians take strong measures to prevent terrorist groups from using their territory as a launching pad for attacks against Israel.

Cloud seeding, which Israel has been successful with in its northern region, could also be carried out jointly by both parties. The East Ghor Canal was originally envisioned to supply water to the West Bank. It is possible that the East Ghor Canal could be extended to supply water to people on the west side of the Jordan River. If certain settlements were to draw their water from the East Ghor instead of the riverbeds of the Yarmuk and Jordan, sweeter water would be supplied.

Kally's study details a cooperative scheme between Israel and Egypt based on the assumption that if the "surplus" of Nile were to be utilized, then most of the region's water problems could be resolved. If this assumption is true, this would be a major step towards lasting stability in the region.

The study assumes that at least in the near future Egypt will have abundant water resources during the winter months. The study predicts that agricultural, technological, and urban development will not absorb the current surpluses before new water resources become available. Improved irrigation methods are predicted to save an additional 10 BCM per year. Egypt, during the winter months releases extra water into the Mediterranean Sea. Water used to generate hydroelectric power and for navigation exceed her needs for irrigation. Since Egypt has already begun planning the diversion of Nile water to the Sinai for irrigation purposes, this diversion could be extended to Gaza. This would increase the amount of water available to the residents of the Gaza Strip and reduce the salinity of current supplies. Water purchased from Egypt by Israel could also be used to supply the Negev. This is more economical than supplying it with water from the Galilee. Israel might then supply the water from the Sea of Galilee, originally meant for the Negev to the West Bank or Jordan. Although these plans do not take into account any potential water shortage for Egypt, the projects outlined would utilize less than 1% of the Nile's water to supply Gaza, the West Bank and Israel.

The study goes on to say that the El-Salaam [Peace] canal, will have to be expanded to connect with the Egyptian-Sinai Canal. The carrying capacity would have to be increased for the water to reach other areas in the region. Starting at the Suez Canal, the new canal (Sinai Canal) would extend for about 220km, through Sinai. In its flat western region it would be divided into segments of 25km, in the steeper eastern region it would be divided into 5km segments with pumping stations in between each segment. If the project was to supply the Negev, the canal would have to reach Nir Yitzhak, southeast of the Gaza Strip, where an arm would extend to supply the Gaza Strip and perhaps another arm to supply the Negev. Water from the arms would be distributed through reservoirs to different localities. The price paid for the water would be contingent on the hauling ability of the Egyptian Sinai project and "on whether the investment in

its extension would be charged to it as a marginal or as a proportional user of the entire project."[40]

A "Middle East Water Plan Under Peace" reports that under conditions of peace, Israel and Lebanon could jointly generate electric power utilizing water resources flowing into Israel and/or by transferring Lebanese waters to Israel for use by Israel, the West Bank, or Jordan. To generate hydroelectric power, the Hasbani River provides the best possibilities. In this scenario a power facility would be located in Israel to exploit the full potential of the River's flow. The waters of the Hasbani River would be stored in Lebanon. Although the project is technically feasible, it would produce little energy; about 40 million kwh, according to the study.

A more significant area of cooperation involves diverting the lower Litani to the Sea of Galilee to produce additional electric power, but may result in diminished water in Lebanon. As of now the lower Litani has extra water but this might change as the demand for water in Lebanon grows.

To divert the Litani to the Sea of Galilee a tunnel would have to be built. This tunnel, which would direct the flow of the Litani to the Hisbani or the Ayun Rivers, could be built at several locations. It would cost about $40 million to pay for a reservoir, a penstock, a tunnel, and a power station which would generate 23 million kwh per year. It is estimated that about 60 million kwh would be produced at the Almagor station in Israel. The amount of energy produced by the power stations would more than pay for the building costs.

The West Bank and the Gaza Strip differ from other areas in the Middle East because both of these regions are dependent, although to a different extent, on outside sources for water. The Nile River would be the best choice of extra water for the Gaza Strip, while the West Bank needs could best be met by using the Yarmuk and Litani Rivers. Both diversion schemes would utilize the Sea of Galilee as the site of imported waters. In both plans the water would have to travel through Israel's National Water Carrier.

The areas of the West Bank that are cultivated lie in the areas of higher elevation. It is more expensive to supply water in higher elevated areas than to those in lower areas because the water sources are located in the low areas of the West Bank. A decision might have to be made between supplying water to low areas and the political pressure to supply water to areas of higher elevation.

Two complementary systems could be used to supply the western part of the West Bank with water. The first system would carry water from Israel's National Water Carrier to areas requiring water in the east. The other system would insert water into aquifers within Israel itself, in exchange for water to be pumped from local wells in the West Bank. The eastern part of the West Bank would receive water from a separate system that would begin at the Sea of Galilee and head southward. This system would supply the Jordan Valley and then transfer the water westward to supply the eastern slopes in the central mountain range of

[40] Elisha Kally, "A Middle East Water Plan Under Peace," (Tel Aviv: The Armand Hammer Fund for Economic Cooperation in the Middle East, Tel Aviv University, 1986) 27.





the West Bank.

Money would be needed to pay for extracting the water from its source and distributing it where designated. If this plan were enacted then the cost of water per cubic meter would be lower. The cost of water is derived from the cost of energy required, the cost of operating and maintaining the facility, and the capital costs. The study assumes the rate of interest charged will be 5%. Citing the current cost of capital the study claims that this rate would represent a subsidization of the project. The low cost attached to the "West Bank option" is due to the short distance the water would have to travel from the Sea of Galilee to the Jordan Valley. This is in contrast to the higher cost that would result from supplying water to the upper elevated areas of the West Bank.

In order for the programs developed to succeed, a regional agreement on the distribution of water would have to be reached. Israel would have to agree that this water could pass through her territory. This obviously would only be possible under conditions of peace. Under the schemes proposed, the West Bank and Gaza Strip would be dependent on outside sources for their water. Egypt and Israel might be in a position to dissociate themselves from the territories without incurring too great an economic loss. But Egypt's stated commitment to the Palestinian cause precludes this from happening. If Israel were to disassociate itself from the plan and not allow the water to travel through Israeli territory, this would be viewed as a hostile act. The same considerations apply to Jordan. The development of a genuine water arrangement for the West Bank and the Gaza Strip could either serve as a concrete element in an already established peace or help create momentum for the Middle Eastern nations to seek peace. These reasons are enough to make the plan outlined in the study worthy of consideration.

Turkey's "Peace Pipeline" could also serve as a catalyst for peace in the Middle East. As now envisioned, the pipeline could carry 6 million cubic meters of water daily to the West Bank, Syria, Iraq, Jordan and the Saudi and Gulf State deserts. The plan would rely on an underground network of pipes, each pipe 13 feet long, and would use the waters of the Ceyhan and Seyhan Rivers in Turkey. The project is estimated to cost about $20 billion. Due to current political tensions in the area it is unlikely that this proposal will reach fruition in the foreseeable future.

## CONCLUSION

Although the issue of water resources has rarely been at the forefront of public discussion on the Middle East conflict, it is clearly as important as the issue of land itself. In the past, the search for a continuing supply of water has dominated the actions of the riparian nations. There have been many attempts at a regional solution that would have undoubtedly led to peace; none of these have come to

fruition, although some nations use these agreements as a basis for their present consumption. The issue of water rights has also been one of the underlying causes in the region's many wars, and will continue to be so, as the situation grows more grave.

Each country faces a shortage. The techniques that they have utilized to save or replenish existing supplies has worked in various degrees. But these measures have only served to provide a little breathing room, they have not solved the problem. If the countries are to avert a crisis, then cooperation must be the course of action, not conflict. We have seen, in the past, the destructive role water has played in various military confrontations, most notably the 1967 War. Had the countries entered into negotiations and ratified the Johnston Plan, the War of 1967 might not have taken place and there probably would not be the crisis we speak of today.

The nations of the Middle East have their fates bound into one, their common need for water. If, as in the past, reasonable and equitable arrangements are blocked by selfish political actions, then conflict will be the rule rather than the exception. Working together, the riparian states can marshall the means necessary to solve this crisis. But as we have seen in the past, unilateral solutions have brought only temporary relief. If a longterm solution is to be found, the nations of the Middle East will have to work together. Water then, will truly be a catalyst for peace.





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One Hundred First Congress

# Congress of the United States

## Committee on Foreign Affairs

House of Representatives

Washington, DC 20515

June 20, 1990

Professor John Kolars
Department of Geography
University of Michigan
Ann Arbor, Michigan 48104

Dear Professor Kolars:

I am writing to confirm an invitation to appear at a public hearing of the House Foreign Affairs Committee, Subcommittee on Europe and the Middle East, on June 26, 1990 at 9:00 a.m. in room 2200 of the Rayburn House Office Building. The subject of the hearing will be Middle East water issues in the 1990's.

The Subcommittee would be particularly interested in your assessment and projections of the water shortages in the Middle East, potential international disputes related to water distribution problems, and how the water issue will affect the political and economic situation in the region in the coming years. The Subcommittee would especially welcome your analysis of the problems related to waters of the Nile, Jordan, and Euphrates rivers.

Other witnesses will include Professor John Waterbury of Princeton University and Professor Thomas Naff of the University of Pennsylvania.

Your participation in this hearing will add an important dimension to the testimony. Your written statement will be made part of the record of the hearing and the Subcommittee would ask that you limit your opening remarks to 5-7 minutes in order to maximize time for questioning. The hearing is likely to terminate around 11:00 a.m. because of a planned Joint Session.

Given our budgetary constraints, we very much hope that your institution can provide the cost of your travel.

I look forward to meeting you and your participation in this hearing next week.

With best wishes,

Sincerely,

[redacted]

Lee H. Hamilton
Chairman
Subcommittee on Europe and
the Middle East