

The Agenda for the Next 20 Years

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INTRODUCTION

At this symposium we have heard much about the historical and current trends in water use in the Arab World. It has been emphasized that the water situation in many of the countries and regions is very constrained already. It is so constrained that one has the impression that many water professionals and government officials would rather not think about the future when water use will be even further constrained. The future use of water must be directly faced, however, if any sensible policies are to be adopted in the present. Hence, from the perspective of this paper the future is relevant to the degree that it conditions present choices.

In order to be relevant for today's choice how much of the future do we need to consider? Five years, ten years, twenty years, or more? The nature of the investments in water infrastructure give us some idea of the length of time before investments made today will need to be replaced. For large structures like dams and reservoirs, 50 years seems appropriate, for treatment plants and components of the urban distribution and wastewater systems, and for irrigation systems, 20 years may be more appropriate. For the purpose of this paper we have chosen an intermediate time horizon of thirty-two years which brings us up to the year 2025. Thirty-two years is a very long time into the future and the reliability of forecasts will be consequently not very high. Recall that 1961 was only thirty two years ago and since that time the world has undergone several major convulsions; the war in Vietnam, two wars in the Middle East, the oil price hikes, the rapid economic growth in Europe and in the Asian rim countries and Japan, discovery of human impacts upon the ozone layer and the global "greenhouse" heat balance, unprecedented growth of the world's population, and the breakup of the Soviet Union just to name a few. All this happened within that relatively short time period. Some of these developments have had major impacts upon water and the aquatic environment, for example, the widespread use of washing machines and flush toilets in residences and the rapid development of water-consuming service industries. Will the next 32 years see major political and economic changes? Almost certainly so.

For instance, the oil price raises changed the terms of trade between the developed countries and the oil exporting countries, particularly those in the Arab world, leading to huge increases in the demands for middle class amenities in many Arab countries. These amenities were accompanied by large increases in the water demanded first for domestic use and later agricultural and industrial water purposes.

There are 20 countries in the Arab World stretching from Mauritania on the Atlantic to Oman on the Indian Ocean. Apart from language, culture, and religion, the countries all share one important physical characteristic: they all are very arid. Within the region there are, of course, wide divergences between the individual countries, but nevertheless the absolute water availability is restricted in each country. Morocco, Lebanon, and parts of Algeria are relatively well watered and Libya, Egypt, and Saudi Arabia are very poorly served. Figure 1 (Gischler, 1979) shows the location of the countries, the location of international rivers, the Nubian sandstone aquifer, and the major surface and groundwater recharge zones. Figure 2 (Gischler, 1979) is a rainfall map of the region showing that almost 90% of the region receives an average annual rainfall of less than 250 mm. Below this level of rainfall, irrigation is needed to ensure most agricultural production.

Another distinguishing feature of this arid region is that there are a substantial number of international river basins and aquifers shared by at least two riparians. Several river basins have 3 riparians, and the Nile is shared by 9 countries. Table 1 (Gischler, 1979) lists 24 international rivers in the region (not including the Jordan).

Of the 20 countries in the region seven are quite small and 4 are quite large. In terms of land area (Figure 3), Algeria and the Sudan top the list followed by Saudi Arabia and Libya. Mauritania and Egypt are substantially smaller and they are followed by Somalia, Yemen, Morocco, and Iraq. When arable land is considered (Figure 4), Sudan leads followed by Morocco, Algeria, and Iraq. Syria and Tunisia both have more arable land than Egypt.

A determining feature of resource utilization in the Arab World is the rapid rates of population growth which are being experienced in all of the countries. Since 1965 the total population of the 20 countries has risen from 108 million to more than 220 million by 1990. Figure 5 shows the distribution of the population and how it has changed from 1965 to 1989 for each of the 20 countries. The countries with the largest populations are Egypt, Morocco, Algeria, and the Sudan. Population by itself is not necessarily a determining factor, but rather the density of population on the resource base is what helps define scarcity. In terms of raw population density Bahrain (Figure 6) is by far the most densely settled. Much further behind are Lebanon and Kuwait. However, in terms of population density on arable land (Figure 7) the situation changes and Egypt places second behind Bahrain with a density of almost 20 person per hectare of arable land. Compare this to 1.3 for the United States and one can immediately understand the potential food crises of a country like Egypt particularly when faced with continued rapid population growth.

Population growth by itself does not lead to increasing per capita rates of water use. It just leads to increased total water use. Increasing incomes which influence tastes and preferences determine whether the rate of growth of water use will exceed the population growth rate or not. Along with population size and density, the degree of urbanization is an important indicator of increasing water use. Figure 8 shows that urbanization has occurred rapidly in all the countries between 1960 and 1991.

Figure 9 indicates a fairly high level of access to safe drinking water for urban populations. The rural populations are, however, much worse off with less than half of them having access to potable water in many countries. Figure 10 shows water withdrawn for all uses in terms of annual volume per capita. Iraq is by far the heaviest water user followed by Egypt, the Sudan, and Yemen. Figure 11 gives a breakdown of the water withdrawals by sector. In all of the large water using countries, agriculture uses by far the largest amounts of water; well over 90% goes to agriculture in Egypt, Iraq, the Sudan, and Morocco.

## SUPPLY OPTIONS

In the Arab world, as in other parts of the world, there are two major ways of meeting the demand for water; conventional supply options, and supplying water by conserving its use. Under conventional supply options we typically consider; direct use of rainwater and its capture in cisterns and

tanks, surface water diversions from rivers and lakes, abstraction of groundwater from shallow and deep aquifers, and desalination of brackish water or seawater. In addition to these sources, water may also be saved by various unconventional methods. This is not new water but it is just as useful at meeting demands as water from the more conventional sources. The conservation sources of water typically encompass; recycling of municipal and industrial wastewater, recycling of agricultural drainage water, increasing yields of watersheds or aquifers by management of the watersheds, reduction of urban water system leakages, demand reduction by pricing or other rationing methods, use of water saving devices, process change within industry, and change to water-saving crops in irrigated agriculture. Not all of these options are available in every case, but many studies of water supply focus exclusively upon the so-called "conventional" supply options, and the perspective should definitely be enlarged to take into account these possibilities.

In considering supply options, engineering practice, economic theory, and plain common sense suggest that the least expensive options be exercised first, followed by the next least expensive, and so forth, until the planned demand can be met. Consider a hypothetical example of a municipality planning to expand its water supply capacity by 4 million  $m^3$  per day. While the following data are hypothetical they are typical of the magnitudes that water planners would be faced with in several different Arab countries. The city water planners might be faced with the following potential supplies; an amount of 1.0 million  $m^3$ /day of surface water may be developed for about \$0.10 per  $m^3$ , an amount of 0.5 million  $m^3$ /day of shallow groundwater for \$0.17 per  $m^3$ , an amount of 1.0 million  $m^3$ /day of deep groundwater for about \$0.50 per  $m^3$ , up to 1.0 million  $m^3$ /day of water can be imported by tanker for about \$0.60 per  $m^3$  and the same amount by pipeline for \$0.80 per  $m^3$ , an amount of 1.0 million  $m^3$ /day of brackish water may be desalinated by electrodialysis or reverse osmosis for about \$1.0 per  $m^3$ , and an unlimited amount of water could be supplied by desalination of sea water by multistage flash distillation or multiple effect distillation for about \$2.0 per  $m^3$ . It is now possible to derive from this information a supply schedule for meeting the future demand. Table 2a reports these hypothetical data and Figure 12 shows the implied supply schedule.

The same logic hold for the case of non-conventional supply options based upon all forms of conservation. Imagine that it is possible to reduce non-beneficial evaporation and seepage losses in agriculture by an amount of 1.0 million  $m^3$ /day at a cost of \$0.05 per  $m^3$ , to recycle 0.5 million  $m^3$ /day of water in industry at a cost of \$0.13 per  $m^3$ , to eliminate 0.2 million  $m^3$ /day of urban unaccounted-for water at a cost of \$0.15 per  $m^3$ , to recycle 2 million  $m^3$ /day of urban wastewater at a cost of \$0.70 per  $m^3$ , and to reduce urban demands by 0.1 million  $m^3$ /day by demand management techniques at a cost of \$0.90 per  $m^3$ . Table 2b gives the possible ranges of conservation options and their costs per unit. If these are incorporated with the conventional supply options then the new supply schedule for the potential investment would look like Figure 13.

Figures 12 and 13 demonstrate vividly how the supply options are radically expanded simply by thinking about the problem in a wider context. For example, the water planner now has a much wider range of alternatives available for consideration, and following a rational strategy based upon developing the least expensive water first, would now be able to meet a 4 million  $m^3$ /day expansion of the system by using a combination of traditional supplies and conservation. In this case expensive importation of water by both tanker and pipeline can be avoided. If the water planner had a demand curve for water

demand by urban consumers it would be possible to overlay it on the supply curve and identify where the curves intersected; this intersection point (quantity and price) would determine the economically efficient level at which to supply water. Unfortunately, it is very difficult to estimate econometrically demand curves for urban water supply in situations where water prices have been administered and where they have not varied much over time or space. Few such curves have been estimated for the United States (Gomez, 1987, reports several for Latin American cities), and the general results show price elasticities in the range of -0.3 to -0.7, with average prices of about \$0.40 per m<sup>3</sup>.

Even though demand curves are not available for the Arab countries, Al-Awadi and Abdulrazzak (1993) and Jellali and Jebali (1993) report typical tariffs in various countries. Table 3 shows how these tariffs compare with typical U.S. prices. It is interesting to note how they cluster around typical U.S. prices for urban water supplies. The table is particularly instructive in showing how far away the typical tariffs are from the real costs of desalination \$1.5 to \$2.0 per m<sup>3</sup>. Moreover, the table shows clearly the problems of irrigating crops in these arid regions. At \$0.40 per m<sup>3</sup> the equivalent irrigation costs are \$491 per acre-ft or \$4,000 per hectare-meter. It is hard to imagine being able to afford the cost of this input for most field crops when U.S. farmers are finding it hard to survive with irrigation water costing less \$36 per acre-ft. The cost of providing incremental water supply, which by the logic examined above is always more expensive than what the existing water supplies cost, makes it difficult to imagine any expansion of irrigation water supplies in this region. This is the basis of the restrictive assumptions made about diversions of water to agriculture in the next section.

#### THE FUTURE WATER DEMANDS

The demand for water is not something set by arbitrary notions of "need" but it is set by a complex interaction of economic and social forces. Several writers (e.g., Falkenmark, 1989, and Postel, 1992) see "water crises" of varying magnitudes around the world, and particularly within the Arab World. A water resource base of one thousand cubic meters available per capita per year is supposed to represent some sort of "water barrier" below which nations and regions will become increasingly susceptible to all sorts of economic and social pathologies. The economic data from the 20 countries in the Arab world seems to contradict these dismal predictions. In Figure 14 the data for GNP per capita are plotted against the total amount of potential water resource per capita in each of the 20 countries. This is a surprising graph. First, only Iraq, Mauritania, Lebanon, Syria, Somalia, Morocco, and Egypt have potential water resources in excess of the "water barrier," the remainder of the countries lie more or less below 500 cubic meters per capita per year. The 13 countries below the "water barrier," however, lie along an extremely wide range of per capita incomes ranging from less than \$500 (Sudan) to more than \$18,000 per capita (United Arab Emirates). Moreover, those three countries (Iraq, Egypt, and the Sudan) which have the most water resources on a per capita basis all lie within the low income end of the spectrum. Clearly water alone does not account for the difference between these levels of economic performance. Another liquid mineral, oil, seems to account much more for economic performance than water. Even when the oil-rich states are eliminated, as in Figure 15, the water availability seems to account for little of the differences between per capita income in the different countries.

In order to predict comparative water demands for the region ideally one would have access to reliable forecasts of population size and composition and economic growth parameters for each country. In the absence of such information it may still be possible to arrive at rough estimates of the probable course of demand over the next 27 years if one is willing to make some simplifying assumptions. In the following we have been willing to make these assumptions for the sake of identifying potential conflicts in water use and to stimulate a discussion of this approach to establishing country-wide and regional water policies.

For the purposes of this exercise the following assumptions are made:

1. From 1990 onwards the future growth of GNP in each country returns to the rates obtaining prior to 1973. (In many of the countries the GNP has actually been declining in the past few years.) The situation in 1990 is projected forward at these rates until 2025.
2. The population in each country is predicted to increase at the rates given in the UN (1990) predictions.
3. Two cases are considered for irrigated agriculture. In the first, and probably the most realistic, no additional water will be made available for agriculture. All increases in production will have to come from improved efficiency within the agricultural system itself. In the second case water supply to agriculture is assumed to grow at a rate of 3% per annum.
4. After 1990 the rural populations in all the countries are assumed to remain at the 1990 levels with all increases in population resulting in increased urbanization. This fits well with the first case in 3 above when irrigation expansion is restricted to improving the efficiency of existing water supplies, but given the large amounts of underemployment in the rural areas it also fits the second case as well.
5. In projecting water demands for the urban domestic sector two cases were considered. First, assume that domestic water demand grows from 1990 at the rate of urbanization. Second, assume that it grows from 1990 as a function of both the population and the income growth; or in other words, at the rate of urbanization plus the rate of per capita income times an income elasticity of 0.5.
6. The industrial sector water demand is assumed to grow at the rate of growth of GNP.
7. Assume no major attempts to ration industrial and urban demand by various demand management techniques. (These could be factored in later if it turns out that the demands exceed the resource base by the end of the period.)

Table 4 summarizes the results under three variants; the first, Case I, as suggested above assuming that the urban demand is not responsive to changes in income, the second, Case II, with an assumed income elasticity of demand of 0.5, and the third, Case III, assuming an income effect and that the irrigation water supply is increased at a rate of 3% per annum. Table 4 indicates that out of a total water resource availability of 281 km<sup>3</sup> per year for the entire Arab World, by 1990, 167 km<sup>3</sup> per year was already being diverted for use. This refers to withdrawals not consumption so some of this water can be used a few times within the year, however, given the fact that the bulk of the water is withdrawn for irrigated agriculture a large percentage of this (as high as 70%) will be lost to evaporation. So already in 1990, 60% of the total water is being withdrawn in any year. This compares with a figure of 19% for the United States.

A surprising conclusion that can be drawn from the demand forecasting model is that, for Cases I and II which prohibit any additional water to agriculture, the overall demand will rise only about 40 km<sup>3</sup> per year to between 200 and 215 km<sup>3</sup> per year by the year 2025; leading to about a 75% use of the total available resource. If, however, irrigation water supply is allowed to grow at 3% per annum the total demand jumps to 486 km<sup>3</sup> per year by 2025; almost twice the available resource base. This case seems to be out of the question given the resource base and the costs of alternative supply options. However, most countries in the region are planning to increase the amount of water going to irrigation in the future. Analyses of the type provide by forecasting models like this one should cause them to reconsider the level of commitment to providing new irrigation. To an outside observer Case III does not look like a productive avenue for water policy in an arid country.

The implications become much more interesting when individual countries are considered. Even though the total resource base is not exceeded in the first two cases, some countries do already, and more will in the future, exceed their own water resource bases. When these individual shortfalls are added-up the total regional shortfall increases from 13 km<sup>3</sup> per year in 1990 to between 33 and 43 km<sup>3</sup> per year by 2025. Table 4 shows that several countries are already using considerably more than their current annually renewable water supply (Bahrain, Kuwait, Libya, Qatar, Saudi Arabia, and UAE which had a combined deficit of 13 km<sup>3</sup> per year in 1990 which is met by overexploiting the groundwater and desalination) and these countries will be even more severely impacted in the future. Even without additional water to agriculture our model predicts that Egypt, Oman, and the Sudan will join the deficit nations by 2025. We also reach the conclusion that, while there would be a small and uncomfortable surplus for the region as a whole in 2025, there will be a total shortfall of between 33 and 53 km<sup>3</sup> per year summed over the individual deficit countries. Unfortunately, these shortfalls cannot be easily solved by transporting water between the individual countries; some such transfers are potentially possible, but most are not because of the long distances between the water surplus and water short areas. They are also unlikely to be solved by reallocating water use in international river basins. The deficits will have to be met pretty much as the deficits in the 6 countries which already have deficits by a combination of mining groundwater, desalination, and water conservation. One important form of conservation may indeed be the reallocation of water away from agriculture; actually reducing the quantities below the 1990 levels.

One simple test of how reasonable the demand forecasting model is would be to examine the projections for urban water use. Table 5 gives the forecasts of the urban water use in 2025 under the scenarios of cases I and II given above. Given the assumptions of the model there is no difference

between the per capita use in 1990 and 2025 in the case where the income elasticity is assumed to be zero: people keep on using the same per capita amount only the population size increases leading to increased total water demands but no per capita increase. This does not seem to be a reasonable assumption since we know that in most parts of the world as per capita, or per family, income increases there is an increase in water demanded. Whether it is as much as that indicated by our model with an assumed income elasticity of 0.5 is a question. Careful examination of Table 5 raises several questions. First, looking at the 1990 per capita urban water use for Oman (349 gpcd) and UAE (299 gpcd) the question of the reliability of the data arises. The 1990 per capita use in California is about 200 gpcd and we believe it unlikely that these two countries would be so much larger than that figure. When these figures are projected, along with those of Qatar, unreasonably large demands are forecast. Nevertheless, these are all micro-states and the predicted total quantities are small in comparison to the other demands in the table and can essentially be ignored. By and large, the urban per capita demands predicted by our model (the last column in Table 5) seem plausible with the exception of Djibouti and Somalia both of which seem to have much too small amounts of per capita urban demand. This may reflect suppressed demand conditioned by the present supply. We believe that the urban and industrial demands will lie somewhere between the results of Cases I and II. Case III does not look like a reasonable scenario. It does serve the purpose, however, of bracketing the potential upper limits of the demands.

Despite the crudity of the present model and the temporal and spatial uncertainties inherent in the raw data and any projections based upon them, we conclude that the demand forecasting model provides plausible predictions and, therefore, can serve as a useful point of departure for a discussion of policy implications.

## IMPLICATIONS FOR POLICY

### *Is There a Water Crisis in the Arab World?*

To many observers it may seem strange to pose this question. To them the answer is resoundingly affirmative. The data marshalled in this paper, and in other papers in the Symposium, however, raise serious questions about what is meant by a "water crisis" in the Arab World. A water crisis would imply a severe shortage of water for all reasonable uses leading to serious economic and social disruptions. A comparison with the "oil crisis" of the 1970s and early 1980s might help explain some of the important concepts involved. Even though oil is a nonrenewable resource and water is a generally a renewable resource, the similarities of the two so-called crises are instructive.

First, as water is essential to life, so is energy essential to life in many parts of the world (for example, in Massachusetts one would simply freeze to death without adequate heating).

Second, as with water in the Arab World, many people and industries were committed to using a particular form of energy and its attendant technologies for their livelihood.

Third, the price of the resource to the consumers was kept artificially low by governments via price controls in the consuming countries.

Fourth, it was deemed morally reprehensible and politically impossible to ration the resource use by raising the price for such a fundamental life-sustaining resource.

Fifth, there was as much talk about "energy independence," as there is of "food self-sufficiency" in the Arab World.

The major objection often voiced about this comparison is that there is no substitute for water for sustaining life. While this is true, there is however, an almost infinite supply of seawater which could be desalinated to produce fresh water, at a price and provided there was enough energy available. Hence, the limit may not be fresh water, but energy, or capital to build the energy systems. The resolution of the "energy crisis" has many lessons for the water policymakers in the Arab World.

The single most important factor in the resolution the "energy crisis" was the willingness of governments in the consuming countries to let the price of oil rise fairly rapidly. As a result of these price increases there were major adjustments by the consumers in terms of improved energy efficiency and substitution of other fuels. No western governments fell because of rapid rise in energy prices, the concept of "energy independence" was fairly quickly abandoned by all except the U.S. with its strategic oil reserve, and the transition from a low energy-cost to a high energy-cost regime was relatively painless. On the supply side the existence of higher prices made exploration for, and development of, more expensive reserves economically attractive. This in turn expanded the resource base. Finally, as a result of the lessons learned dealing with the oil price shock the world is now better prepared to deal with similar rapid adjustments in other commodity markets.

The analogy to water in the Arab World should be fairly clear. Table 3, for example holds one of the keys. If the tariffs charged in the different Arab countries reflected the real costs of providing the water and the opportunity costs associated with potential uses of that water elsewhere in the system then in many situations irrigating field crops, such as rice and wheat, would no longer be profitable and large quantities of water would become available for other uses. New irrigation would be restricted to higher value crops such as fruit and vegetables. This does not imply that the countries would move out of agriculture all together or even partially. Table 4 demonstrates this. Typically there is an order of magnitude in the differences of the quantities of water demanded by cities and industries and agriculture. In most countries, a reduction of 10% of the water currently going to agriculture would meet the increasing demands of cities and industries by the year 2025. In the worst case, Egypt, maybe as much as 25% would have to be diverted from current agricultural water supplies if there were no other unused sources of water.

Higher prices will lead to an expansion of the resource base to include more expensive supply options. Hence, adequate water can be supplied to all economically appropriate users. This is the opposite of a "crisis" situation, therefore one is tempted to say that the "water crisis" like the oil crisis is a passing phenomenon. The problem seems to be one of misallocation rather than absolute shortage. One should not assume that the transitions involved are going to be painless. They will, however, be less

painful than carrying forward into the next century massive sectoral misallocations of water. The recent history of the eastern nations reveals the shortsightedness of such policies. With careful planning the worst impacts of the reallocation of water upon economically disadvantaged groups can be mitigated. There is no reason that basic "lifeline services" for the poor are incompatible with a major rationalization of the water sector.

#### *Has a Shortage of Water Been a Serious Drawback to Development in the Region?*

Despite many predictions about water being a limit on economic development the data from the Arab World plotted in Figures 13 and 14 seem to provide no corroboration of these gloomy predictions. On the contrary those countries with the largest per capita water potentials seem to be on the lower end of the economic ladder and those with virtually no potential water resource (apart from desalination) are at the top of the ladder. It is also instructive to compare these countries to other non-Arab but better-watered African and Middle Eastern countries. The comparison reveals, if it reveals anything at all, that the Arab countries are doing better economically than the much better watered sub-Saharan African countries, about the same as Pakistan and worse than Turkey and Iran.

A more important question to ask is "Will a shortage of water be a drawback to the future development of the Arab countries?" The answer to this is less equivocal; under the pattern of economic development currently happening in the Third World the Arab countries will be left behind if they do not improve the infrastructure for industrial development. One important part of this infrastructure is the provision of adequate supplies of high quality water. Unless the policies regarding water allocation are not changed then the Arab countries are likely to be severely impacted by water shortages in the future.

#### *How Important is Resolving Disputes Over International Rivers and Aquifers?*

As mentioned earlier there are at least 25 international rivers (see Table 1) and several shared aquifers. While Figure 1 indicates the international rivers and major aquifers, it does not include the many smaller aquifers bordering on Saudi Arabia and Jordan, on the borders of Syria, Iraq, Iran, and Turkey, and between Jordan and Israel. All internationally shared rivers have potential for water disputes and those rivers in the Arab World are no exceptions to this general rule. Conflicts over the use of the Jordan and the Tigris-Euphrates waters have tended to obscure real and developing conflicts for the resources in the other basins such as the Nile and the Juba and the groundwater impacts being felt on the Nubian aquifer.

Resolving disputes over water on international rivers is not only a complex problem in international law and diplomacy, but as Rogers (1993) points out there are also major problems associated with the applications of the developing legal principles and common economic and engineering approaches to these problems.

Looking at the magnitudes of the present and predicted future water deficits and the nature of the conflicts on the international rivers and aquifers, one is forced to conclude that while expeditious resolution of the conflicts will be a wise and useful thing to do, it will make little dent in reducing the current deficits and deficits of the magnitudes predicted by our model. For example, resolution of

international disputes in the Nile basin can hardly increase the amounts available to Egypt and the Sudan and might actually reduce the amounts. Similarly, resolving the Tigris-Euphrates disputes would impact Iraq and Syria which are both predicted to be not severely impacted by Cases I and II in our demand forecasting model. For all of the other water disputes, while they involve amounts of water significant to the conflicted parties, they do not involve amounts of water significantly large enough to resolve the deficits.

#### AGENDA FOR THE NEXT 20 YEARS

The water agenda for the countries in the Arab World for the next 20 years should include the following areas of concern.

##### *Studies and Investigations*

###### Agriculture

The first area concerns the use of water for agriculture. Agricultural water use is by far the largest water use in the Arab World and is therefore the one which should merit the closest examination. Given the asymmetry in the quantities of water consumed small percentage savings in agricultural water use could lead to very large amounts of water becoming available to the other sectors. Two areas which are most widely suggested are improvement of irrigation efficiency and the shifting to less water consuming crops. Large savings are usually promised for activities in these two areas. Seckler (1993) and Abu-Zeid and Seckler (1992), however, raise some questions as to whether these savings are actually realizable. Using Egyptian data Seckler argues that for systems in which there is irrigation drainage-water capture, either by surface drains or by tubewells, the actual level of irrigation efficiency must consider all of the water that is recycled by the drainage capture works. He claims that for the Egyptian system the realized irrigation potential is substantially higher than what is expected when only the field efficiencies are considered. Secondly, he marshalls evidence that shows little can be saved by crop switching. Most of the water saved by the supposedly water-saving crops depends either upon growth in a cooler season, or the fact that the new crops are in the field less time than the traditional so-called high-water using crops.

Hence, there is a great need to carry out the detailed agronomic and agro-economic studies to elucidate for the individual countries in the region just how much water might be saved by these approaches. The issue is so important that the need is to look at real field situations and not rely upon conceptual or desk studies.

###### Municipal and Industrial Water Use

The issue of urban and industrial water use is also very important since the bulk of the water saved from agriculture will go to urban supply. Detailed studies need to be made to compare and contrast conventional and unconventional supply methods as shown in Figures 12 and 13. As part of the conventional supply the issue of desalination needs to be handled carefully. Table 3 indicates that

desalination as it is currently envisaged is probably too expensive to be considered as an alternate to most other types of water supply over the next few decades. Nevertheless, additional work needs to be done on site-specific cases to elucidate the real costs of desalination as an option. Conservation of water for urban and industrial uses appears to be much more economically attractive than desalination. The issue of concern here is to establish precisely how much water could be supplied by various levels of effort on conservation both within the urban system and also in the local watershed and aquifer environments.

##### Hydrological and Geophysical Explorations

Detailed geophysical investigations need to be carried out to establish the sources and amounts of recharge to the fractured rock zones. This will entail substantial work on the ground and with geographical information systems involving remote sensing and ground truthing. There is a wealth of geographical data from the petroleum industry that needs to be reviewed from a geohydrological point of view.

##### Economic Evaluation of the Benefits of Cooperation on International Rivers and Aquifers

The detailed analysis of international river basins with an eye to identifying Pareto efficient solutions is also strongly recommended. As mentioned above there is great merit in arriving at a good political and economically efficient solutions for their own sake. These are very good confidence builders for further economic and social interactions.

##### *Institutional Development*

###### Intersectoral Water Agencies

Institutions dealing with water need to be strengthened in each country. Of paramount importance is to establish genuine intersectoral water agencies. In most countries the control of water is fragmented between various agencies. Rarely does one ministry have responsibility for all aspects of ground and surface water and water supply and wastewater disposal. A first prerequisite for truly multidisciplinary studies is the existence of institutions that will help foster and support such activities.

###### Agricultural Water User Institutions

Another set of institutions that tend to be neglected are the farmers user-groups or irrigation cooperatives. These should be in the non-governmental sector so that they can provide a counterweight to the government department's own technical agencies. They should be flexible enough to arrange for water sharing within and between years and water transfers between different user groups.

###### Regional and Bilateral Institutions

There is room for a series of international or bilateral regional water agencies in the Arab world. The existence of such agencies will legitimize the need for broad-scale thinking by water professionals.

They would also provide the fora for exchange of technical and economic approaches to solving the problems of the region. In addition they provide the venues in which water problems would receive some political prominence.

#### Developing Private Sector Institutions

Finally, the role of the private sector should be much more widely promoted than is currently the case. Several countries are now experimenting with various forms of private participation in water planning, management, and control. A lot of flexibility and improved economic efficiency can be achieved with the appropriate mix of public and private agencies. This may require changes in the legal, political, and banking systems.

#### Specific Actions

##### Water Pricing

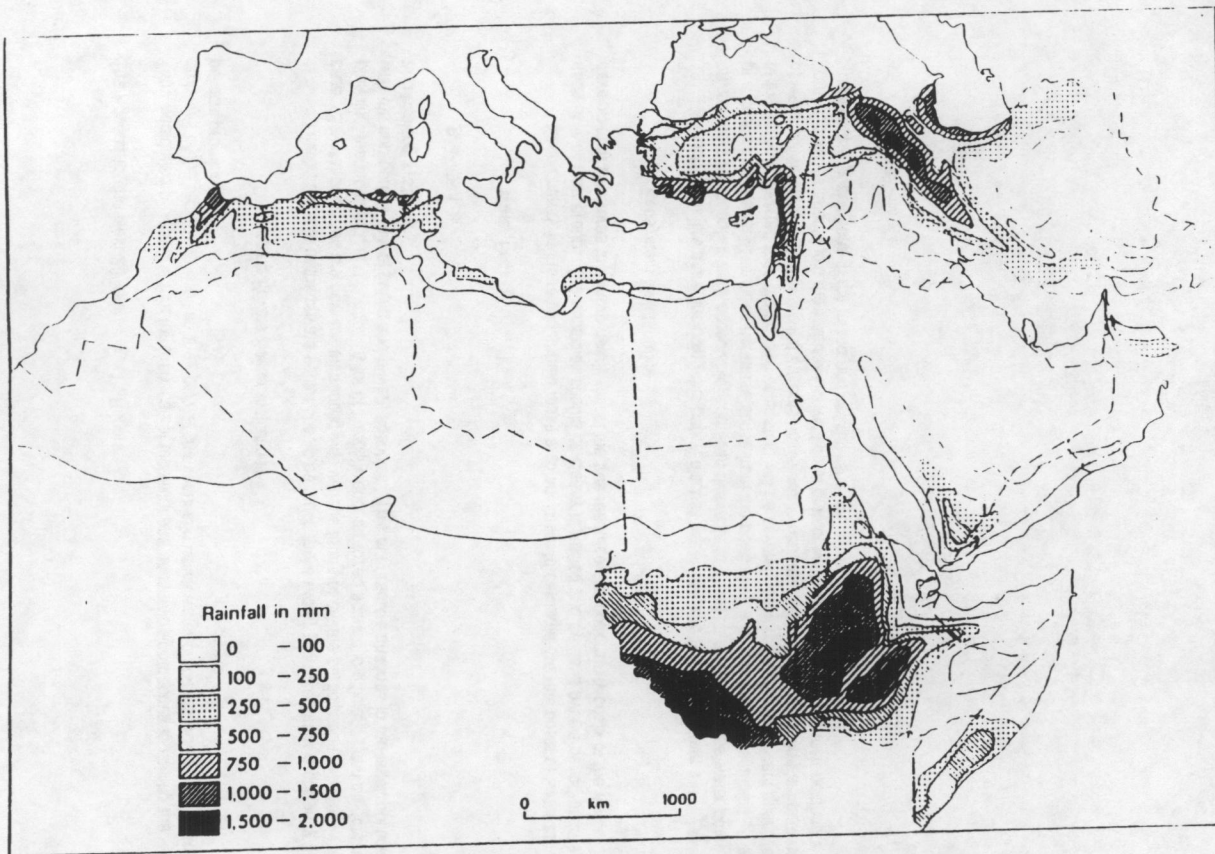
Each country in the region should make a commitment to calculate the real costs of water to each user or user group. The subsidies should be clearly identified and be used over a period of time to develop tariff structures that more nearly reflect the true resource and opportunity costs of the water.

##### Ecosystem Maintenance

Much of the literature, including this paper, discuss water use and abstraction from the environment as though it were acceptable, and even desirable to divert up to 100% of the water potential of a country or region. This does not make sense from the point of view of the environment itself. If all of the water is diverted then the aquatic ecosystem will be severely compromised. Significant quantities of water will need to be left in flowing streams, lakes, reservoirs, and wetlands to maintain the fauna and flora. Countries should join the Ramsar Convention to protect wetlands and work with their neighbors to maintain fish populations in the inland and coastal fisheries.

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Rainfall in the Middle East and North Africa

Figure 2

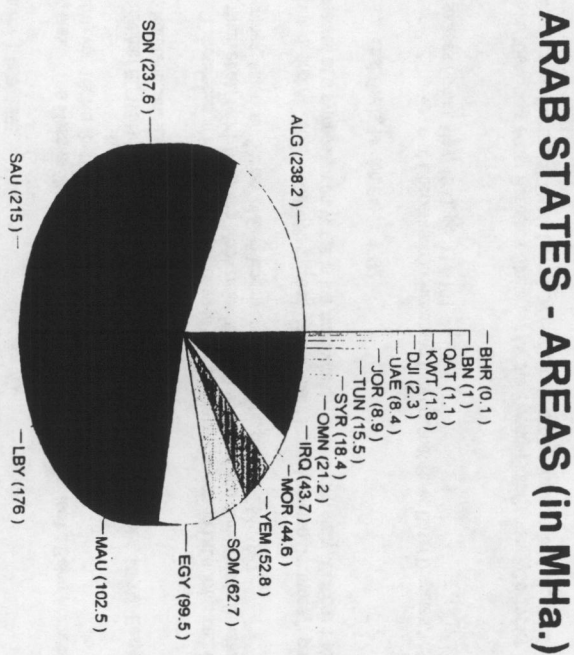


Figure 3



# ARABLE AREA (in MHa.)

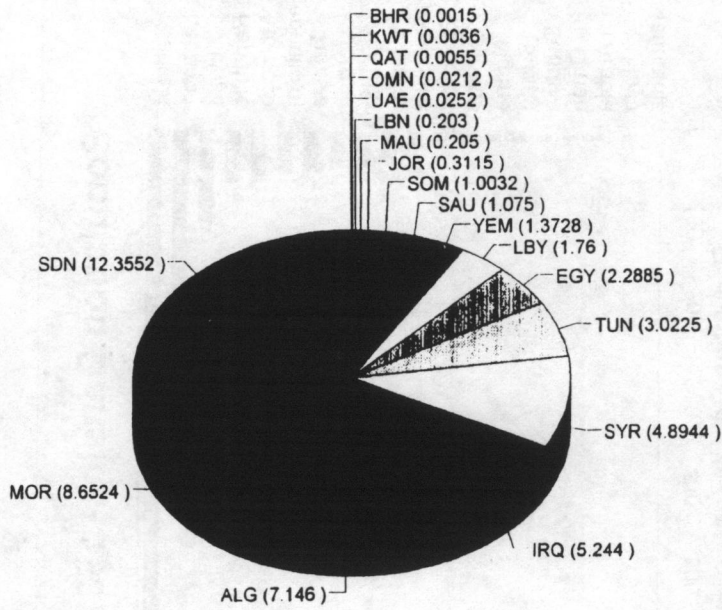


Figure 4

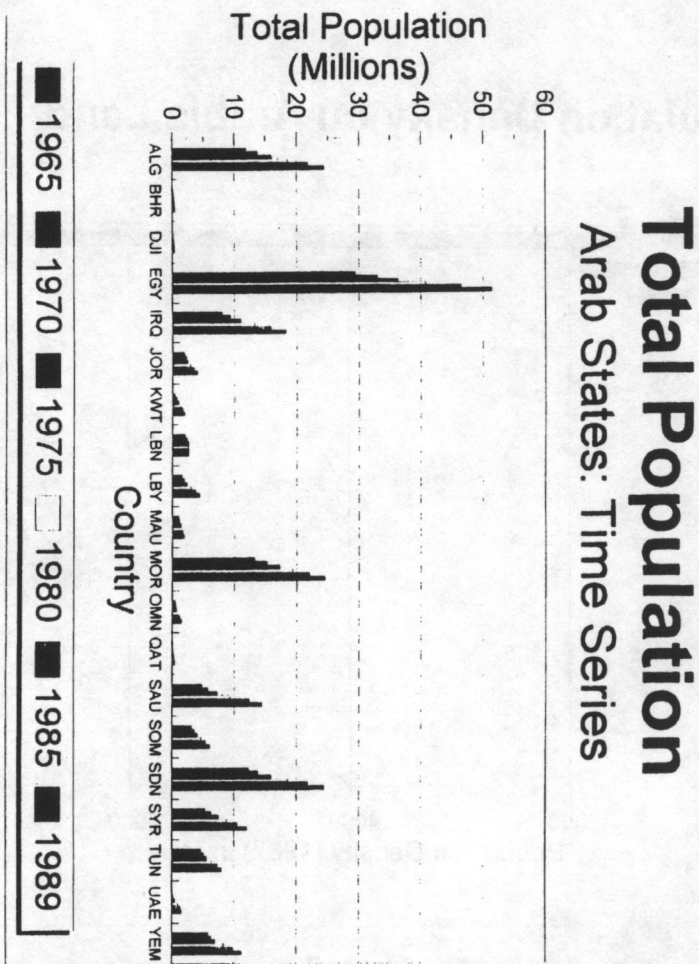


Figure 5

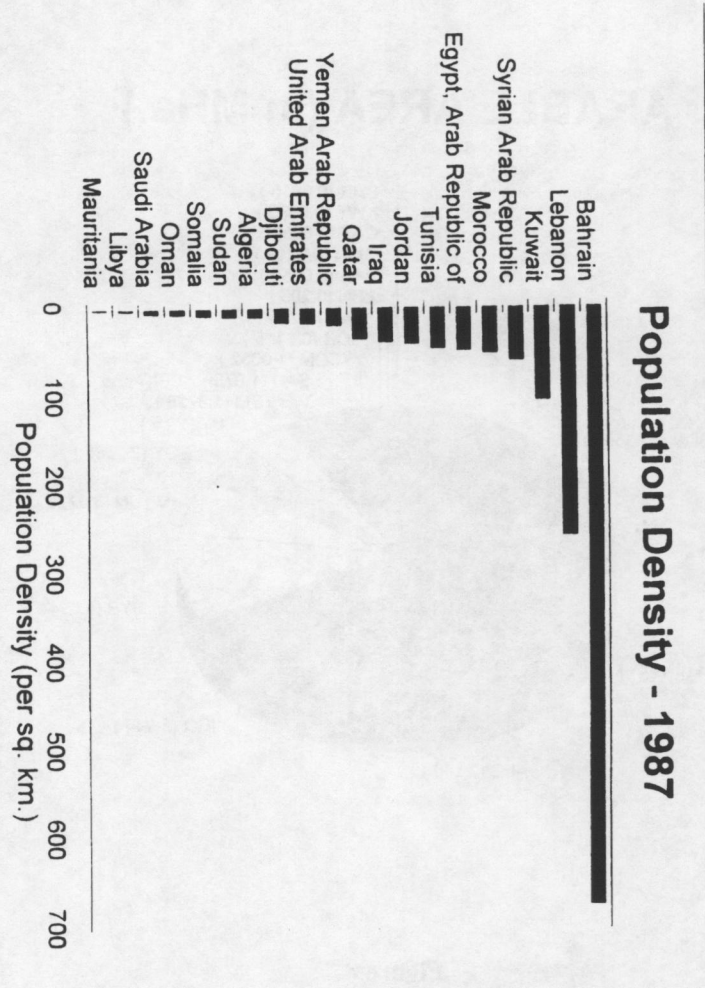


Figure 6

### Population Density on Arable Land

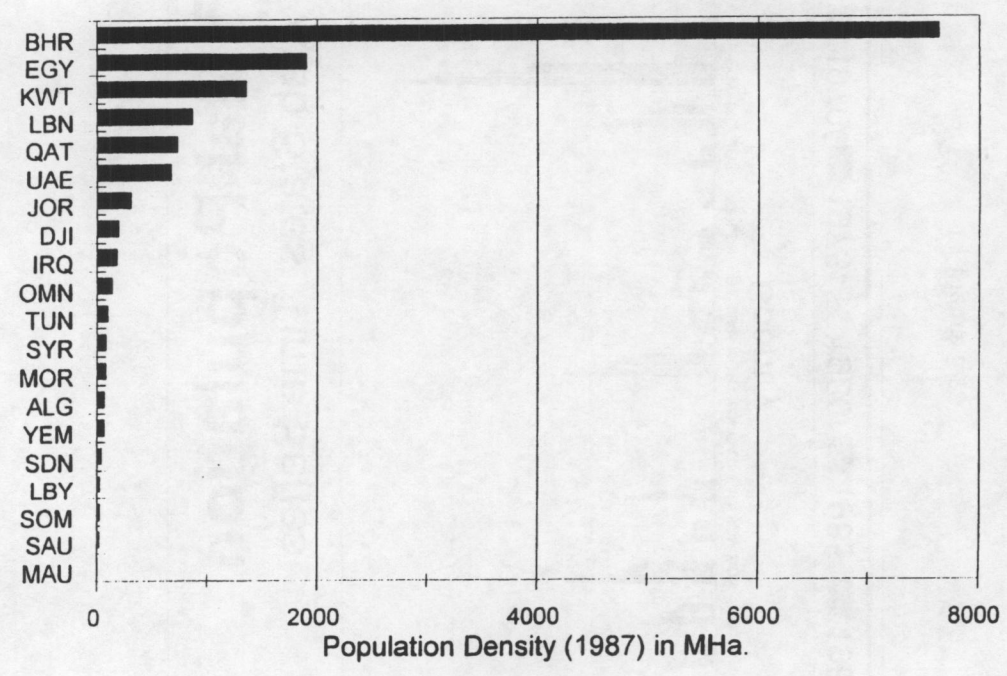


Figure 7

### ARAB STATES - % URBANIZATION

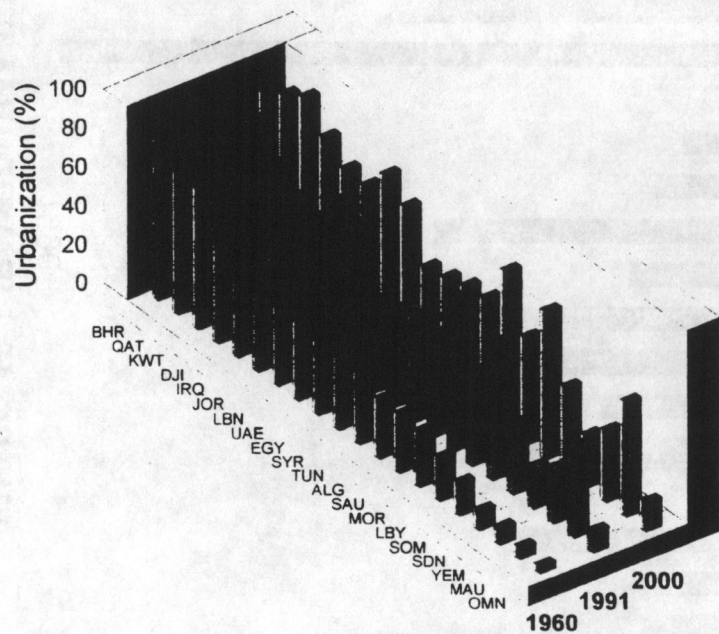


Figure 8

Urbanization in Arab States: 1960 to 2000

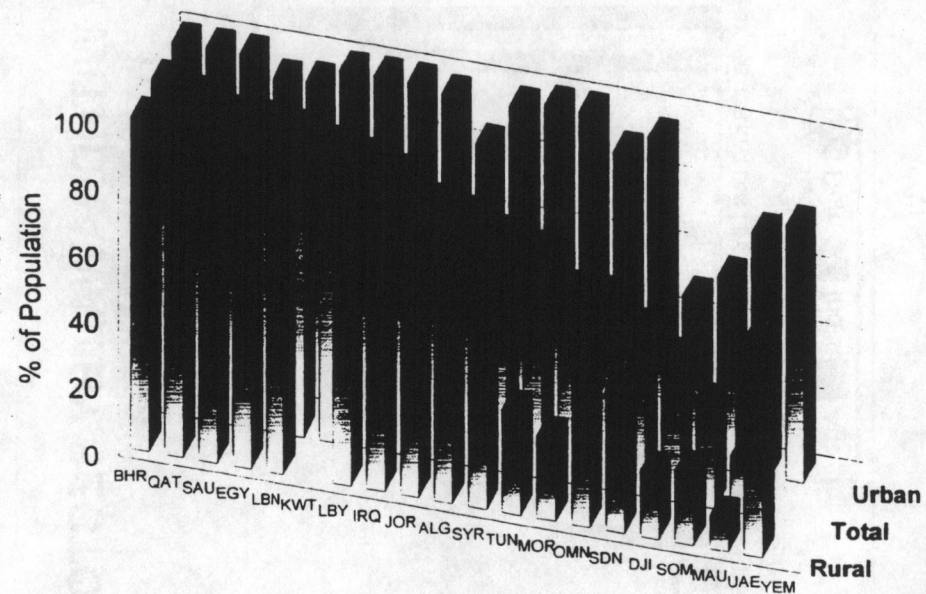


Figure 9

Access to Safe Drinking Water

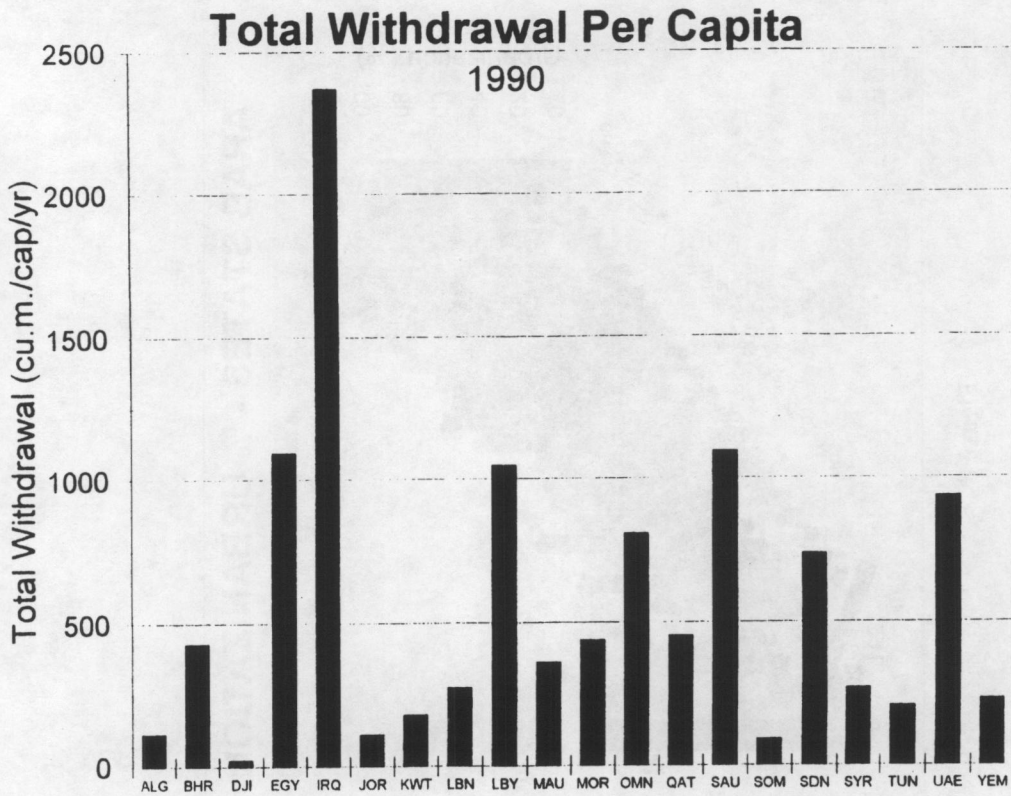


Figure 10

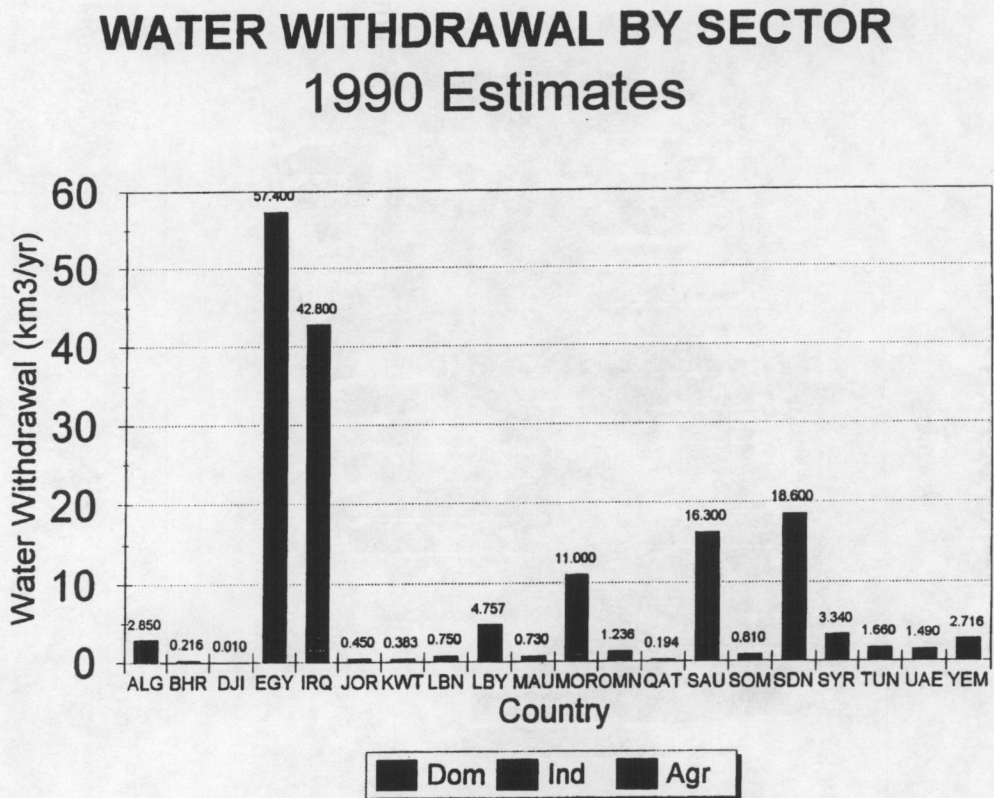


Figure 11

### CONVENTIONAL SUPPLY CURVE

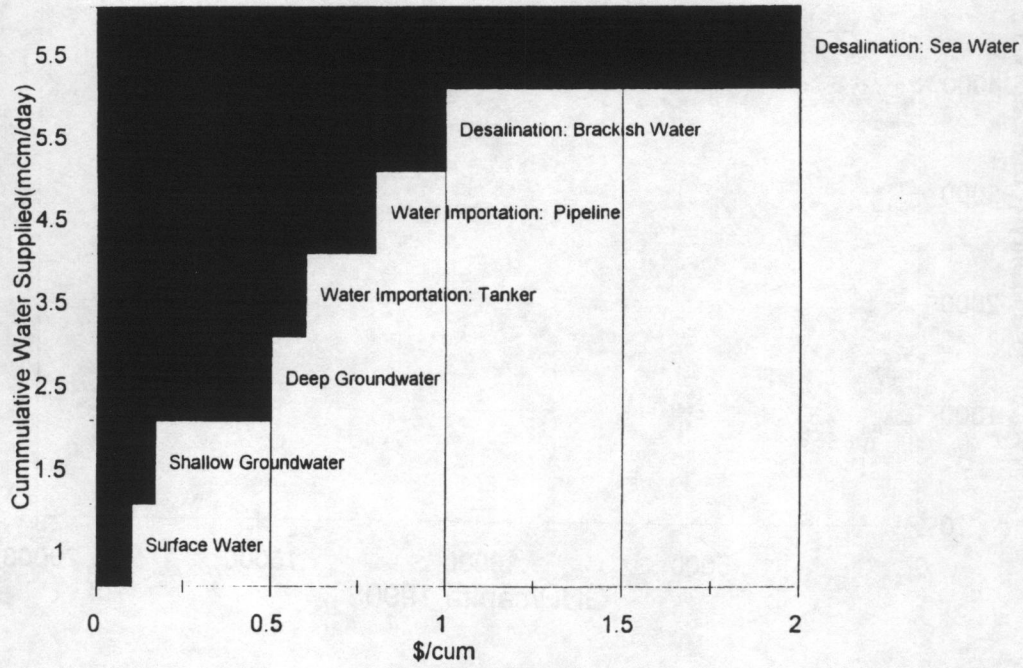


Figure 12

### UNCONVENTIONAL SUPPLY CURVE

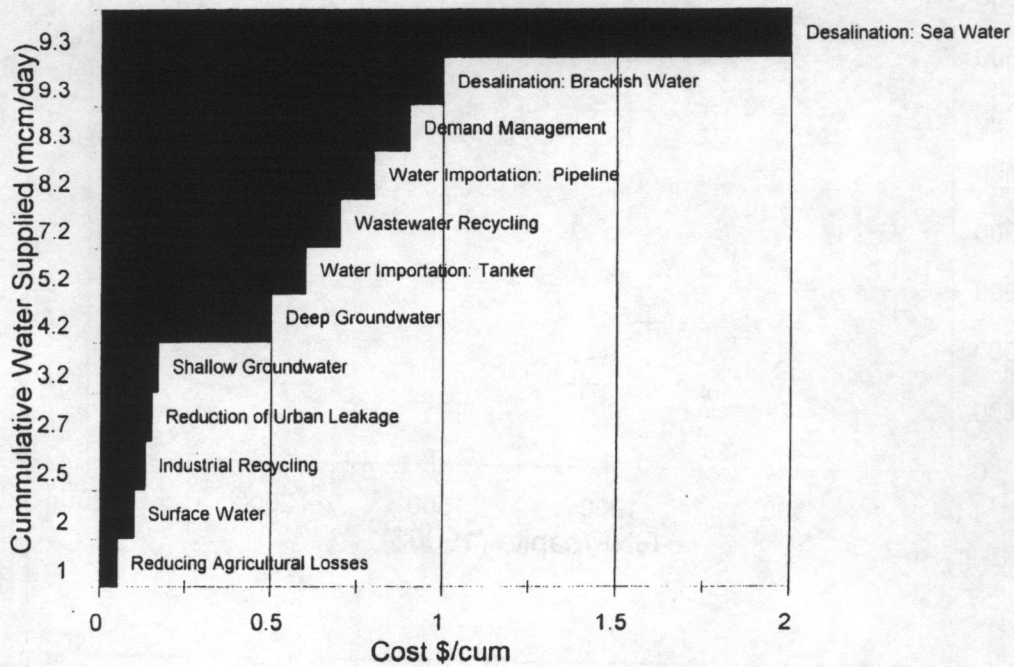


Figure 13

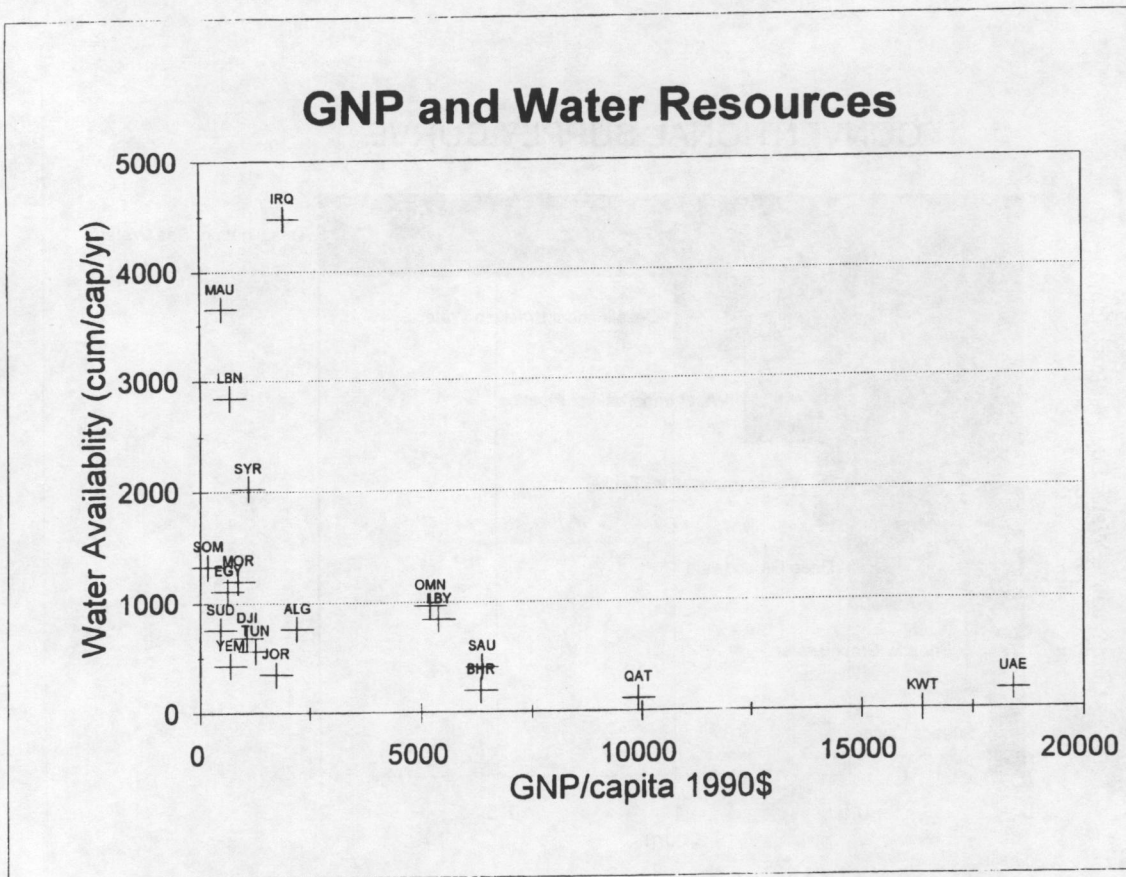


Figure 14

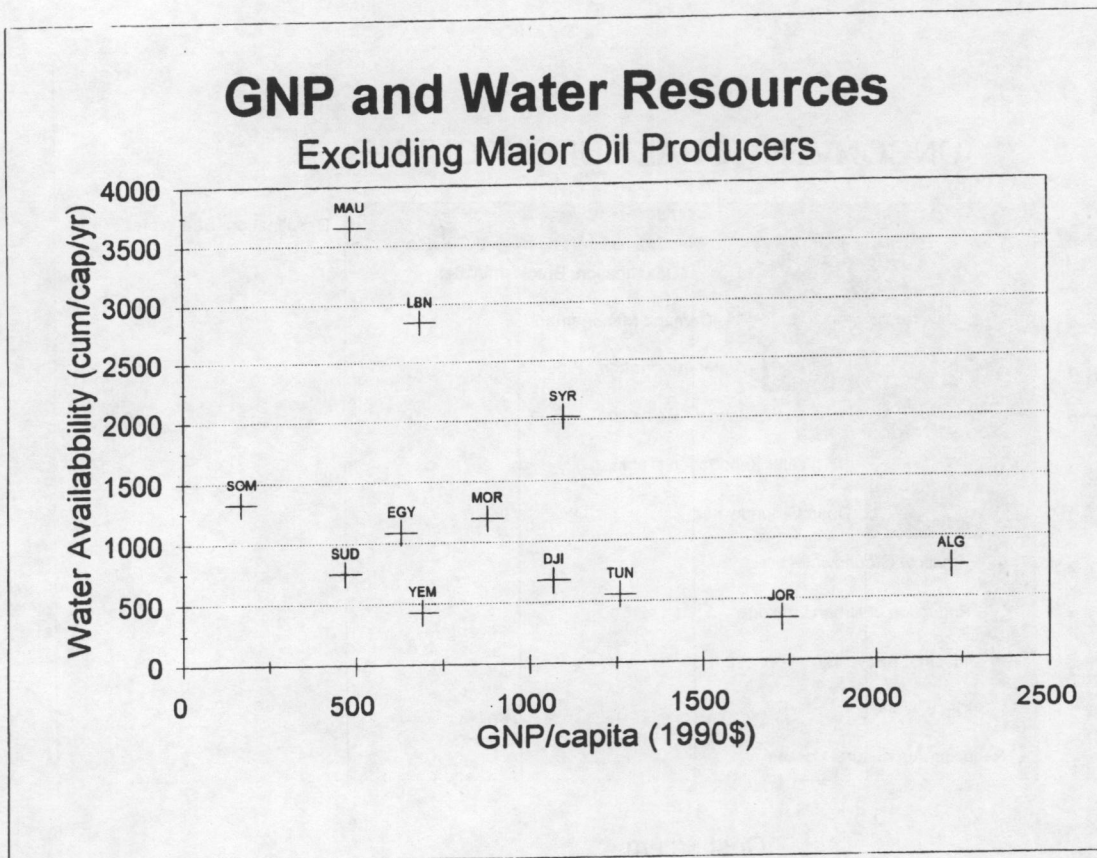


Figure 15

Water and Per Capita Income Excluding Major Oil Producers

| No. | International river    | Recharge area       | Countries in downstream direction | Area drainage basin in km <sup>2</sup>                 |
|-----|------------------------|---------------------|-----------------------------------|--|
| 1   | Senegal                |                     | Guinee, Mali, Senegal, Mauretania |  |
| 2   | Atui                   | Atlas               | Mauretania                        |  |
| 3   | Oued Draa              |                     | Morocco, Algeria                  |  |
| 4   | Oued Daoura            |                     | Morocco, Algeria                  |  |
| 5   | Qued Guir              |                     | Morocco, Algeria                  |  |
| 6   | Tafna                  |                     | Morocco, Algeria                  |  |
| 7   | Medjerda               |                     | Algeria, Tunisia                  | 23 000   |
| 8   | Nile                   |                     | Central African uplands and Sudan | Tanzania, Kenya, Burundi, Rwanda, Uganda, Sudan, Egypt |
| 9   | White Nile             |                     | Sudan                             |  |
| 10  | Sobat                  | Ethiopian Highlands | Ethiopia, Sudan                   |  |
| 11  | Blue Nile              |                     | Ethiopia, Sudan                   | 325 000  |
| 12  | Atbara                 |                     | Ethiopia, Sudan                   |  |
| 13  | Gash                   |                     | Ethiopia, Sudan                   | 21 000   |
| 14  | Baraka                 |                     | Ethiopia, Sudan                   |  |
| 15  | Lagh Bor               |                     | Ethiopia, Kenya, Somalia          |  |
| 16  | Juba                   |                     | Ethiopia, Somalia                 | 200 000  |
| 17  | Scebeli                |                     | Ethiopia, Somalia                 | 260 000  |
| 18  | Yarmouk                |                     | Syria, Jordan                     |  |
| 19  | Nahr el Assi (Orontes) |                     | Lebanon, Syria                    |  |
| 20  | Euphrates              | Taurus/Zagros       | Turkey, Syria, Iraq               | 350 000  |
| 21  | Khabur                 |                     | Turkey, Syria                     | 31 800   |
| 22  | Tigris                 |                     | Turkey, Syria, Iraq (Iraq only)   | 253 000  |
| 23  | Great Zab              |                     | Turkey, Iraq                      | 26 473   |
| 24  | Karun                  |                     | Iran, Iraq                        |  |

**Table 1**  
**List of International Rivers**

|                              | Amount mcm/day | Cost \$/cum | Cummul mcm/day |
|------------------------------|----------------|-------------|----------------|
| Surface Water                | 1              | 0.1         | 1              |
| Shallow Groundwater          | 0.5            | 0.17        | 1.5            |
| Deep Groundwater             | 1              | 0.5         | 2.5            |
| Water Importation: Tanker    | 1              | 0.6         | 3.5            |
| Water Importation: Pipeline  | 1              | 0.8         | 4.5            |
| Desalination: Brackish Water | 1              | 1           | 5.5            |
| Desalination: Sea Water      | infinite       | 2           | 5.5            |

**Table 2a**  
**Traditional Water Supply Options**

|                               | Amount mcm/day | Cost \$/cum | Cummul mcm/day |
|-------------------------------|----------------|-------------|----------------|
| Reduction Agricultural Losses | 1              | 0.05        | 1              |
| Industrial Recycling          | 0.5            | 0.13        | 1.5            |
| Reduction of Urban Leakage    | 0.2            | 0.15        | 1.7            |
| Wastewater Recycling          | 2              | 0.7         | 3.7            |
| Demand Management             | 0.1            | 0.9         | 3.8            |

**Table 2b**  
**Unconventional Water Supply Options**

Table 3  
Water Costs and Water Tariffs

Notes:  
AA refers to Jamil Al-Awadi and Mohammed Abdurazzak, "Water Problems in the Arabian Peninsula," (1993).  
JJ refers to Mohammed Jellali and Ali Jebali, "Water resources Management in the Maghreb Countries," (1993).

| Price \$/1000gal                        | Price \$/Acre-ft | Price \$/Acre-in | Price \$/Acre-in |
|---|------------------|------------------|------------------|
| 0                                       | 0                | 0                | 0                |
| 0.01                                    | 0.04             | 12.29            | 100              |
| 0.02                                    | 0.08             | 24.58            | 200              |
| Typical U.S. rates for irrigation water |                  |                  |                  |
| 0.03                                    | 0.11             | 36.88            | 300              |
| 0.04                                    | 0.15             | 49.17            | 400              |
| 0.05                                    | 0.19             | 61.46            | 500              |
| 0.06                                    | 0.23             | 73.75            | 600              |
| 0.07                                    | 0.26             | 86.04            | 700              |
| 0.08                                    | 0.30             | 98.34            | 800              |
| 0.09                                    | 0.34             | 110.63           | 900              |
| 0.1                                     | 0.38             | 122.92           | 1000             |
| 0.2                                     | 0.76             | 245.84           | 2000             |
| 0.3                                     | 1.13             | 368.76           | 3000             |
| Typical U.S. rates for municipal supply |                  |                  |                  |
| 0.4                                     | 1.51             | 491.68           | 4000             |
| 0.5                                     | 1.89             | 614.60           | 5000             |
| 0.6                                     | 2.27             | 737.52           | 6000             |
| 0.7                                     | 2.65             | 860.44           | 7000             |
| 0.8                                     | 3.03             | 983.36           | 8000             |
| 0.9                                     | 3.40             | 1106.28          | 9000             |
| 1                                       | 3.78             | 1229.20          | 10000            |
| 1.1                                     | 4.16             | 1352.12          | 11000            |
| 1.2                                     | 4.54             | 1475.04          | 12000            |
| 1.3                                     | 4.92             | 1597.96          | 13000            |
| 1.4                                     | 5.30             | 1720.88          | 14000            |
| Other                                   |                  |                  |                  |
| 1.5                                     | 5.67             | 1843.80          | 15000            |
| 1.6                                     | 6.05             | 1966.72          | 16000            |
| 1.7                                     | 6.43             | 2089.64          | 17000            |
| 1.8                                     | 6.81             | 2212.56          | 18000            |
| 1.9                                     | 7.19             | 2335.48          | 19000            |
| Typical U.S. rates for irrigation water |                  |                  |                  |
| 2                                       | 7.56             | 2458.40          | 20000            |
| 2.1                                     | 7.94             | 2581.32          | 21000            |
| 2.2                                     | 8.32             | 2704.24          | 22000            |
| 2.3                                     | 8.70             | 2827.16          | 23000            |
| 2.4                                     | 9.08             | 2950.08          | 24000            |
| 2.5                                     | 9.46             | 3073.00          | 25000            |

| Country          | Resource Base km <sup>3</sup> | 1990 Withdrawal (Km <sup>3</sup> /yr) |       |         |         | 2025 Withdrawal (Km <sup>3</sup> /yr) Without Income Effect |        |         |         | 2025 Withdrawal (Km <sup>3</sup> /yr) With Income Effect |        |         |         | 2025 Withdrawal (Km <sup>3</sup> /yr) With Incr. Agr & Inc Eff |        |         |         |
|------------------|-------------------------------|---------------------------------------|-------|---------|---------|---|--------|---------|---------|--|--------|---------|---------|--|--------|---------|---------|
|                  |                               | Dom                                   | Ind   | Agr     | Total   | Dom   | Ind    | Agr     | Total   | Dom  | Ind    | Agr     | Total   | Dom  | Ind    | Agr     | Total   |
| Algeria          | 19.000                        | 0.846                                 | 0.154 | 1.850   | 2.850   | 2.597   | 0.435  | 1.850   | 4.883   | 4.367  | 0.435  | 1.850   | 6.652   | 4.367  | 0.435  | 5.208   | 10.008  |
| Bahrain          | 0.100                         | 0.086                                 | 0.017 | 0.113   | 0.216   | 0.191   | 0.017  | 0.113   | 0.321   | 0.191  | 0.017  | 0.113   | 0.321   | 0.191  | 0.017  | 0.318   | 0.526   |
| Djibouti         | 0.300                         | 0.003                                 | 0.002 | 0.005   | 0.010   | 0.008   | 0.007  | 0.005   | 0.021   | 0.015  | 0.007  | 0.005   | 0.027   | 0.015  | 0.007  | 0.014   | 0.037   |
| Egypt            | 58.100                        | 3.100                                 | 4.600 | 49.700  | 57.400  | 8.272   | 12.929 | 49.700  | 70.901  | 13.868   | 12.929 | 49.700  | 76.498  | 13.868   | 12.929 | 139.849 | 166.647 |
| Iraq             | 81.000                        | 1.284                                 | 2.140 | 39.376  | 42.800  | 4.103   | 2.140  | 39.376  | 45.619  | 4.103  | 2.140  | 39.376  | 45.619  | 4.103  | 2.140  | 110.799 | 117.041 |
| Jordan/West Bank | 1.400                         | 0.131                                 | 0.027 | 0.293   | 0.450   | 0.456   | 0.051  | 0.293   | 0.799   | 0.625  | 0.051  | 0.293   | 0.969   | 0.625  | 0.051  | 0.823   | 1.499   |
| Kuwait           | 0.000                         | 0.295                                 | 0.008 | 0.080   | 0.383   | 0.388   | 0.015  | 0.080   | 0.482   | 0.527  | 0.015  | 0.080   | 0.622   | 0.527  | 0.015  | 0.225   | 0.767   |
| Lebanon          | 7.800                         | 0.083                                 | 0.030 | 0.638   | 0.750   | 0.145   | 0.058  | 0.638   | 0.841   | 0.202  | 0.058  | 0.638   | 0.898   | 0.202  | 0.058  | 1.794   | 2.054   |
| Libya            | 3.830                         | 0.289                                 | 0.193 | 4.275   | 4.757   | 1.045   | 0.406  | 4.275   | 5.726   | 1.516  | 0.406  | 4.275   | 6.197   | 1.516  | 0.406  | 12.029  | 13.951  |
| Mauritania       | 7.400                         | 0.088                                 | 0.029 | 0.613   | 0.730   | 0.361   | 0.062  | 0.613   | 1.036   | 0.524  | 0.062  | 0.613   | 1.199   | 0.524  | 0.062  | 1.725   | 2.311   |
| Morocco          | 30.000                        | 0.667                                 | 0.333 | 10.000  | 11.000  | 1.404   | 1.074  | 10.000  | 12.477  | 2.520  | 1.074  | 10.000  | 13.594  | 2.520  | 1.074  | 28.139  | 31.733  |
| Oman             | 1.470                         | 0.081                                 | 0.005 | 1.150   | 1.236   | 1.618   | 0.005  | 1.150   | 2.773   | 1.583  | 0.005  | 1.150   | 2.738   | 1.583  | 0.005  | 3.236   | 4.824   |
| Qatar            | 0.050                         | 0.076                                 | 0.009 | 0.109   | 0.194   | 0.137   | 0.178  | 0.109   | 0.423   | 0.608  | 0.178  | 0.109   | 0.894   | 0.608  | 0.178  | 0.307   | 1.092   |
| Saudi Arabia     | 6.080                         | 1.508                                 | 0.192 | 14.600  | 16.300  | 4.874   | 0.404  | 14.600  | 19.878  | 7.070  | 0.404  | 14.600  | 22.074  | 7.070  | 0.404  | 41.082  | 48.556  |
| Somalia          | 11.500                        | 0.024                                 | 0.000 | 0.786   | 0.810   | 0.139   | 0.000  | 0.786   | 0.925   | 0.227  | 0.000  | 0.786   | 1.013   | 0.227  | 0.000  | 2.211   | 2.438   |
| Sudan, The       | 19.000                        | 0.186                                 | 0.000 | 18.414  | 18.600  | 1.373   | 0.000  | 18.414  | 19.787  | 1.858  | 0.000  | 18.414  | 20.272  | 1.858  | 0.000  | 51.814  | 53.672  |
| Syria            | 25.000                        | 0.234                                 | 0.334 | 2.772   | 3.340   | 1.100   | 0.114  | 2.772   | 4.886   | 1.917  | 0.114  | 2.772   | 5.703   | 1.917  | 0.114  | 7.801   | 10.732  |
| Tunisia          | 4.500                         | 0.179                                 | 0.097 | 1.384   | 1.660   | 0.400   | 0.411  | 1.384   | 2.195   | 0.823  | 0.411  | 1.384   | 2.619   | 0.823  | 0.411  | 3.894   | 5.129   |
| UAE              | 0.280                         | 0.513                                 | 0.027 | 0.950   | 1.490   | 1.011   | 0.058  | 0.950   | 2.019   | 1.483  | 0.058  | 0.950   | 2.491   | 1.483  | 0.058  | 2.673   | 4.215   |
| Yemen            | 5.000                         | 0.144                                 | 0.072 | 2.500   | 2.716   | 1.102   | 0.266  | 2.500   | 3.868   | 2.118  | 0.266  | 2.500   | 4.884   | 2.118  | 0.266  | 7.035   | 9.419   |
| SUM              | 281.810                       | 9.816                                 | 8.269 | 149.607 | 167.692 | 30.725  | 19.529 | 149.607 | 199.861 | 46.147   | 19.529 | 149.607 | 215.283 | 46.147   | 19.529 | 420.974 | 486.650 |
| MEAN             | 14.091                        | 0.491                                 | 0.413 | 7.480   | 8.385   | 1.536   | 0.976  | 7.480   | 9.993   | 2.307  | 0.976  | 7.480   | 10.764  | 2.307  | 0.976  | 21.049  | 24.332  |
| MIN              | 0.000                         | 0.003                                 | 0.000 | 0.005   | 0.010   | 0.008   | 0.000  | 0.005   | 0.021   | 0.015  | 0.000  | 0.005   | 0.027   | 0.015  | 0.000  | 0.014   | 0.037   |
| MAX              | 81.000                        | 3.100                                 | 4.600 | 49.700  | 57.400  | 8.272   | 12.929 | 49.700  | 70.901  | 13.868   | 12.929 | 49.700  | 76.498  | 13.868   | 12.929 | 139.849 | 166.647 |
| STDS             | 21.228                        | 0.744                                 | 1.092 | 13.755  | 15.409  | 2.056   | 2.862  | 13.755  | 18.019  | 3.235  | 2.862  | 13.755  | 19.007  | 3.235  | 2.862  | 38.706  | 43.806  |

Table 4  
Water Demand Forecasts for 2025 by Country and by Sector



| Country          | Resource Base km <sup>3</sup> | Total Projected Withdrawal 2025 |         |          | PERCENT OF RESOURCE BASE |         |          | AMOUNT OF SHORTFALL |         |          | POPULATION |         |          | TOTAL WITHDRAWAL PER CAPITA (m <sup>3</sup> /yr/capita) |        |       |        |        |      |
|------------------|-------------------------------|---------------------------------|---------|----------|--------------------------|---------|----------|---------------------|---------|----------|------------|---------|----------|---|--------|-------|--------|--------|------|
|                  |                               | Case I                          | Case II | Case III | 1990                     | 2025    | 2025     | 1990                | 2025    | 2025     | 1990       | 2025    | 2025     | 1990  | 2025   | 2025  |        |        |      |
|                  |                               |                                 |         |          | Case I                   | Case II | Case III | Case I              | Case II | Case III | Case I     | Case II | Case III | 1990  | 2025   | 2025  |        |        |      |
| Algeria          | 19 000                        | 4 883                           | 6 652   | 10 008   | 15%                      | 26%     | 35%      | 53%                 | 0.0     | 0.0      | 0.0        | 0.0     | 24960000 | 51830000  | 114.2  | 94.2  | 128.3  | 163.1  | ALG  |
| Bahrain          | 0 100                         | 0 321                           | 0 321   | 0 526    | 218%                     | 321%    | 321%     | 526%                | 0.1     | 0.2      | 0.2        | 0.4     | 503000   | 1014000   | 429.4  | 316.8 | 316.8  | 519.0  | BHR  |
| Dibouti          | 0 300                         | 0 021                           | 0 027   | 0 037    | 3%                       | 7%      | 9%       | 12%                 | 0.0     | 0.0      | 0.0        | 0.0     | 440000   | 1159000   | 22.7   | 17.7  | 23.7   | 31.6   | DIB  |
| Egypt            | 58 100                        | 70 901                          | 76 498  | 166 647  | 99%                      | 122%    | 132%     | 287%                | 0.0     | 12.8     | 18.4       | 108.5   | 52426000 | 93536000  | 1094.9 | 758.0 | 817.8  | 1781.6 | EGY  |
| Iraq             | 81 000                        | 45 619                          | 45 619  | 117 041  | 53%                      | 56%     | 56%      | 144%                | 0.0     | 0.0      | 0.0        | 36.0    | 18080000 | 46260000  | 2367.3 | 986.1 | 986.1  | 2530.1 | IRQ  |
| Jordan/West Bank | 1 400                         | 0 799                           | 0 969   | 1 499    | 32%                      | 57%     | 69%      | 107%                | 0.0     | 0.0      | 0.0        | 0.1     | 4009000  | 10807000  | 112.2  | 74.0  | 89.6   | 136.7  | JOR  |
| Kuwait           | 0 000                         | 0 482                           | 0 622   | 0 767    | 383000%                  | 482416% | 621739%  | 766848%             | 0.4     | 0.5      | 0.6        | 0.8     | 2143000  | 2789000   | 178.7  | 173.0 | 222.9  | 275.0  | KWT  |
| Lebanon          | 7 800                         | 0 841                           | 0 898   | 2 054    | 10%                      | 11%     | 12%      | 26%                 | 0.0     | 0.0      | 0.0        | 0.0     | 2740000  | 4478000   | 273.7  | 187.8 | 200.6  | 458.9  | LBN  |
| Libya            | 3 830                         | 5 726                           | 6 197   | 13 951   | 124%                     | 150%    | 162%     | 364%                | 0.9     | 1.9      | 2.4        | 10.1    | 4545000  | 12873000  | 1046.8 | 444.8 | 481.4  | 1063.7 | LYB  |
| Mauritania       | 7 400                         | 1 036                           | 1 199   | 2 311    | 10%                      | 14%     | 16%      | 31%                 | 0.0     | 0.0      | 0.0        | 0.0     | 2024000  | 4963000   | 360.7  | 207.4 | 240.1  | 462.9  | MRT  |
| Morocco          | 30 000                        | 12 477                          | 13 594  | 31 733   | 37%                      | 42%     | 45%      | 108%                | 0.0     | 0.0      | 0.0        | 1.7     | 25061000 | 47477000  | 438.9  | 262.8 | 286.3  | 668.4  | MOR  |
| Oman             | 1 470                         | 2 773                           | 2 738   | 4 824    | 84%                      | 189%    | 186%     | 328%                | 0.0     | 1.3      | 1.3        | 3.4     | 1524000  | 4705000   | 811.0  | 589.3 | 581.9  | 1025.2 | OMN  |
| Qatar            | 0 050                         | 0 423                           | 0 884   | 1 082    | 388%                     | 847%    | 1788%    | 2184%               | 0.1     | 0.4      | 0.8        | 1.0     | 427000   | 731000  | 454.3  | 579.1 | 1223.1 | 1493.6 | QAT  |
| Saudi Arabia     | 6 080                         | 19 878                          | 22 074  | 48 556   | 268%                     | 327%    | 363%     | 799%                | 10.2    | 13.8     | 16.0       | 42.5    | 14870000 | 40426000  | 1096.2 | 491.7 | 546.0  | 1201.1 | SAU  |
| Somalia          | 11 500                        | 0 925                           | 1 013   | 2 438    | 7%                       | 8%      | 9%       | 21%                 | 0.0     | 0.0      | 0.0        | 0.0     | 8677000  | 23401000  | 93.4   | 39.5  | 43.3   | 104.2  | SOM  |
| Sudan, The       | 19 000                        | 19 787                          | 20 272  | 53 672   | 98%                      | 104%    | 107%     | 282%                | 0.0     | 0.8      | 1.3        | 34.7    | 25203000 | 60602000  | 738.0  | 326.5 | 334.5  | 885.7  | SUD  |
| Syria            | 25 000                        | 4 886                           | 5 703   | 10 732   | 13%                      | 20%     | 23%      | 43%                 | 0.0     | 0.0      | 0.0        | 0.0     | 12355000 | 35250000  | 270.3  | 138.6 | 161.8  | 304.4  | SYR  |
| Tunisia          | 4 500                         | 2 195                           | 2 619   | 5 129    | 37%                      | 49%     | 58%      | 114%                | 0.0     | 0.0      | 0.0        | 0.0     | 8057000  | 13425000  | 206.0  | 163.5 | 195.1  | 382.1  | TUN  |
| UAE              | 0 280                         | 2 019                           | 2 491   | 4 215    | 532%                     | 721%    | 890%     | 1505%               | 1.2     | 1.7      | 2.2        | 3.9     | 1589000  | 2792000   | 937.7  | 723.2 | 892.4  | 1509.5 | UAE  |
| Yemen            | 5 000                         | 3 868                           | 4 884   | 9 419    | 54%                      | 77%     | 98%      | 188%                | 0.0     | 0.0      | 0.0        | 4.4     | 11684000 | 34237000  | 232.5  | 113.0 | 142.7  | 275.1  | YEM  |
| SUM              | 281 810                       | 199 861                         | 215 283 | 486 650  |                          |         |          |                     | 13.0    | 33.4     | 43.2       | 248.3   | 2 21E+08 | 4 83E+08  |        |       |        |        | SUM  |
| MEAN             | 14 091                        | 9 993                           | 10 764  | 24 332   |                          |         |          |                     | 0.6     | 1.7      | 2.2        | 12.4    | 11065850 | 24639150  | 757.7  | 405.6 | 436.9  | 987.6  | MEAN |
| MIN              | 0 000                         | 0 021                           | 0 027   | 0 037    |                          |         |          |                     | 0.0     | 0.0      | 0.0        | 0.0     | 427000   | 731000  | 22.7   | 17.7  | 23.7   | 31.6   | MIN  |
| MAX              | 81 000                        | 70 901                          | 76 498  | 166 647  |                          |         |          |                     | 10.2    | 13.8     | 16.4       | 108.5   | 52426000 | 93536000  | 2367.3 | 986.1 | 1223.1 | 2530.1 | MAX  |
| STDS             | 21 228                        | 18 019                          | 19 007  | 43 806   |                          |         |          |                     | 2.3     | 4.0      | 5.2        | 26.3    | 13021125 | 25654746  | 554.7  | 273.0 | 342.1  | 664.7  | STDS |

Table 4 (Cont'd)  
Water Demand Forecasts for 2025 by Country and by Sector

| Country    | m <sup>3</sup> /cap/yr | g/cap/yr | g/cal/day | Urban Water Use in 1990 | Urban Water Use in 2025 | Urban Water Use in 2025 | Urban Water Use in 2025 |
|------------|------------------------|----------|-----------|-------------------------|-------------------------|-------------------------|-------------------------|
|            |                        |          |           | No Income Effect        | Income Effect           | Income Effect           | Income Effect           |
| Algeria    | 65.2                   | 17220.9  | 47.2      | 65.2                    | 17220.9                 | 47.2                    | 109.6                   |
| Bahrain    | 206.0                  | 54423.3  | 149.1     | 206.0                   | 54423.3                 | 149.1                   | 206.0                   |
| Dibouti    | 7.9                    | 2075.6   | 5.7       | 7.9                     | 2075.6                  | 5.7                     | 14.3                    |
| Egypt      | 125.8                  | 33239.2  | 91.1      | 125.8                   | 33239.2                 | 91.1                    | 210.9                   |
| Iraq       | 100.0                  | 26426.6  | 72.4      | 100.0                   | 26426.6                 | 72.4                    | 55726.2                 |
| Jordan/WB  | 47.9                   | 12847.3  | 34.7      | 47.9                    | 12847.3                 | 34.7                    | 17346.3                 |
| Kuwait     | 143.4                  | 37884.5  | 103.8     | 143.4                   | 37884.5                 | 103.8                   | 194.9                   |
| Lebanon    | 35.8                   | 9470.2   | 25.9      | 35.8                    | 9470.2                  | 25.9                    | 50.0                    |
| Libya      | 90.8                   | 23999.3  | 66.7      | 90.8                    | 23999.3                 | 66.7                    | 131.7                   |
| Mauritania | 92.1                   | 24329.2  | 66.7      | 92.1                    | 24329.2                 | 66.7                    | 33320.4                 |
| Morocco    | 32.9                   | 8681.1   | 23.8      | 32.9                    | 8681.1                  | 23.8                    | 59.0                    |
| Oman       | 483.2                  | 127655.7 | 349.7     | 483.2                   | 127655.7                | 349.7                   | 472.7                   |
| Qatar      | 200.0                  | 52835.8  | 144.8     | 200.0                   | 52835.8                 | 144.8                   | 888.2                   |
| Saudi Ara  | 131.7                  | 34796.3  | 95.3      | 131.7                   | 34796.3                 | 95.3                    | 191.0                   |
| Somalia    | 7.8                    | 2055.3   | 5.6       | 7.8                     | 2055.3                  | 5.6                     | 12.7                    |
| Sudan, TT  | 33.5                   | 8862.8   | 24.3      | 33.5                    | 8862.8                  | 24.3                    | 45.4                    |
| Syria      | 37.8                   | 9899.2   | 27.4      | 37.8                    | 9899.2                  | 27.4                    | 65.9                    |
| Tunisia    | 41.1                   | 10869.7  | 29.8      | 41.1                    | 10869.7                 | 29.8                    | 84.7                    |
| UAE        | 413.9                  | 109353.2 | 299.6     | 413.9                   | 109353.2                | 299.6                   | 607.3                   |
| Yemen      | 42.5                   | 11228.1  | 30.8      | 42.5                    | 11228.1                 | 30.8                    | 81.7                    |
| MEAN       | 117.0                  | 30902.7  | 84.7      | 117.0                   | 30902.7                 | 84.7                    | 186.3                   |
| MIN        | 7.8                    | 2055.3   | 5.6       | 7.8                     | 2055.3                  | 5.6                     | 12.7                    |
| MAX        | 483.2                  | 127655.7 | 349.7     | 483.2                   | 127655.7                | 349.7                   | 888.2                   |
| STDS       | 124.3                  | 32846.7  | 90.0      | 124.3                   | 32846.7                 | 90.0                    | 216.4                   |

Table 5  
Forecasts of Urban Water Demand: 2025

**Data Appendix to Paper by Prof. Peter Rogers**  
THE AGENDA FOR THE NEXT 20 YEARS

**Symposium on Water in the Arab World**

**Harvard University 1-3 Oct., 1993**

Populations in the Arab Nations: Past, Present and Projections

|                  | 1950       | 1955       | 1960       | 1965       | 1970       | 1975       | 1980       | 1985       | 1990       | 1995       | 2000       | 2005       | 2010       | 2015       | 2020       | 2025       |
|------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Algeria          | 8,753,000  | 9,715,000  | 10,800,000 | 11,923,000 | 13,746,000 | 16,018,000 | 18,740,000 | 21,788,000 | 24,960,000 | 28,581,000 | 32,693,000 | 37,054,000 | 41,311,000 | 45,158,000 | 48,361,000 | 51,830,000 |
| Bahrain          | 116,000    | 134,000    | 156,000    | 191,000    | 220,000    | 272,000    | 347,000    | 429,000    | 503,000    | 578,000    | 653,000    | 730,000    | 812,000    | 891,000    | 960,000    | 1,014,000  |
| Djibouti         | 60,000     | 69,000     | 80,000     | 114,000    | 168,000    | 243,000    | 304,000    | 380,000    | 440,000    | 511,000    | 591,000    | 683,000    | 787,000    | 902,000    | 1,027,000  | 1,159,000  |
| Egypt            | 20,330,000 | 22,990,000 | 25,922,000 | 29,389,000 | 33,053,000 | 36,289,000 | 40,875,000 | 46,511,000 | 52,426,000 | 58,519,000 | 64,810,000 | 71,285,000 | 77,681,000 | 83,549,000 | 88,492,000 | 93,536,000 |
| Iraq             | 5,158,000  | 5,911,000  | 6,847,000  | 7,976,000  | 9,356,000  | 11,020,000 | 13,007,000 | 15,319,000 | 18,080,000 | 21,224,000 | 24,779,000 | 28,676,000 | 32,868,000 | 37,299,000 | 41,828,000 | 46,260,000 |
| Jordan/West Bank | 1,237,000  | 1,447,000  | 1,695,000  | 1,962,000  | 2,299,000  | 2,600,000  | 2,923,000  | 3,407,000  | 4,009,000  | 4,755,000  | 5,624,000  | 6,572,000  | 7,572,000  | 8,626,000  | 9,724,000  | 10,807,000 |
| Kuwait           | 152,000    | 199,000    | 278,000    | 471,000    | 744,000    | 1,007,000  | 1,375,000  | 1,720,000  | 2,143,000  | 2,604,000  | 3,178,000  | 3,864,000  | 4,672,000  | 5,612,000  | 6,692,000  | 7,914,000  |
| Lebanon          | 1,443,000  | 1,613,000  | 1,857,000  | 2,151,000  | 2,469,000  | 2,767,000  | 2,669,000  | 2,668,000  | 2,740,000  | 3,028,000  | 3,312,000  | 3,562,000  | 3,777,000  | 4,006,000  | 4,244,000  | 4,476,000  |
| Libya            | 1,029,000  | 1,126,000  | 1,349,000  | 1,623,000  | 1,986,000  | 2,446,000  | 3,043,000  | 3,786,000  | 4,545,000  | 5,407,000  | 6,386,000  | 7,492,000  | 8,720,000  | 10,046,000 | 11,440,000 | 12,873,000 |
| Mauritania       | 825,000    | 901,000    | 991,000    | 1,096,000  | 1,221,000  | 1,371,000  | 1,551,000  | 1,766,000  | 2,024,000  | 2,335,000  | 2,680,000  | 3,064,000  | 3,491,000  | 3,962,000  | 4,468,000  | 4,993,000  |
| Morocco          | 8,953,000  | 10,132,000 | 11,626,000 | 13,323,000 | 15,310,000 | 17,305,000 | 19,382,000 | 22,025,000 | 25,061,000 | 28,260,000 | 31,719,000 | 35,266,000 | 38,724,000 | 41,912,000 | 44,626,000 | 47,477,000 |
| Oman             | 413,000    | 455,000    | 505,000    | 571,000    | 654,000    | 766,000    | 988,000    | 1,263,000  | 1,524,000  | 1,822,000  | 2,168,000  | 2,571,000  | 3,038,000  | 3,557,000  | 4,118,000  | 4,705,000  |
| Qatar            | 25,000     | 35,000     | 45,000     | 70,000     | 111,000    | 171,000    | 229,000    | 358,000    | 427,000    | 490,000    | 542,000    | 590,000    | 634,000    | 676,000    | 709,000    | 731,000    |
| Saudi Arabia     | 3,201,000  | 3,593,000  | 4,075,000  | 4,793,000  | 5,745,000  | 7,251,000  | 9,372,000  | 12,379,000 | 14,870,000 | 17,608,000 | 20,667,000 | 24,066,000 | 27,796,000 | 31,820,000 | 36,074,000 | 40,426,000 |
| Somalia          | 3,072,000  | 3,401,000  | 3,785,000  | 4,239,000  | 4,791,000  | 5,471,000  | 6,713,000  | 7,875,000  | 8,677,000  | 10,173,000 | 11,864,000 | 13,777,000 | 15,915,000 | 18,274,000 | 20,793,000 | 23,401,000 |
| Sudan, The       | 9,190,000  | 10,150,000 | 11,165,000 | 12,359,000 | 13,859,000 | 16,012,000 | 18,681,000 | 21,822,000 | 25,203,000 | 28,960,000 | 33,166,000 | 37,865,000 | 43,045,000 | 48,632,000 | 54,509,000 | 60,602,000 |
| Syria            | 3,495,000  | 3,967,000  | 4,561,000  | 5,325,000  | 6,258,000  | 7,438,000  | 8,704,000  | 10,348,000 | 12,355,000 | 14,775,000 | 17,546,000 | 20,698,000 | 24,153,000 | 27,834,000 | 31,595,000 | 35,250,000 |
| Tunisia          | 3,530,000  | 3,860,000  | 4,221,000  | 4,630,000  | 5,127,000  | 5,611,000  | 6,384,000  | 7,261,000  | 8,057,000  | 8,933,000  | 9,781,000  | 10,550,000 | 11,296,000 | 12,005,000 | 12,725,000 | 13,425,000 |
| UAE              | 70,000     | 79,000     | 90,000     | 144,000    | 223,000    | 505,000    | 1,015,000  | 1,349,000  | 1,589,000  | 1,785,000  | 1,970,000  | 2,162,000  | 2,351,000  | 2,526,000  | 2,674,000  | 2,792,000  |
| Yemen            | 4,316,000  | 4,734,000  | 5,247,000  | 5,843,000  | 6,332,000  | 6,991,000  | 8,219,000  | 9,758,000  | 11,684,000 | 13,897,000 | 16,424,000 | 19,308,000 | 22,574,000 | 26,198,000 | 30,118,000 | 34,237,000 |

SOURCE: UN

| Table 22 1 |                                   | Col.01            | Col.02                  | Col.03                 | Col.04                  | Col.05                        | Col.06          | Col.07                    | Col.08         | Col.09           | Col.10           | Col.11              |
|------------|-----------------------------------|-------------------|-------------------------|------------------------|-------------------------|-------------------------------|-----------------|---------------------------|----------------|------------------|------------------|---------------------|
| Country    | Freshwater Resources & Withdrawal | Wat. Res (km3/yr) | Water Res(000m3/cap/yr) | River Flows IN(km3/yr) | River Flows OUT(km3/yr) | Year of Data: Ann. Withdrawal | Tot.W/D(km3/yr) | W/D as % of Water Resour. | W/D(m3/cap/yr) | Withdrawal       |                  |                     |
|            |                                   |                   |                         |                        |                         |                               |                 |                           |                | Domestic W/D (%) | Industry W/D (%) | Agriculture W/D (%) |
| ALG        | Algeria                           | 19.00             | 0.75                    | 0.20                   | 0.70                    | 80                            | 3.00            | 16.00                     | 161.00         | 22.00            | 4.00             | 74.00               |
| BHR        | Bahrain                           | 0.00              | 0.00                    |                        |                         | 75                            | 0.20            |                           | 735.00         | 60.00            | 36.00            | 4.00                |
| DJI        | Djibouti                          | 0.30              | 0.74                    | 0.00                   |                         | 73                            | 0.01            | 2.00                      | 28.00          | 28.00            | 21.00            | 51.00               |
| EGY        | Egypt                             | 1.80              | 0.03                    | 56.50                  | 0.00                    | 85                            | 56.40           | 97.00                     | 1202.00        | 7.00             | 5.00             | 88.00               |
| IRQ        | Iraq                              | 34.00             | 1.80                    | 66.00                  |                         | 70                            | 42.80           | 43.00                     | 4575.00        | 3.00             | 5.00             | 92.00               |
| JOR        | Jordan                            | 0.70              | 0.16                    | 0.40                   |                         | 75                            | 0.45            | 41.00                     | 173.00         | 29.00            | 6.00             | 65.00               |
| KWT        | Kuwait                            | 0.00              | 0.00                    | 0.00                   |                         | 74                            | 0.01            |                           | 10.00          | 64.00            | 32.00            | 4.00                |
| LBN        | Lebanon                           | 4.80              | 1.62                    | 0.00                   | 0.86                    | 75                            | 0.75            | 16.00                     | 271.00         | 11.00            | 4.00             | 85.00               |
| LYB        | Libya                             | 0.70              | 0.15                    | 0.00                   | 0.00                    | 85                            | 2.62            | 374.00                    | 262.00         | 15.00            | 10.00            | 75.00               |
| MAU        | Mauritania                        | 0.40              | 0.20                    | 7.00                   |                         | 78                            | 0.73            | 10.00                     | 473.00         | 12.00            | 4.00             | 84.00               |
| MOR        | Morocco                           | 30.00             | 1.19                    | 0.00                   | 0.30                    | 85                            | 11.00           | 37.00                     | 501.00         | 6.00             | 3.00             | 91.00               |
| OMN        | Oman                              | 2.00              | 1.36                    | 0.00                   |                         | 75                            | 0.43            | 22.00                     | 561.00         | 3.00             | 3.00             | 94.00               |
| QAT        | Qatar                             | 0.02              | 0.06                    | 0.00                   |                         | 75                            | 0.04            | 174.00                    | 234.00         | 36.00            | 26.00            | 38.00               |
| SAU        | Saudi Arabia                      | 2.20              | 0.16                    | 0.00                   |                         | 75                            | 2.33            | 106.00                    | 321.00         | 45.00            | 8.00             | 47.00               |
| SOM        | Somalia                           | 11.50             | 1.52                    | 0.00                   |                         | 87                            | 0.81            | 7.00                      | 167.00         | 3.00             | 0.00             | 97.00               |
| SDN        | Sudan                             | 30.00             | 1.19                    | 100.00                 | 56.50                   | 77                            | 18.60           | 14.00                     | 1089.00        | 1.00             | 0.00             | 99.00               |
| SYR        | Syrian Arab Rep                   | 7.60              | 0.61                    | 27.90                  | 30.00                   | 76                            | 3.34            | 9.00                      | 449.00         | 7.00             | 10.00            | 83.00               |
| TUN        | Tunisia                           | 3.75              | 0.46                    | 0.60                   | 0.00                    | 85                            | 2.30            | 53.00                     | 325.00         | 13.00            | 7.00             | 80.00               |
| UAE        | United Arab Emirates              | 0.30              | 0.19                    | 0.00                   |                         | 80                            | 0.42            | 140.00                    | 429.00         | 11.00            | 9.00             | 80.00               |
| YEM        | Yemen Arab Rep                    | 1.00              | 0.12                    | 0.00                   |                         | 87                            | 1.47            | 147.00                    |                | 4.00             | 2.00             | 94.00               |
| YMD        | Yemen, People's Dem Rep           | 1.50              | 0.60                    | 0.00                   |                         | 75                            | 1.93            | 129.00                    | 1167.00        | 5.00             | 2.00             | 93.00               |

SOURCE: WORLD RESOURCES INSTITUTE

|                  | Total GNP<br>US \$ billions<br>1990 | Urban Population<br>as % of total |      |      | Arable Land<br>(as % of land<br>area 1989-90) | Arable Land<br>(MHa.)<br>(1989-90) | Irrigated Land<br>(as % of arable<br>land area 89-90) | Internal renewable<br>water resources per cap<br>(1000 cu.m. per year)<br>1990 | Annual freshwater withdrawals    |                              | Land Area<br>(million)<br>(hectares) |     |
|------------------|-------------------------------------|-----------------------------------|------|------|---|------------------------------------|---|--|----------------------------------|------------------------------|--------------------------------------|-----|
|                  |                                     | 1960                              | 1991 | 2000 |   |                                    |   |  | as % of water<br>resources 80-87 | per capita (cu.m)<br>1980-87 |                                      |     |
|                  |                                     |                                   |      |      |   |                                    |   |  |                                  |                              |                                      |     |
| Algeria          | 51.6                                | 30                                | 52   | 60   | 3   | 714.6                              | 5   | 0.7  | 16                               | 161                          | 238.2                                | ALG |
| Bahrain          | -                                   | 83                                | 83   | 85   | 1.5   | 0.15                               | -   | (.)  |                                  | 609                          | 0.1                                  | BHR |
| Djibouti         | -                                   | 50                                | 81   | 84   | -   | -                                  | -   | 0.7  | 2                                | 28                           | 2.3                                  | DJI |
| Egypt            | 31.4                                | 38                                | 47   | 54   | 2.3   | 228.85                             | 100   | (.)  | 97                               | 1202                         | 99.5                                 | EGY |
| Iraq             | -                                   | 43                                | 71   | 75   | 12  | 524.4                              | 47  | 1.8  | 43                               | 4575                         | 43.7                                 | IRQ |
| Jordan/West Bank | 3.9                                 | 43                                | 68   | 74   | 3.5   | 31.15                              | 15  | 0.2  | 41                               | 173                          | 8.9                                  | JOR |
| Kuwait           | -                                   | 72                                | 96   | 97   | 0.2   | 0.36                               | 50  | (.)  |                                  | 238                          | 1.8                                  | KWT |
| Lebanon          | -                                   | 40                                | 84   | 87   | 20.3  | 20.3                               | 29  | 1.5  | 16                               | 271                          | 1                                    | LBN |
| Libya            | -                                   | 23                                | 70   | 76   | 1   | 176                                | 11  | 0.2  | 404                              | 623                          | 176                                  | LBY |
| Mauritania       | 1                                   | 6                                 | 47   | 59   | 0.2   | 20.5                               | 6   | 0.2  | 10                               | 473                          | 102.5                                | MAU |
| Morocco          | 23.8                                | 29                                | 48   | 55   | 19.4  | 865.24                             | 14  | 1.2  | 37                               | 501                          | 44.6                                 | MOR |
| Oman             | -                                   | 4                                 | 11   | 15   | 0.1   | 2.12                               | 85  | 1.4  | 24                               | 325                          | 21.2                                 | OMN |
| Qatar            | 7                                   | 73                                | 89   | 91   | 0.5   | 0.55                               | -   | 0.1  | 663                              | 415                          | 1.1                                  | QAT |
| Saudi Arabia     | -                                   | 30                                | 77   | 82   | 0.5   | 107.5                              | 36  | 0.2  | 164                              | 255                          | 215                                  | SAU |
| Somalia          | 0.9                                 | 17                                | 36   | 44   | 1.6   | 100.32                             | 11  | 1.5  | 7                                | 167                          | 62.7                                 | SOM |
| Sudan, The       | -                                   | 10                                | 22   | 27   | 5.2   | 1235.52                            | 15  | 1.2  | 14                               | 1089                         | 237.6                                | SDN |
| Syria            | 12.4                                | 37                                | 50   | 56   | 26.6  | 489.44                             | 12  | 0.6  | 9                                | 449                          | 18.4                                 | SYR |
| Tunisia          | 11.6                                | 36                                | 54   | 59   | 19.5  | 302.25                             | 6   | 0.5  | 53                               | 325                          | 15.5                                 | TUN |
| UAE              | 31.6                                | 40                                | 78   | 78   | 0.3   | 2.52                               | 13  | 0.2  | 299                              | 565                          | 8.4                                  | UAE |
| Yemen            | -                                   | 9                                 | 29   | 37   | 2.6   | 137.28                             | -   | -  | -                                | 1167                         | 52.8                                 | YEM |

SOURCE: HUMAN DEVELOPMENT INDICATORS

| Basic Indicators            | Pop. (mill.) mid-1989                                     | Area (000Km <sup>2</sup> )                                | GNP (\$/cap) 1989 | GNP per capita; av. annual growth rate (%) 1965-89 |
|-----------------------------|---|---|-------------------|--|
| Somalia                     | 6.1   | 638   | 170               | 0  |
| Mauritania                  | 1.9   | 1,026   | 500               | (1)  |
| Sudan                       | 24.5  | 2,506   |                   |  |
| Egypt, Arab Rep.            | 51.0  | 1,001   | 640               | 4  |
| Yemen, Rep.                 | 11.2  | 528   | 650               |  |
| Morocco                     | 24.5  | 447   | 880               | 2  |
| Syrian Arab Rep.            | 12.1  | 185   | 980               | 3  |
| Tunisia                     | 8.0   | 164   | 1,260             | 3  |
| Jordan                      | 3.9   | 89  | 1,640             |  |
| Algeria                     | 24.4  | 2,382   | 2,230             | 3  |
| Lebanon                     |   | 10  |                   |  |
| Oman                        | 1.5   | 212   | 5,220             | 6  |
| Libya                       | 4.4   | 1,760   | 5,310             | (3)  |
| Iraq                        | 18.3  | 438   |                   |  |
| +Saudi Arabia               | 14.4  | 2,150   | 6,020             | 3  |
| +Kuwait                     | 2.0   | 18  | 16,150            | (4)  |
| +United Arab Emirates       | 1.5   | 84  | 18,430            |  |
| World                       | 5,206.1   | 133,609   | 3,980             | 2  |
| Oil exporters (excl. USSR)  | 265.2   | 12,120  | 1,840             | 1  |
| <b>Agriculture and food</b> | <b>Value added in agriculture (mill. current \$) 1970</b> | <b>Value added in agriculture (mill. current \$) 1989</b> |                   |  |
| Somalia                     | 167   | 705   |                   |  |
| Mauritania                  | 58  | 339   |                   |  |
| Sudan                       | 757   |   |                   |  |
| Egypt, Arab Rep.            | 1,942   | 5,858   |                   |  |
| Yemen, Rep.                 |   |   |                   |  |
| Morocco                     | 789   | 3,679   |                   |  |
| Syrian Arab Rep.            | 435   | 2,475   |                   |  |
| Tunisia                     | 245   | 1,235   |                   |  |
| Jordan                      |   | 241   |                   |  |
| Algeria                     | 492   | 6,187   |                   |  |
| Lebanon                     | 136   |   |                   |  |
| Oman                        | 40  | 202   |                   |  |
| Libya                       | 93  |   |                   |  |
| Iraq                        | 579   |   |                   |  |
| +Saudi Arabia               | 219   | 6,150   |                   |  |
| +Kuwait                     | 8   | 238   |                   |  |
| +United Arab Emirates       |   | 481   |                   |  |
| World                       | 249,704   |   |                   |  |
| Oil exporters (excl. USSR)  | 9,822   | 65,457  |                   |  |

SOURCE: WORLD DEVELOPMENT INDICATORS

| Population growth and projections | Population (avg. ann. growth %) 1965-80 | Population (avg. ann. growth %) 1980-89 | Population (avg. ann. growth %) 1989-2000 | Population (millions) 1989 | Population (millions) 2000 | Population (millions) 2025 |
|-----------------------------------|---|---|---|----------------------------|----------------------------|----------------------------|
| Somalia                           | 3                                       | 3                                       | 3   | 6                          | 9                          | 17                         |
| Mauritania                        | 2                                       | 2                                       | 3   | 2                          | 3                          | 5                          |
| Sudan                             | 3                                       | 3                                       | 3   | 24                         | 33                         | 57                         |
| Egypt, Arab Rep.                  | 2                                       | 3                                       | 2   | 51                         | 62                         | 86                         |
| Yemen, Rep.                       | 2                                       | 3                                       | 4   | 11                         | 17                         | 38                         |
| Morocco                           | 3                                       | 3                                       | 2   | 25                         | 32                         | 48                         |
| Syrian Arab Rep.                  | 3                                       | 4                                       | 4   | 12                         | 18                         | 36                         |
| Tunisia                           | 2                                       | 3                                       | 2   | 8                          | 10                         | 14                         |
| Jordan                            | 3                                       | 3                                       | 3   | 4                          | 5                          | 9                          |
| Algeria                           | 3                                       | 3                                       | 3   | 24                         | 33                         | 52                         |
| Lebanon                           | 2                                       |   |   |                            |                            |                            |
| Oman                              | 4                                       | 5                                       | 4   | 1                          | 2                          | 5                          |
| Libya                             | 4                                       | 4                                       | 4   | 4                          | 6                          | 14                         |
| Iraq                              | 3                                       | 4                                       | 3   | 18                         | 26                         | 48                         |
| +Saudi Arabia                     | 5                                       | 5                                       | 4   | 14                         | 21                         | 43                         |
| +Kuwait                           | 7                                       | 4                                       | 3   | 2                          | 3                          | 4                          |
| +United Arab Emirates             | 17                                      | 5                                       | 2   | 2                          | 2                          | 3                          |
| World                             | 2                                       | 2                                       | 2   | 5,206                      | 6,220                      | 8,524                      |
| Oil exporters (excl. USSR)        | 3                                       | 3                                       | 3   | 265                        | 373                        | 692                        |

| Urbanization               | Urban population (% of total pop.) 1965 | Urban population (% of total pop.) 1989 | Urban population (avg. ann. growth rate (%)) 1965-80 | Urban population (avg. ann. growth rate (%)) 1980-89 | Population in capital city as % of urban, 1965 | Population in capital city as % of total, 1990 |
|----------------------------|---|---|--|--|--|--|
| Somalia                    | 20                                      | 36                                      | 5  | 6  | 31   | 11   |
| Mauritania                 | 9                                       | 45                                      | 11   | 8  | 83   | 39   |
| Sudan                      | 13                                      | 22                                      | 6  | 4  | 35   | 8  |
| Egypt, Arab Rep.           | 41                                      | 46                                      | 3  | 3  | 37   | 17   |
| Yemen, Rep.                | 11                                      | 28                                      | 7  | 7  | 11   | 3  |
| Morocco                    | 32                                      | 47                                      | 4  | 4  | 9  | 4  |
| Syrian Arab Rep.           | 40                                      | 50                                      | 5  | 4  | 32   | 16   |
| Tunisia                    | 40                                      | 54                                      | 4  | 3  | 37   | 20   |
| Jordan                     | 46                                      | 67                                      | 4  | 5  | 53   | 32   |
| Algeria                    | 38                                      | 51                                      | 4  | 5  | 23   | 12   |
| Lebanon                    | 50                                      |   | 5  |  |  |  |
| Oman                       | 4                                       | 10                                      | 8  | 9  | 41   | 4  |
| Libya                      | 26                                      | 69                                      | 10   | 7  |  |  |
| Iraq                       | 51                                      | 71                                      | 5  | 4  | 30   | 21   |
| +Saudi Arabia              | 39                                      | 76                                      | 9  | 7  | 17   | 13   |
| +Kuwait                    | 78                                      | 95                                      | 8  | 5  | 53   | 50   |
| +United Arab Emirates      | 41                                      | 78                                      | 24   | 4  |  |  |
| World                      | 36                                      | 49                                      | 3  | 5  | 14   | 6  |
| Oil exporters (excl. USSR) | 30                                      | 50                                      | 6  | 5  | 23   | 11   |

SOURCE: WORLD DEVELOPMENT INDICATORS

| Forests, protected areas, and water | Int renew. water res:ann.withdr,total (cu km)70-87 | Int renew. water res:ann.withdr,(% tot.res):70-87 | Int renew. water res:ann.withdr,per cap tot(cu m)70-87 | Int renew. water res:ann.withdr,per cap dom(cu m)70-87 | Int renew. water res:ann.withdr,per cap l&a(cu m)70-87 |
|-------------------------------------|--|---|--|--|--|
| Somalia                             | 1  | 7   | 167  | 5  | 162  |
| Mauritania                          | 1  | 10  | 473  | 57   | 417  |
| Sudan                               | 19   | 14  | 1,089  | 11   | 1,079  |
| Egypt, Arab Rep.                    | 56   | 97  | 1,202  | 84   | 1,118  |
| Yemen, Rep.                         |  |   |  |  |  |
| Morocco                             | 11   | 37  | 501  | 30   | 471  |
| Syrian Arab Rep.                    | 3  | 9   | 449  | 31   | 418  |
| Tunisia                             | 2  | 53  | 325  | 42   | 283  |
| Jordan                              | 0  | 41  | 173  | 50   | 123  |
| Algeria                             | 3  | 16  | 161  | 35   | 125  |
| Lebanon                             | 1  | 16  | 271  | 30   | 241  |
| Oman                                | 0  | 22  | 561  | 17   | 545  |
| Libya                               | 3  | 374   | 262  | 39   | 222  |
| Iraq                                | 43   | 43  | 4,575  | 137  | 4,437  |
| +Saudi Arabia                       | 2  | 106   | 321  | 145  | 177  |
| +Kuwait                             | 0  |   | 10   | 6  | 4  |
| +Unfted Arab Emirates               | 0  | 140   | 429  | 47   | 381  |

SOURCE: WORLD DEVELOPMENT INDICATORS



Table with 21 columns (1965-1988) and 27 rows. Header: SP POP TOTL Total population. Rows include countries like ALG, BHR, DJI, EGY, IRQ, JOR, KWT, LBN, LYB, MAU, MOR, OMN, QAT, SAU, SOM, SDN, SYR, TUN, UAE, YEM. Values represent population counts.

Table with 21 columns (1965-1988) and 27 rows. Header: SP URB SIZE Urban population as % of total. Rows include countries like DZA, BHR, DJI, EGY, IRQ, JOR, KWT, LBN, LYB, MRT, MAR, OMN, QAT, SAU, SOM, SDN, SYR, TUN, ARE, YEM. Values represent percentages.

Table with 21 columns (1965-1988) and 27 rows. Header: SP GRO TOTL Population growth rate. Rows include countries like DZA, BHR, DJI, EGY, IRQ, JOR, KWT, LBN, LYB, MRT, MAR, OMN, QAT, SAU, SOM, SDN, SYR, TUN, ARE, YEM. Values represent growth rates.

Table with 21 columns (1965-1988) and 27 rows. Header: SP URB GROW Urban population growth rate. Rows include countries like DZA, BHR, DJI, EGY, IRQ, JOR, KWT, LBN, LYB, MRT, MAR, OMN, QAT, SAU, SOM, SDN, SYR, TUN, ARE, YEM. Values represent urban population growth rates.



| SH H2O SAFE | Access to safe water (% of total pop) | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|-------------|---------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DZA         | Algeria                               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 75   |
| BHR         | Bahrain                               |      |      |      |      |      | 99   |      |      |      |      | 100  |      |      |      |      |      |      |      |      |      |      |      | 100  |
| DJI         | Djibouti                              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 43   |
| EGY         | Egypt, Arab Republic of               |      |      |      |      |      | 93   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| IRQ         | Iraq                                  |      |      |      |      |      | 51   |      |      |      |      | 66   |      |      |      |      |      |      |      |      |      |      |      | 84   |
| JOR         | Jordan                                |      |      |      |      |      | 77   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| KWT         | Kuwait                                |      |      |      |      |      | 51   |      |      |      |      | 89   |      |      |      |      |      |      |      |      |      |      |      |      |
| LBN         | Lebanon                               |      |      |      |      |      | 92   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| LBY         | Libya                                 |      |      |      |      |      | 58   |      |      |      |      | 87   |      |      |      |      |      |      |      |      |      |      |      |      |
| MRT         | Mauritania                            |      |      |      |      |      | 17   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| MAR         | Morocco                               |      |      |      |      |      | 51   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| OMN         | Oman                                  |      |      |      |      |      |      |      |      |      |      | 52   |      |      |      |      |      |      |      |      |      |      |      | 58   |
| QAT         | Qatar                                 |      |      |      |      |      | 95   |      |      |      |      | 97   |      |      |      |      |      |      |      |      |      |      |      | 58   |
| SAU         | Saudi Arabia                          |      |      |      |      |      | 49   |      |      |      |      | 64   |      |      |      |      |      |      |      |      |      |      |      | 93   |
| SOM         | Somalia                               |      |      |      |      |      | 15   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 31   |
| SDN         | Sudan                                 |      |      |      |      |      | 19   |      |      |      |      | 50   |      |      |      |      |      |      |      |      |      |      |      |      |
| SYR         | Syrian Arab Republic                  |      |      |      |      |      | 71   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| TUN         | Tunisia                               |      |      |      |      |      | 49   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| ARE         | United Arab Emirates                  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 68   |
| YEM         | Yemen Arab Republic                   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

| SH H2O SAFE | Access to safe water (% of urban pop) | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|-------------|---------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DZA         | Algeria                               |      |      |      |      |      | 84   |      |      |      |      |      |      |      |      |      | 100  |      |      |      |      |      |      | 85   |
| BHR         | Bahrain                               |      |      |      |      |      | 100  |      |      |      |      | 100  |      |      |      |      |      |      |      |      |      |      |      | 100  |
| DJI         | Djibouti                              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 50   |
| EGY         | Egypt, Arab Republic of               |      |      |      |      |      | 94   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| IRQ         | Iraq                                  |      |      |      |      |      | 83   |      |      |      |      | 100  |      |      |      |      |      |      |      |      |      |      |      | 100  |
| JOR         | Jordan                                |      |      |      |      |      | 98   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| KWT         | Kuwait                                |      |      |      |      |      | 60   |      |      |      |      | 100  |      |      |      |      |      |      |      |      |      |      |      |      |
| LBN         | Lebanon                               |      |      |      |      |      | 95   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| LBY         | Libya                                 |      |      |      |      |      | 100  |      |      |      |      | 100  |      |      |      |      |      |      |      |      |      |      |      |      |
| MRT         | Mauritania                            |      |      |      |      |      | 98   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| MAR         | Morocco                               |      |      |      |      |      | 92   |      |      |      |      |      |      |      |      |      | 100  |      |      |      |      |      |      | 73   |
| OMN         | Oman                                  |      |      |      |      |      |      |      |      |      |      | 100  |      |      |      |      | 70   |      |      |      |      |      |      | 100  |
| QAT         | Qatar                                 |      |      |      |      |      | 100  |      |      |      |      | 100  |      |      |      |      |      |      |      |      |      |      |      | 90   |
| SAU         | Saudi Arabia                          |      |      |      |      |      | 100  |      |      |      |      | 97   |      |      |      |      |      |      |      |      |      |      |      | 100  |
| SOM         | Somalia                               |      |      |      |      |      | 17   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 58   |
| SDN         | Sudan                                 |      |      |      |      |      | 61   |      |      |      |      | 96   |      |      |      |      |      |      |      |      |      |      |      |      |
| SYR         | Syrian Arab Republic                  |      |      |      |      |      | 98   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| TUN         | Tunisia                               |      |      |      |      |      | 92   |      |      |      |      | 93   |      |      |      |      |      |      |      |      |      |      |      | 100  |
| ARE         | United Arab Emirates                  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 77   |
| YEM         | Yemen Arab Republic                   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

| SH H2O SAFE | Access to safe water (% of rural pop) | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|-------------|---------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| DZA         | Algeria                               |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 70   |      |      |      |      |      |      | 55   |
| BHR         | Bahrain                               |      |      |      |      |      | 94   |      |      |      |      | 100  |      |      |      |      |      |      |      |      |      |      |      | 100  |
| DJI         | Djibouti                              |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 20   |
| EGY         | Egypt, Arab Republic of               |      |      |      |      |      | 93   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| IRQ         | Iraq                                  |      |      |      |      |      | 7    |      |      |      |      | 11   |      |      |      |      |      |      |      |      |      |      |      | 54   |
| JOR         | Jordan                                |      |      |      |      |      | 59   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| KWT         | Kuwait                                |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| LBN         | Lebanon                               |      |      |      |      |      | 85   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| LBY         | Libya                                 |      |      |      |      |      | 42   |      |      |      |      | 82   |      |      |      |      |      |      |      |      |      |      |      | 77   |
| MRT         | Mauritania                            |      |      |      |      |      | 10   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| MAR         | Morocco                               |      |      |      |      |      | 28   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| OMN         | Oman                                  |      |      |      |      |      |      |      |      |      |      | 48   |      |      |      |      | 10   |      |      |      |      |      |      | 25   |
| QAT         | Qatar                                 |      |      |      |      |      | 75   |      |      |      |      | 83   |      |      |      |      |      |      |      |      |      |      |      | 49   |
| SAU         | Saudi Arabia                          |      |      |      |      |      | 37   |      |      |      |      | 56   |      |      |      |      |      |      |      |      |      |      |      | 68   |
| SOM         | Somalia                               |      |      |      |      |      | 14   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 22   |
| SDN         | Sudan                                 |      |      |      |      |      | 13   |      |      |      |      | 43   |      |      |      |      |      |      |      |      |      |      |      |      |
| SYR         | Syrian Arab Republic                  |      |      |      |      |      | 50   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| TUN         | Tunisia                               |      |      |      |      |      | 17   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 31   |
| ARE         | United Arab Emirates                  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 65   |
| YEM         | Yemen Arab Republic                   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

SOURCE: SOCIAL INDICATORS OF DEVELOPMENT







|                |  | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|----------------|--|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| NP AGR TOTL ZG | Agriculture: contribution to growth of GDP (%) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| DZA            | Algeria  |      |      | 0    | 0    | (1)  | 2    | 3    | (0)  | (1)  | 1    | 1    | 1    | 0    | (1)  | (0)  | 1    | 3    | 1    | 1    | (1)  | 2    |      |
| BHR            | Bahrain  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| EGY            | Egypt, Arab Republic of                        |      | 1    | 1    | 4    | 1    | 0    | 3    | 1    | (1)  | 2    | 1    | 1    | 0    | 1    | 1    | 1    | 1    | 0    | 0    | 1    | 0    | 0    |
| JOR            | Jordan   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | (1)  | 1    | 0    | 2    | 1    | (1)  | 1    |
| KWT            | Kuwait   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| LBY            | Libya  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| MRT            | Mauritania                                     |      | (2)  | (5)  | 14   | (9)  | (0)  | (8)  | 1    | 2    | (1)  | 1    | 4    | 3    | 1    | 6    | (8)  | 1    | 3    | 1    | (0)  | 1    | (1)  |
| MAR            | Morocco  |      | 1    | 2    | (1)  | (2)  | 0    | (1)  | 3    | (2)  | 3    | (0)  | 2    | (5)  | 4    | (2)  | 1    | 3    | 8    | (5)  | 5    | (0)  | 1    |
| OMN            | Oman   |      |      |      |      |      |      |      |      |      |      | 1    | 1    | 0    | 0    | 1    | 0    | 1    | (0)  | (0)  | 0    |      |      |
| SAU            | Saudi Arabia                                   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| SDN            | Sudan  |      | 10   | 4    | (1)  | (4)  | 8    | 3    | 2    | 7    | 1    | (7)  | (2)  | (2)  | 13   | (4)  | (2)  | (4)  | 7    | 0    | (5)  | 8    |      |
| SYR            | Syrian Arab Republic                           |      | (9)  | 2    | 14   | (15) | 17   | 0    | 5    | (4)  | 6    | (4)  | 10   | 1    | (1)  | (0)  | (2)  | 2    | 2    | (4)  | 8    |      |      |
| TUN            | Tunisia  |      | 1    | 4    | 5    | (2)  | 3    | 1    | 1    | (2)  | 1    | (1)  | 2    | 1    | (2)  | 0    | 2    | 3    | (2)  | 3    | (4)  | 1    | 4    |
| ARE            | United Arab Emirates                           |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

|                |   | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|----------------|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| NP IND TOTL ZG | Industry: contribution to growth of GDP (%) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| DZA            | Algeria                                     |      |      | (9)  | 18   | 3    | (10) | (2)  | 5    | 3    | 5    | 2    | 1    | 5    | 3    | 8    | 4    | 3    | (0)  | (5)  | 2    | (1)  |      |
| BHR            | Bahrain                                     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| EGY            | Egypt, Arab Republic of                     |      | 2    | 1    | 0    | (1)  | (1)  | 4    | 4    | 6    | 5    | 3    | 4    | 1    | 1    | 2    | 3    | 2    | 1    | 1    | 1    | 1    | (1)  |
| JOR            | Jordan                                      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 2    | (3)  | 2    | 0    | 0    | 1    | (3)  |
| KWT            | Kuwait                                      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| LBY            | Libya                                       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| MRT            | Mauritania                                  |      | 2    | 1    | (2)  | (1)  | 3    | (2)  | 2    | (2)  | 1    | 2    | (1)  | 0    | (1)  | (1)  | 5    | 1    | 1    | (0)  | 1    | 3    | 0    |
| MAR            | Morocco                                     |      | 1    | 3    | 2    | 2    | 2    | 4    | 4    | 3    | (0)  | 3    | (1)  | 1    | 1    | 1    | 2    | 0    | 1    | 3    | (0)  | 1    |      |
| OMN            | Oman  |      |      |      |      |      |      |      |      |      |      | (3)  | (0)  | 12   | 7    | 16   | 11   | 13   | 8    | 1    |      |      |      |
| SAU            | Saudi Arabia                                |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| SDN            | Sudan                                       |      | (1)  | (0)  | (1)  | (1)  | 2    | 2    | 3    | 1    | (1)  | (0)  | 1    | 1    | 2    | 2    | (1)  | 0    | 1    | 1    | 0    | (0)  |      |
| SYR            | Syrian Arab Republic                        |      | 2    | 5    | 2    | (0)  | 5    | 6    | 2    | (2)  | 1    | 1    | (0)  | (0)  | 1    | 1    | (2)  | 2    | 2    | (4)  | 2    |      |      |
| TUN            | Tunisia                                     |      | 3    | 2    | 4    | 0    | 1    | 5    | (0)  | 2    | 3    | 4    | 3    | 2    | 0    | 2    | 1    | 1    | (0)  | 0    | 1    | 2    | 1    |
| ARE            | United Arab Emirates                        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

|                |   | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|----------------|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| NP SRV TOTL ZG | Services: contribution to growth of GDP (%) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| DZA            | Algeria                                     |      |      | 1    | 2    | 1    | 15   | 4    | 4    | 3    | 4    | 5    | (1)  | (2)  | 4    | (1)  | (1)  | 0    | 1    | 6    | (4)  | 8    |      |
| BHR            | Bahrain                                     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| EGY            | Egypt, Arab Republic of                     |      | 3    | 2    | (1)  | 4    | 5    | 3    | 11   | 8    | 1    | 4    | 6    | 2    | 9    | 5    | 3    | 4    | 2    | 1    | 2    | 2    | 1    |
| JOR            | Jordan                                      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      | 1    | 4    | 8    | 3    | (2)  | (4)  | (5)  |
| KWT            | Kuwait                                      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| LBY            | Libya                                       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| MRT            | Mauritania                                  |      | 10   | 5    | (10) | 3    | 7    | 2    | 5    | (1)  | (0)  | 2    | 2    | 1    | (2)  | 0    | (5)  | 1    | 2    | 2    | 3    | 0    | 2    |
| MAR            | Morocco                                     |      | 3    | 1    | 1    | 4    | 3    | 4    | 5    | 4    | 1    | 2    | 7    | 1    | 4    | 1    | 3    | 2    | 2    | 2    | 3    | 2    | 2    |
| OMN            | Oman  |      |      |      |      |      |      |      |      |      |      | 4    | 3    | 5    | 4    | 2    | 4    | 2    | (2)  | 1    |      |      |      |
| SAU            | Saudi Arabia                                |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| SDN            | Sudan                                       |      | (4)  | 3    | (1)  | (3)  | 0    | 9    | 14   | 7    | (1)  | (3)  | 2    | 2    | (2)  | 4    | (3)  | (2)  | 3    | 0    | 3    | (1)  |      |
| SYR            | Syrian Arab Republic                        |      | 1    | 3    | 0    | 10   | 5    | 16   | 2    | 4    | 1    | 8    | (1)  | 9    | 3    | 1    | (0)  | 0    | (5)  | (2)  | 3    |      |      |
| TUN            | Tunisia                                     |      | 3    | 5    | 10   | 2    | 4    | 2    | 7    | 3    | 3    | 4    | 3    | 2    | 1    | 2    | 3    | 2    | 1    | 3    | 5    | 1    | 2    |
| ARE            | United Arab Emirates                        |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

SOURCE: WORLD TABLES