

**ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA**

**POPULATION AND DEVELOPMENT REPORT**

**FIRST ISSUE**

**WATER SCARCITY IN THE ARAB WORLD**

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## **Preface**

This study was prepared by the Economic and Social Commission for Western Asia (ESCWA) through its Social Development Division in collaboration with the Population Reference Bureau (PRB) and the Cairo Office of the Ford Foundation.

It represents a component of the commitment by ESCWA to its members to follow up on the outcomes of the United Nations International Conference on Population and Development (ICPD) (Cairo, 5-13 September 1994) and within the general framework of the twenty-first special session of the United Nations General Assembly (New York, 30 June – 2 July 1999) and the plan of action for the Millennium Development Goals.

This report is the first of a series of reports on population and development to be published every biennium with the principal aim of highlighting the strong links between population and development and their economic, social and political impacts at national and regional levels.



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## ABBREVIATIONS AND EXPLANATORY NOTES

AFESD	Arab Fund for Economic and Social Development
AU	African Union
BWR	basic water requirement
BPW	births per woman
CESCR	United Nations Committee on Economic, Social and Cultural Rights
CGIAR	Consultative Group on International Agricultural Research
DESA	United Nations, Department of Economic and Social Affairs
ENS	Environment News Service
ICPD	United Nations International Conference on Population and Development
IPTRID	International Programme for Technology and Research in Irrigation and Drainage
IWMI	International Water Management Institute
km <sup>3</sup> /y	cubic kilometres per year
l/d	litres per day
LAS	League of Arab States
m <sup>3</sup> /y	cubic metres per year
MEI	Middle East Institute
NBI	Nile Basin Initiative
NGO	non-governmental organization
PRB	Population Reference Bureau
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WCD	World Commission on Dams
WHO	World Health Organization
WRI	World Resources Institute
WSSD	World Summit on Sustainable Development

References to the dollar symbol (\$) indicate American dollars.

## Introduction

At its fifty-fifth session, the General Assembly declared 2003 the International Year of Freshwater to highlight the key role played by freshwater on public health, food production and socio-economic development. Water is such a critical and essential resource for human life that it could ultimately define the limits of sustainable development at both national and global levels. Within the context of sustainable development, freshwater is a particularly pressing issue in the Arab region, which contains a modest 1.1 per cent of global renewable freshwater for a total of 4.6 per cent of the world's population.

Access to safe water is a global concern. While certain innovations can maximize the use of available water, technological advances cannot change the rate at which water is renewed in the global water circulation system. This rate has remained static from the first civilizations that arose in river basins when population growth and distribution were intimately linked to the availability of freshwater. Given the subsequent population explosion since those earliest days of civilization, water has become an increasingly crucial concern, particularly in the Arab region where severe water scarcity has been compounded by one of the fastest-growing populations in the world.<sup>1</sup> Water scarcity is a key dimension of poverty in Arab countries. Moreover, as population pressures in the region increase, the demand for water resources rise, thereby further hampering efforts aimed at alleviating poverty and promoting sustainable development in the region.

In the Arab region, it is particularly crucial to address the issue of water in the context of ICPD. The Programme of Action that emanated from that Conference presents a policy dialogue and a framework for achieving sustainable development that is socially equitable. Additionally, the Programme promotes a harmonious and dynamic balance between population, natural resources, the environment and development, thereby providing a blueprint for slowing down population growth and improving the quality of life. The links between population growth, widespread poverty, unsustainable use of natural resources and environmental degradation "call for patterns of development that reflect the new understanding of these and other inter-sectoral linkages".<sup>2</sup>

This report examines the severity of freshwater shortages in the Arab region; the impact of such shortages on the population; and the challenges that Arab countries face in meeting a growing demand for safe water. Within that context, this study explores options and strategies available to Governments in controlling scarce freshwater supplies and in managing demand through conservation and the use of

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<sup>1</sup> In this study, the Arab region refers to the member countries of the League of Arab States (LAS).

<sup>2</sup> See the Programme of Action of ICPD, chapter 3, paragraph 3.1



efficient technologies. Additionally, this report investigates demographic trends in the Arab region with the aim of reducing long-term pressure on water by slowing down population growth and by improving the reproductive healthcare of women, which can contribute to equitable sustainable development.

# I. POPULATION GROWTH AND WATER SCARCITY IN THE ARAB WORLD

## A. POPULATION TRENDS IN THE ARAB REGION

Given that demographic trends have a direct impact on the demand for freshwater, it is important to understand such demand by analysing population trends. In the Arab region, as in most other regions of the developing world, a decline in mortality, particularly since the second half of the twentieth century, led to rapid population growth. The introduction of modern medical services and of such public health interventions as antibiotics, immunizations and improved sanitation caused death rates in the developing world to drop rapidly after the 1950s, while the decline in birth rates lagged behind, which resulted in high rates of natural increase or a surplus of births over deaths. The resulting declines in mortality in the developing world benefited mainly infants and young children. In the Arab region, infant mortality dropped from approximately 200 deaths per 1,000 live births in the early 1950s to less than 70 deaths per 1,000 live births in 2000.<sup>3</sup>

As death rates dropped and fertility rates remained relatively high, the population in the Arab region more than doubled in 30 years, growing from 125 million in 1970 to exceed 280 million in 2000. This growth is expected to continue unabated in the next 30 years and reach an estimated 500 million inhabitants in 2030, see table 1.

TABLE 1. POPULATION OF ARAB COUNTRIES IN 1970, 2000 AND 2030  
(PROJECTED)

Country and territory	Total fertility rate	Annual growth rate of population (percentage)	Population (thousands)		
			1970	2000	2030
Algeria	2.8	1.8	13 746	30 291	44 914
Bahrain	2.6	1.8	220	640	923
Comoros	6.8	3.5	276	706	1 455
Djibouti	5.9	2.0	155	632	860
Egypt	3.5	2.1	35 285	67 884	99 492
Iraq	5.4	2.5	9 356	22 946	43 099
Jordan	3.7	2.4	1 623	4 913	9 345
Kuwait	4.0	1.7	744	1 914	3 394
Lebanon	2.4	1.4	2 469	3 496	4 730
Libyan Arab Jamahiriya	3.7	2.4	1 986	5 290	8 448

<sup>3</sup> Infant mortality is defined as the death of children under the age of one year.

TABLE 1 (continued)

Country and territory	Total fertility rate	Annual growth rate of population (percentage)	Population (thousands)		
			1970	2000	2030
Mauritania	6.0	2.9	1 221	2 665	6 027
Morocco	2.7	1.6	15 310	29 878	44 124
Oman	4.1	2.5	723	2 538	6 108
Palestine	5.7	3.5	1 096	3 191	8 143
Qatar	3.5	1.6	111	565	775
Saudi Arabia	5.7	2.9	5 745	20 346	44 778
Somalia	7.2	2.9	3 601	8 778	24 657
Sudan	5.5	2.8	14 428	31 095	52 577
Syrian Arab Republic	3.8	2.4	6 258	16 189	29 256
Tunisia	2.1	1.1	5 127	9 459	12 780
United Arab Emirates	3.0	1.4	223	2 606	3 548
Yemen	7.0	3.3	6 332	18 349	57 526
Arab region		2.7	126 035	284 371	506 959

Sources: United Nations, Department of Economic and Social Affairs (DESA), *World Urbanization Prospects: The 2001 Revision* (New York, 2002), available at: <http://www.un.org/esa/population/publications/wup2001/>; and C. Haub, *2003 World Population Data Sheet* (PRB, 2003), available at: [http://www.prb.org/pdf/WorldPopulationDS03\\_Eng.pdf](http://www.prb.org/pdf/WorldPopulationDS03_Eng.pdf).

At a regional level, the population is currently growing at 2.7 per cent a year and is set to double in 26 years.<sup>4</sup> At a national level, the highest annual rates of population growth are found in the following: Comoros (3.5 per cent); Mauritania (2.9 per cent); Palestine (3.5 per cent); Saudi Arabia (2.9 per cent); Somalia (2.9 per cent); and Yemen (3.3 per cent).

While average fertility has been declining in the region and currently stands at approximately 4 births per woman (bpw), down from some 7 bwp in the 1960s, it remains significantly above the global average of 2.8 bpw. However, this rate varies dramatically across the region, ranging from a low of 2.1 bpw in Tunisia to over 5 bpw in Comoros, Djibouti, Iraq, Mauritania, Palestine, Saudi Arabia, Somalia, Sudan and Yemen. Moreover, countries with high levels of fertility and population growth rate are typically the least equipped to meet their growing demand for water, both financially and technologically.

<sup>4</sup> Mathematically, a population that grows annually by x per cent doubles in size every n years, where  $(1+x)^n = 2$ .

At a regional level, average fertility is expected to continue its decline. However, population is set to continue its rapid growth due to a phenomenon known as population momentum.<sup>5</sup> An estimated one-third of the population in the region is aged under 15 years. Consequently, the drop in fertility rates is offset by a comparatively larger number of young women entering into their childbearing years. This population momentum has been measured in Jordan where, despite a projected drop in fertility from the current 3.7 bpw to 2.1 bpw in 2050, which represents a decline by over 50 per cent, the population is expected to double in that period given that 40 per cent of the population in 2000 was aged under 15 years.<sup>6</sup>

The population growth has generally been surpassed by the high rate of urbanization. Given the expansion of urban areas and a continued migration to these areas from rural settings, the number of urban dwellers in the Arab region grew from approximately 50 million in 1970 to 150 million in 2000, and is projected to reach more than 300 million by 2030 (see table 2). Urban developers and planners are increasingly concerned with the speed at which cities are growing, and are struggling to provide adequate services, including safe water and sanitation, to a growing number of urban residents.

TABLE 2. URBAN AND RURAL POPULATIONS OF ARAB COUNTRIES  
IN 1970, 2000 AND 2030 (PROJECTED)  
(Thousands)

Country and territory	Urban population			Rural population		
	1970	2000	2030	1970	2000	2030
Algeria	5 430	17 311	32 212	8 316	12 980	12 702
Bahrain	173	590	884	47	50	39
Comoros	53	235	759	222	471	695
Djibouti	96	531	767	59	101	93
Egypt	14 894	28 970	54 102	20 391	38 914	45 390
Iraq	5 254	15 493	31 867	4 102	7 453	11 232
Jordan	910	3 867	7 887	713	1 046	1 458
Kuwait	579	1 838	3,308	165	76	87
Lebanon	1 466	3 138	4 440	1 003	359	290
Libyan Arab Jamahiriya	900	4 635	7 774	1 086	654	675
Mauritania	167	1 539	4 846	1 054	1 126	1 181
Morocco	5 298	16 571	31 333	10 012	13 307	12 792
Oman	83	1 928	5 249	640	610	859
Palestine	595	2 132	6 258	501	1 059	1 884

<sup>5</sup> Population momentum is an age structure that favours continuation of high birth rates resulting from a large number of women in or entering into their childbearing years.

<sup>6</sup> United Nations, DESA, *World Population Prospects: The 2000 Revision (Highlights)* (New York, 2001).

TABLE 2 (continued)

Country and territory	Urban population			Rural population		
	1970	2000	2030	1970	2000	2030
Qatar	89	524	744	22	41	31
Saudi Arabia	2 796	17 531	41 453	2 949	2 815	3 325
Somalia	733	2 413	11 291	2 868	6 365	13 366
Sudan	2 364	11 231	30 323	12 064	19 864	22 254
Syrian Arab Republic	2 713	8 324	19 201	3 545	7 865	10 055
Tunisia	2 283	6 198	10 020	2 844	3 261	2 760
United Arab Emirates	127	2 260	3 309	95	346	239
Yemen	842	4 534	23 601	5 489	13 815	33 925
Arab region	47 845	151 793	331 628	78 187	132 578	175 332

Source: United Nations, DESA, *World Urbanization Prospects: The 2001 Revision* (New York, 2002), available at: <http://www.un.org/esa/population/publications/wup2001/>.

Currently, more than half the population of the region resides in cities, which is projected to rise to 65 per cent by 2030. Moreover, the percentage of urban population already exceeds 75 per cent in 10 countries, namely, Bahrain, Djibouti, Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia and United Arab Emirates (see table 3).

Equally, rural populations in most Arab countries are projected to experience similar growths due to comparatively higher fertility rates in rural areas. This rural growth is expected to be more significant in countries where a majority of the population are currently rural dwellers, particularly Somalia and Yemen, where some three-quarters of their populations reside outside cities. While the rural populations of those two countries are expected to more than double between 2000 and 2030, their urban populations are projected to quadruple over the same period.

TABLE 3. PERCENTAGE OF URBAN POPULATION OF ARAB COUNTRIES  
IN 1970, 2000 AND 2030 (PROJECTED)  
(Percentage)

Country and territory	1970	2000	2030
Algeria	40	57	72
Bahrain	79	92	96
Comoros	19	33	52
Djibouti	62	84	89
Egypt	42	43	54
Iraq	56	68	74
Jordan	56	79	84

TABLE 3 (continued)

Country and territory	1970	2000	2030
Kuwait	78	96	97
Lebanon	59	90	94
Libyan Arab Jamahiriya	45	88	92
Mauritania	14	58	80
Morocco	35	56	71
Oman	11	76	86
Palestine	54	67	77
Qatar	80	93	96
Saudi Arabia	49	86	93
Somalia	20	28	46
Sudan	16	36	58
Syrian Arab Republic	43	51	66
Tunisia	45	66	78
United Arab Emirates	57	87	93
Yemen	13	25	41
Arab region	38	53	65

Source: United Nations, DESA, *World Urbanization Prospects: The 2001 Revision* (New York, 2002), available at: <http://www.un.org/esa/population/publications/wup2001/>.

#### B. CRITICAL FRESHWATER RESOURCES

Access to safe water is a global concern. Freshwater sustains human health, food production and economic development. While certain innovations can maximize the use of available water, technological advances cannot change the rate at which water is renewed in the global water circulation system. Freshwater or salt-free water resources amount to a meagre 3 per cent of global water. Moreover, nearly 70 per cent of freshwater is locked in glaciers and icebergs and is not available for human use. The freshwater that is available comes from rain, rivers, lakes, springs and groundwater reserves, including aquifers.<sup>7</sup> At a regional level, the available renewable freshwater is estimated at 474 cubic kilometres a year ( $\text{km}^3/\text{y}$ ), and the per capita renewable freshwater in 2000 was 1,687 cubic metres a year ( $\text{m}^3/\text{y}$ ) (see table 4).

<sup>7</sup> Water below the water table contained in solid or fractured rock is known as groundwater; aquifers are geologic formations that store, transport and yield groundwater to wells. P.H. Gleick, *The World's Water 2000-2001: The Biennial Report on Freshwater Resources* (Island Press, 2000).

TABLE 4. ANNUAL RENEWABLE FRESHWATER AVAILABLE IN ARAB COUNTRIES IN 1970, 2000 AND 2030 (PROJECTED)

Country and territory	Total renewable freshwater (km <sup>3</sup> /y)	Per capita renewable freshwater (m <sup>3</sup> /y)		
		1970	2000	2030
Algeria	14.3	1 040	472	318
Bahrain	0.1	455	156	108
Comoros	1	3 623	1 416	687
Djibouti	0.3	1 935	475	349
Egypt	86.8	2 460	1 279	872
Iraq	96.4	10 304	4 201	2 237
Jordan	0.9	555	183	96
Kuwait	0.02	27	10	6
Lebanon	4.8	1 944	1 373	1 015
Libyan Arab Jamahiriya	0.6	302	113	71
Mauritania	11.4	9 337	4 278	1 891
Morocco	30.0	1 960	1 004	680
Oman	1.0	1 383	394	164
Palestine	..	..	..	..
Qatar	0.1	901	177	129
Saudi Arabia	2.4	418	118	54
Somalia	15.7	4 360	1 789	637
Sudan	154	10 674	4 953	2 929
Syrian Arab Republic	46.1	7 367	2 848	1 576
Tunisia	4.1	800	433	321
United Arab Emirates	0.2	897	77	56
Yemen	4.1	648	223	71
Arab region <sup>a/</sup>	474.32	3 796	1 687	951

Sources: United Nations, DESA, *World Population Prospects: The 2000 Revision (Highlights)* (New York, 2001); and P.H. Gleick et al., *The World's Water 2002-2003: The Biennial Report on Freshwater Resources* (Island Press, 2002).

Note: Two dots (..) indicate that data are not available.

<sup>a/</sup> Excluding Palestine.

The rapid population growth has exacerbated water scarcity in the Arab region. While such natural factors as intermittent droughts and limited freshwater reserves cause scarcity, high population growth imposes additional pressures. Water experts define regions where per capita water supply drops below 1,700 m<sup>3</sup>/y as experiencing “water stress”, which is a situation in which disruptive water shortages can frequently occur. In regions where per capita water supplies drop below 1,000 m<sup>3</sup>/y, the consequences can be more severe and lead to problems with food production and economic development. Countries below this lower threshold are termed “water-scarce”. Table 4 illustrates that, with a per capita supply of 1,687 m<sup>3</sup>/y in 2000, the region was already water-stressed. Moreover, given the growing population, this

supply is projected to fall below the threshold of 1,000 m<sup>3</sup>/y by 2030, thereby shifting the region into the water-scarce bracket.

However, these regional averages mask the already severe water shortages in a number of countries. In 2000, there were four water-stressed countries in the region, namely, Comoros, Egypt, Lebanon and Morocco, and 12 water-scarce countries with per capita supplies of renewable freshwater below 500 m<sup>3</sup>/y, as follows: Algeria, Bahrain, Djibouti, Jordan, Kuwait, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates and Yemen. Kuwait, which has negligible renewable freshwater of its own, is almost entirely dependent on such unconventional sources as desalination to meet its demand for water. Moreover, by 2030, the per capita supply in the Syrian Arab Republic is expected to drop below 1,700 m<sup>3</sup>/y due to the high population growth in that country. Consequently, only two Arab countries are projected to be above the water-stressed threshold in 2030, namely, Sudan and Iraq, which currently account for half of the renewable freshwater resources in the Arab region.

Moreover, water use is determined both by the quantity and quality of available freshwater and by the ability to collect and transport the water to users. Additionally, a significant amount of renewable freshwater in the Arab region is lost due to evaporation and other ecological factors before it can be collected for human use. Water withdrawal in the region is estimated to be close to 200 km<sup>3</sup>/y, or some 700 m<sup>3</sup>/y per person. If this per capita withdrawal rate persists, the region will be exploiting 70 per cent of its renewable freshwater resources by 2030, which represents an increase from 40 per cent in 2000.

Water experts have set a per capita benchmark of 50 litres per day (l/d) as a basic water requirement (BWR) for such domestic uses as drinking, cooking, sanitation services and bathing, and have urged the international community to recognize BWR as a standard against which to measure access to safe water. While national per capita averages can be more than 50 l/d, domestic water use can fall below this threshold. This is the case of Djibouti, Oman and Somalia, which, despite national per capita averages of 1,300 l/d, 1,078 l/d and 4,890 l/d, respectively, all have average per capita domestic water use of less than 50 l/d.<sup>8</sup>

### 1. *Health*

The quality of water is an important aspect of water security, particularly for the poor. According to the World Health Organization (WHO), an estimated 3.4 million people in the world die each year due to inadequate water and sanitation and “over 40 per cent of this burden falls on children under five years of age, even though they

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<sup>8</sup> P.H. Gleick et al., *The World's Water 2002-2003: The Biennial Report on Freshwater Resources* (Island Press, 2002).



make up only about 10 per cent of the world's population".<sup>9</sup> While water-related diseases have largely been eliminated as serious health problems in developed countries, they remain a major concern in most developing countries. Water-related diseases come in a variety of forms. In some instances, water can be the agent of transmission, carrying bacteria, parasites and viruses that cause diarrhoea. Other diseases come from hosts that either live in water or require water for part of their lifecycle. These diseases are transmitted to humans when the water is ingested or comes into contact with the skin. The main examples are schistosomiasis, equally known as bilharzia, and dracunculiasis, commonly known as guinea worm.

While Arab Governments have largely succeeded in eliminating or reducing the incidence of water-related diseases, there are pockets throughout the region where people are still suffering from these diseases. In addition to malaria, which is a water-related disease that is prevalent in the Arab region, approximately 55,000 cases of guinea worm were reported in Sudan in 2000, and a further 8,000 cases in Nigeria.<sup>10</sup>

## 2. Poverty

The links between poverty, water and population are complex and multifaceted. The relationship is particularly profound in the agricultural sector where the livelihood of subsistence farmers depends on the quantity of water available to them. When these quantities are insufficient to grow food and feed animals, these farmers are often forced to leave their rural settings to migrate to the cities where they join the urban poor. Poverty and a sense of helplessness among the rural communities are compounded by droughts in the Arab region.

Furthermore, both the rural and urban poor generally lack access to adequate and safe water. This is largely attributed to a failure by Governments to adopt and implement appropriate policies and strategies with regard to water shortages and distribution. Within the context of the latter, the poor tend to lack water and food because they do not have options for acquiring their share of the scarce resources. Consequently, water insecurity is "not only due to poor water endowment but more importantly to the inability of the agricultural sector, national administrations and institutions to adapt to the resource scarcity and take measures to find alternatives".<sup>11</sup>

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<sup>9</sup> Environment News Service (ENS), "Water for health declared a human right" (ENS, 4 December 2002). Available at: <http://ens-news.com/ens/dec2002/2002-12-04-01.asp>.

<sup>10</sup> P.H. Gleick et al., *The World's Water 2002-2003: The Biennial Report on Freshwater Resources* (Island Press, 2002).

<sup>11</sup> Consultative Group on International Agricultural Research (CGIAR), "Trade as a means to food and water security", which was presented at the Dialogue on Water, Food and Environment organized by the International Water Management Institute (IWMI) (Colombo, 13-16 December 2000).

Access to safe water is key to eliminating a host of preventable diseases and advancing socio-economic development. It represents a component of the commitment by Governments to follow up on the outcomes of the World Summit on Sustainable Development (WSSD) (Johannesburg, South Africa, 2-11 September 2002), which calls on the number of people without access to adequate and safe water to be halved by 2015.

Moreover, in an unprecedented move, the United Nations Committee on Economic, Social and Cultural Rights (CESCR) declared water a basic human right that is “indispensable for leading a healthy life in human dignity”.<sup>12</sup> By this declaration, water becomes an intrinsic human right on par with such social equities as rights to adequate food and nutrition, shelter and education. Recognizing the variation in water use among different cultures, CESCR defined the adequate amount of safe water as that necessary to prevent death from dehydration, reduce the risk of water-related disease, and provide for consumption, cooking, and personal and domestic hygienic requirements.<sup>13</sup> The move was welcomed by the international development community, which saw the declaration as a major boost to efforts aimed at reducing the number of people without access to adequate and safe water. Furthermore, within the framework of this new definition of water, civil societies are entitled to hold Governments accountable for equitable access to water, particularly for the poor.

### C. THE ROLE OF POPULATION IN THE DEMAND FOR FRESHWATER

It is necessary to understand the demographic trends of the region in order to plan and manage water resources that meet the demand for freshwater. Population growth usually increases demand for water in all sectors of the economy, including agricultural, industrial and domestic. In the Arab region, agriculture accounts for the overwhelming majority of water use at 89 per cent of total water supply, while the remaining 11 per cent is divided between industrial and domestic sectors, see table 5.

Between 1965 and 1997, the total amount of land under irrigation in the region nearly doubled, which is partly due to the increase in demand for food to meet the demand of growing populations.<sup>14</sup> Equally, these growing populations have expanded the demand for water in industrial and service sectors. Industry requires water for manufacturing and cooling, in addition to removing wastes generated by these processes. While demand for water in all sectors has increased rapidly in the region, it

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<sup>12</sup> See General Comment No. 15 (2002), twenty-ninth session of the United Nations Committee on Economic, Cultural and Social Rights (Geneva, 11-29 November 2002).

<sup>13</sup> ENS, “Water for health declared a human right” (ENS, 4 December 2002). Available at: <http://ens-news.com/ens/dec2002/2002-12-04-01.asp>.

<sup>14</sup> P.H. Gleick, *The World's Water 2000-2001: The Biennial Report on Freshwater Resources* (Island Press, 2000).

has risen most rapidly in the domestic sector.<sup>15</sup> The domestic share of water is already much higher than the industrial share in some Arab countries, and constitutes 25 per cent or more of total water use in five countries, namely, Algeria, Bahrain, Comoros, Kuwait and Lebanon.

TABLE 5. FRESHWATER USE BY SECTOR IN ARAB COUNTRIES  
(Percentages)

Country and territory	Agricultural	Industrial	Domestic
Algeria (1990)	60	15	25
Bahrain (1991)	56	4	39
Comoros (1987)	47	5	48
Djibouti (1985)	87	0	13
Egypt (1993)	86	8	6
Iraq (1990)	92	5	3
Jordan (1993)	75	3	22
Kuwait (1994)	60	2	37
Lebanon (1994)	68	4	28
Libyan Arab Jamahiriya (1994)	87	2	11
Mauritania (1985)	92	2	6
Morocco (1991)	92	3	5
Oman (1991)	94	2	5
Palestine	..	..	..
Qatar (1994)	74	3	23
Saudi Arabia (1992)	90	1	9
Somalia (1987)	97	0	3
Sudan (1995)	94	1	4
Syrian Arab Republic (1993)	94	2	4
Tunisia (1990)	89	3	9
United Arab Emirates (1995)	67	9	24
Yemen (1990)	92	1	7
Arab region <sup>a/</sup>	89	5	6

Source: P.H. Gleick et al., *The World's Water 2002-2003: The Biennial Report on Freshwater Resources* (Island Press, 2002).

Note: Two dots (..) indicate that data are not available.

<sup>a/</sup> Excluding Palestine.

Additionally, increasing standards of living and consumerism result in greater demand for water in other sectors. Rising income, for example, generally leads to an

<sup>15</sup> D. Koehn, "Water in the Middle East and North Africa", which was presented at the 6<sup>th</sup> Annual Conference cosponsored by the Middle East Institute (MEI) and the World Bank (Washington D.C., 15 May 2001).

increase in meat consumption, which in turn requires substantial additional inputs of water for grains and crops that feed livestock. In some cases, domestic food production cannot meet the demand of growing populations, and Arab Governments are therefore compelled to rely increasingly on imported food.

Modern appliances used in the region have generally been developed in countries where water efficiency is not a high priority. Consequently, appliances are often inefficient in their use of water. An analogous situation arises with regard to human consumers. Expatriates, who come from countries that are not water-stressed, are typically unaware of the water issues in their host countries, particularly the Gulf States. There is therefore a need to build awareness of the profligate uses of water among expatriate populations.

While technological innovations can increase the supply and delivery of available freshwater, human activities often pollute existing sources of water, thereby rendering them unusable or expensive to treat and reuse. Deteriorating water quality in many Arab countries is an increasingly serious problem, and such activities as clearing land, disposing of municipal and industrial wastes, and using fertilizers and pesticides that leachate into groundwater, disrupt the water cycle. Continuing population growth compounds these problems.

Moreover, rapid urbanization and modernization in the region raise the demand for water even faster than the overall population growth. Urban dwellers tend to adopt a more modern lifestyle whereby more water is consumed for domestic use than do rural dwellers or those who in some respects keep to a more traditional way of life.<sup>16</sup> Domestic use of water is affected by the following factors: (a) the distance between the household and the source of water; (b) the frequency of water use; (c) the size of the household; and (d) the consumption pattern.

While a greater population density in urban areas enables communities to invest in more efficient and cost-effective water management systems, rapid urbanization can hinder the development of adequate water management and sewage systems. In Cairo, the water distribution system, which was constructed in the late nineteenth century, is outdated and currently unable to serve all its citizens. Despite substantial investments by the Government of Egypt aimed at improving the water supply systems, some residents of greater Cairo still live in dwellings with no piped water. This is partly attributed to rapid urbanization. Cairo, which is the largest city in the region and one of the most densely populated cities in the world, grew from 2.4 million people in 1950 to 10.5 million in 2000, and its population is projected to reach 13.8 million in 2025.<sup>17</sup>

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<sup>16</sup> For instance, traditionalists tend to favour more water-efficient public baths compared to the private baths of modern urban dwellers.

<sup>17</sup> United Nations, DESA, *World Urbanization Prospects: The 1999 Revision* (New York, 2001).

The gap between rural and urban residents is even wider in terms of access to adequate sanitation. In Iraq, where 93 per cent of those living in urban areas have access to adequate sanitation, a meagre 31 per cent of rural residents have such access, and in Mauritania, 67 per cent of the population lacks access to adequate sanitation, see table 6.

TABLE 6. ACCESS TO SAFE WATER AND SANITATION  
IN THE ARAB REGION IN 2000  
(Percentages)

Country and territory	Percentage of population using improved drinking water sources			Percentage of population using adequate sanitation facilities		
	Total	Urban	Rural	Total	Urban	Rural
Algeria	89	94	82	92	99	81
Bahrain	..	..	..	..	..	..
Comoros	96	98	95	98	98	98
Djibouti	100	100	100	91	99	50
Egypt	97	99	96	98	100	96
Iraq	85	96	48	79	93	31
Jordan	96	100	84	99	100	98
Kuwait	..	..	..	..	..	..
Lebanon	100	100	100	99	100	87
Libyan Arab Jamahiriya	72	72	68	97	97	96
Mauritania	37	34	40	33	44	19
Morocco	80	98	56	68	86	44
Oman	39	41	30	92	98	61
Palestine	86	97	86	100	100	100
Qatar	..	..	..	..	..	..
Saudi Arabia	95	100	64	100	100	100
Somalia	..	..	..	..	..	..
Sudan	75	86	69	62	87	48
Syrian Arab Republic	80	94	64	90	98	81
Tunisia	80	92	58	84	96	62
United Arab Emirates	..	..	..	..	..	..
Yemen	69	74	68	38	89	21

Source: UNICEF, *The State of the World's Children 2003* (UNICEF, 2003). Available at: [www.unicef.org/sowc03/tables/table3.html](http://www.unicef.org/sowc03/tables/table3.html).

Note: Two dots (..) indicate that data are not available.

## II. BALANCING WATER SCARCITY AND HUMAN DEMAND

There is an urgent need to develop a mix of strategies that increases supply and manages demand of freshwater, in addition to reducing long-term pressures on water by slowing down population growth. While Arab Governments have adopted new strategies aimed at balancing scarce water resources with growing demand for freshwater, these strategies have tended to focus on supplying more water, which are largely dictated by such local conditions as topography, the extent of water scarcity, available financial resources, and technical and institutional capacities.

Innovations can only increase the supply of water up to a point. Moreover, new technologies often require substantial investments, which are typically unaffordable to most countries in the region, particularly the low-income States. For instance, Yemen cannot purchase the sophisticated water equipment that is available to high-income Saudi Arabia. However, given that purely technological solutions to water scarcity are likely to have limited effects even for high-income countries, such supply-side solutions relieve only some of the demand for water in the short term.

According to a report by the United Nations Development Programme (UNDP) and the Arab Fund for Economic and Social Development (AFESD), effective water-demand management systems and economic instruments that rationalize the use of water have not been fully developed by a single country in the region.<sup>18</sup> There is therefore an urgent need to focus on the demand side of water management in addition to addressing supply-side issues. The long-term objective of sustainable development can be achieved by moderating population growth in the region and by creating effective policies and programmes that encourage conservation and efficient use of water.

### A. STRATEGIES FOR INCREASING SUPPLY

Governments have traditionally focused on increasing access to freshwater by locating, developing and managing new sources, despite the high costs often involved in such endeavours. While traditional systems of collecting water can still play important roles, new natural sources of water are becoming increasingly scarce and expensive. Consequently, Arab countries are exploring other options, including desalination and treatment and reuse of wastewater. A selection of traditional and new options aimed at increasing water supplies is discussed below.

#### 1. *Underground water distribution systems*

Underground water distribution systems, or *qanats* (in Arabic), were developed in Iran some 3,000 years ago and are still used in arid regions of the world. A *qanat*

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<sup>18</sup> UNDP and AFESD, *Arab Human Development Report 2002: Creating Opportunities for Future Generations* (New York, 2002).

taps underground mountain water sources trapped in and beneath the upper reaches of alluvial fans and channels the water downhill through a series of tunnels, often several kilometres long, to the places where it is needed for irrigation and domestic use.<sup>19</sup> There are three main advantages to such a water delivery system, namely: (a) there is less water loss from seepage and evaporation given that most channels are underground; (b) there is no need for pumps since the system is entirely based on gravity; and (c) it is perfectly sustainable since only renewable groundwater can be extracted.

*Qanats* are still the major source of irrigation water in the hillside terraces of Oman and Yemen. Moreover, underscoring the importance of such traditional systems in the production of wheat and of alfalfa for fodder, the Government of Oman funded a project in the 1980s to repair and upgrade the *qanats* in that country.<sup>20</sup>

## 2. *Collecting rainwater*

Rainwater can be collected on site for domestic use to supplement or replace other sources of household water. The main advantage of collecting rainwater is its flexibility. It can be as simple as a barrel placed under a rain gutter to water a garden, or as complex as a multi-tank, pumped, pressurized system to supply residential and irrigation needs.<sup>21</sup>

In Egypt, Bedouin farmers have rehabilitated degraded agricultural land by storing run-off water in wadis, which are dry riverbeds except in the rainy season, and by constructing earthen dikes.<sup>22</sup> It is important to recognize that such traditional water systems and supply technologies have potential in alleviating water shortages and in promoting sustainable water use.

## 3. *Dams*

Dams have been used for thousands of years to control floodwater, thereby providing water for domestic, agricultural and industrial use. More recently, they have been used to produce electricity. Globally, some 45,000 large-scale dams have been erected over the past five decades;<sup>23</sup> and approximately one-third of all countries rely

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<sup>19</sup> For the history of qanats, see “Water History: Qanats”, available at: [www.waterhistory.org/histories/qanats/](http://www.waterhistory.org/histories/qanats/).

<sup>20</sup> Ibid.

<sup>21</sup> J. Gerston, “Rainwater harvesting: a new water source” (Texas Water Resources Institute, 1997). Available at: <http://twri.tamu.edu/newsletters/TexasWaterSavers/tws-v3n2.pdf>.

<sup>22</sup> M. Nasr, “Assessing desertification and water harvesting in the Middle East and North Africa: policy implications”, *Discussion Papers on Development Policy*, No. 10 (Center for Development Research, University of Bonn, Germany, July 1999).

<sup>23</sup> By definition, a large-scale dam exceeds 15 metres in height.

on dams for more than half their electricity needs. There are currently over a hundred large-scale dams in the following Arab countries: five in Lebanon and Jordan; 13 in Iraq; 38 in Saudi Arabia; and 41 in the Syrian Arab Republic.<sup>24</sup> However, large dams generally transform topographies, particularly in areas adjacent to river basins, which can pose significant social and environmental challenges. Within that context, it is estimated that some 40-80 million people have been displaced by the construction of large dams across the world.<sup>25</sup>

Given the substantial investment involved in building large-scale dams and their widespread social and environmental impacts, the issue of erecting dams represents one of the most contested debates in sustainable development. Moreover, this issue can be the source of friction between neighbouring countries sharing river basins, given that the construction of a dam in an upstream country has significant repercussions on the downstream country.

Following a two-year study of the controversies surrounding dams, the World Commission on Dams (WCD) concluded that the decision to build a large dam needed to have the principal objective of advancing human welfare and “on a basis that is economically viable, socially equitable and environmentally sustainable”; and that where other options provided better solutions, these needed to be pursued instead.<sup>26</sup> That study, which is the most comprehensive report on dams, proposes a broad range of guidelines and recommendations to assist policy-makers in the areas of water and energy development. These recommendations range from conducting assessments of needs and gaining public acceptance, to sustaining rivers and livelihoods, recognizing entitlements and sharing benefits. The study has sparked interest among a number of national and international agencies that are evaluating the guidelines and recommendations and their possible application.<sup>27</sup>

While the substantial investment necessary for building large dams is often an obstacle, there is a general perception among countries, including those in the Arab region, that they represent a good option with regard to managing water supplies and meeting growing demands for freshwater and electricity. In Lebanon, for instance, the 10-year plan to improve water management includes the additional construction of 30 large and small dams, financed in part with the assistance of donors.<sup>28</sup>

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<sup>24</sup> P.H. Gleick et al., op. cit.

<sup>25</sup> World Commission on Dams (WCD), “Dams and development: a new framework for decision-making” (WCD, 16 November 2000). Available at: [www.damsreport.org/docs/overview/wcd\\_overview.pdf](http://www.damsreport.org/docs/overview/wcd_overview.pdf).

<sup>26</sup> Ibid.

<sup>27</sup> P.H. Gleick et al., op. cit.

<sup>28</sup> “Lebanon risks water shortage by 2025”, *The Middle East Times* (2 August 2002). Available at: [www.metimes.com/2K2/issue2002-31/reg/lebanon\\_risks\\_water.htm](http://www.metimes.com/2K2/issue2002-31/reg/lebanon_risks_water.htm).



#### 4. *Sequential water use*

Treated wastewater has become an increasingly valuable source in the Arab region. Given the growing demand for water in the domestic, agricultural and industrial sectors, treated wastewater provides an additional supply of water that is largely independent of seasonal fluctuations. Sequential water use involves collecting and treating water that has been used in one sector, and redirecting it for other uses. Theoretically, treated wastewater can be used for almost any purpose, and different levels of treatment can be applied to bring the water to a quality appropriate for a particular need. Within that context, domestic use requires the highest quality of water. Ideally, therefore, water needs to be used, treated and redirected in the following consecutive order: domestic, industry and agriculture.<sup>29</sup>

Urban wastewater, often referred to as “brown water”, can be treated and channelled from towns and cities onto nearby farms, thereby providing a reliable source for irrigation, increasing crop yields and decreasing the reliance on chemical fertilizers. A higher degree of treatment is required for wastewater that is used to irrigate those crops that are consumed directly, including certain fruits and vegetables, or where people have direct contact with the water. In urban areas, water can be reused in various areas, including irrigation of landscapes and gardens, drainage for toilets, and small-scale industrial purposes. Such water management can be fostered by developing dual water distribution systems, which deliver both drinking water and non-potable water supplies. While this can prove costly, particularly in terms of retrofitting existing plumbing, dual distribution systems allow water agencies to deliver a high-quality supply of drinking water in addition to recycled water for other needs, including drainage. A community in Florida, the United States of America, that provides recycled water for selected residential areas in a dual-piped system has been able to halt the growth of demand for drinking water, despite the substantial population growth of that community.<sup>30</sup>

Wastewater is already an essential source of irrigation in several Arab countries, including Egypt, Jordan, Saudi Arabia and Tunisia. In Tunisia, an estimated 35 million cubic metres of treated water is used for irrigation every year. Wastewater from Tunis is used to irrigate citrus and olive orchards near the city, in addition to watering golf courses and hotel gardens.<sup>31</sup>

Moreover, treated water can be used to augment the natural recharging of aquifers. Artificial recharge of aquifers protects coastal aquifers from saltwater

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<sup>29</sup> M. Falkenmark and C. Widstrand, “Population and water resources: a delicate balance” *Population Bulletin* 47, No. 3 (PRB, 1992).

<sup>30</sup> P.H. Gleick, *The World's Water 2000-2001: The Biennial Report on Freshwater Resources* (Island Press, 2000).

<sup>31</sup> *Ibid.*

intrusion that arises from excessive pumping. The increasing demand for freshwater across the Arab region has resulted in the excessive pumping of aquifers. In the Gaza Strip, the annual water withdrawal is substantially higher than the natural recharge rate of the aquifer, which is severely undermining that coastal aquifer. Consequently, directing wastewater to recharge aquifers assists in increasing the sustainable use of water.

### 5. *Desalination*

While the practice of removing salt from seawater is an ancient one, the original goal was to harvest pure salt given the considerable value of that commodity in the past. Current desalination technologies, which comprise a range of processes that remove salt from water, is used in some 120 countries across the world to extract freshwater from seawater and provide water for a variety of purposes, including potable freshwater for domestic and municipal use, treated water for industrial processes and emergency water for refugees or military operations.<sup>32</sup>

Since the 1950s, Kuwait has been the pioneer in the Arab region in developing desalination techniques to supply freshwater for domestic use. Moreover, approximately one-quarter of the global desalination capacity resides in Saudi Arabia, which has relevant facilities on the coasts of both the Red Sea and the Gulf of Aden. The United States of America has the second-highest desalination capacity in the world, followed by United Arab Emirates, Kuwait, Japan, Spain, Libyan Arab Jamahiriya, Qatar, Italy, Iran, Bahrain, Republic of Korea, India, Iraq and Germany. Cumulatively, the Arab region houses more than half the global desalination capacity.<sup>33</sup>

Desalination is a relatively expensive process and is typically affordable only by high-income countries. The main advantage of desalination is its supply of clean and reliable water independent of seasonal fluctuations. However, desalination requires large quantities of heat energy and has some negative environmental impacts, particularly the production of large quantities of highly saline brine that can damage coastlines. Moreover, desalination facilities are particularly vulnerable during periods of conflict. In the aftermath of the invasion of Kuwait by Iraq in 1990, the desalination installations of Kuwait were among the first targets of the war. Despite these drawbacks, desalination represents an important water source for high-income Arab countries where traditional water supplies or transfers from other sources cannot overcome the national deficits in freshwater.

### 6. *Trading water*

The growing demand for freshwater has created entrepreneurial opportunities in a wide range of markets for water at both national and international levels. Water

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<sup>32</sup> Ibid.

<sup>33</sup> Ibid.

trading and exchange allows regions with abundant freshwater reserves to export their surplus to water-stressed and water-scarce regions. Within that context, the private sector is considering new ways to transfer water by, inter alia, building longer pipelines; producing bottled water in one region for use in another; transporting water in tankers or large bags;<sup>34</sup> and towing icebergs from water-rich to water-scarce regions.<sup>35</sup>

Bottled drinking water is commonly available in Arab countries. Approximately 40 per cent of the rural and urban population of Oman uses bottled water. In Yemen, 15 per cent of the urban population consumes bottled water compared to less than 1 per cent of rural dwellers. Conversely, in Jordan, Libyan Arab Jamahiriya and the Syrian Arab Republic, the rural populations use comparatively more bottled water than their urban counterparts at 11 per cent compared to 1 per cent, 14 per cent to 7 per cent, and 11 per cent to 4 per cent, respectively.<sup>36</sup>

While the majority of large-scale transfers of water have occurred within national borders, there is an increasing interest in trading freshwater internationally, particularly in the water-scarce Arab countries. Kuwait, which is the most water-scarce country in the world, purchases freshwater from Iran. Moreover, the two countries have agreed to construct a pipeline across the Arabian Gulf to transport water from the Karun River in Iran to Kuwait. Similarly, Turkey and a number of Arab countries worked on an ambitious project to transfer freshwater from the Ceyhan and Seyhan Rivers in Turkey, which flow out into the Mediterranean Sea, to the water-scarce Gulf States. However, this project, which was dubbed the “peace pipeline” and was expected to have taken 10-15 years to complete, did not get beyond the planning stage.<sup>37</sup> While importing water can help Arab Governments meet increased demand for water and curb potential migrations, pumping water from one area to another can adversely affect local ecosystems and hydrology.

### *7. Regional cooperation*

The competition over scarce freshwater resources rises with and is compounded by increasing populations. Regional cooperation is a vital element in water supply management, particularly given the preponderance of shared lakes, river basins and aquifers among neighbouring countries in the Arab region, which can engender

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<sup>34</sup> Medusa Bags, which were designed by Medusa Water International, are set to transport 100,000 tonnes of freshwater.

<sup>35</sup> P.H. Gleick et al., op. cit.

<sup>36</sup> Ibid.

<sup>37</sup> A. Nachmani, “A commodity in scarcity: the politics of water in the Middle East” (Jerusalem Center for Public Affairs, 1 March 1994). Available at: [www.jcpa.org/jl/hit02.htm](http://www.jcpa.org/jl/hit02.htm).

conflicts over shared water resources.<sup>38</sup> These conflicts are often triggered by a perception of inequity in terms of sharing the water resources and remain largely unresolved despite intergovernmental efforts aimed at reaching negotiated settlements. While various agreements governing rivers in the region have been endorsed, these are generally incomplete or inequitable, and focus on managing remaining supply, rather than on improving water quality. Furthermore, many agreements do not include all the countries that share a common basin. While Iraq and the Syrian Arab Republic have established an agreement to manage the Euphrates River, the third riparian country, namely, Turkey, is still not a signatory. Similarly, Jordan and the Syrian Arab Republic signed an agreement regarding the Yarmouk River in 1987 that, while acceded to by Israel in 1994, still excludes the Palestinian Authority.<sup>39</sup> Moreover, allocation of shared water resources has been one of the most contentious issues in the peace negotiations between Israel and the Palestinian Authority.

The Nile Basin extends over approximately 10 per cent of Africa in the following countries: Burundi, the Democratic Republic of the Congo, Egypt, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda and Zaire. To varying degrees, these States share widespread poverty and are highly dependent on agriculture. Moreover, given they lack the necessary financial means to initiate large-scale engineering works, including water projects, they are compelled to seek various forms of cooperation from such international bodies as the African Union (AU), the United Nations and the World Bank. Within the context of regional cooperation, the Nile Basin Initiative (NBI) was initiated in 1959 by Egypt and Sudan and aims to achieve sustainable development through equitable use of the water resources of the Nile River. Subsequently, the Initiative, which is currently supported by the 10 countries of the Nile Basin, includes implementing a programme of research, capacity and technical assistance; and preparing cooperative investment programmes in the Eastern Nile and the Equatorial Lakes regions.<sup>40</sup>

Moreover, countries are increasingly tapping into groundwater reserves to satisfy growing demand for freshwater. Legal issues surrounding partnership in using aquifers are new areas for international agreements and are fraught with potential conflicts.<sup>41</sup>

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<sup>38</sup> The most significant river basins of the region include the Jordan, Nile, Euphrates and Tigris Rivers.

<sup>39</sup> M.J. Haddadin, "Water challenges in the Near East: a looming crisis?", which was presented at the 6<sup>th</sup> Annual Conference cosponsored by MEI and the World Bank (Washington D.C., 15 May 2001).

<sup>40</sup> The World Bank, "Nile Basin: Overview", available at: [www.worldbank.org/afr/nilebasin/overview.htm](http://www.worldbank.org/afr/nilebasin/overview.htm).

<sup>41</sup> J. Berkoff, *A strategy for managing water in the Middle East and North Africa* (the World Bank, 1994).

## B. STRATEGIES FOR MANAGING DEMAND

The Arab region is at a critical juncture. Its development cannot be based solely on mobilizing new water resources or on transfers from water-rich to water-poor areas. Equally, managing demand for freshwater is key to promoting sustainable development in the region. Successful policies, strategies and programmes for managing water demand therefore need to promote more desirable patterns and levels of water use. Moreover, such policies need to be multifaceted, thereby enhancing water management through a combination of sound regulations, adequate economic incentives, technological innovations and public awareness programmes. Within that context, Arab countries have formulated various plans to improve water use, while taking into account scarce freshwater resources, growing water demand and development priorities. These are investigated below.

### 1. *Reallocating water*

The agricultural sector in the Arab region is the largest user of water, which is a consumption pattern that is mirrored in other regions of the world. Given that water use in agriculture is highly relative to other sectors, modest percentage reductions in agriculture makes available a significantly higher percentage of water for use in other sectors. Statistically, a 25 per cent reduction in agricultural use whose consumption was 80 per cent of total water effectively doubles the water available to the other sectors combined.

However, while the largest volume of water can be economized from agriculture, reallocating water away from this sector in favour of the domestic and industrial sectors can be a challenge. Such shifts can be politically sensitive, particularly in areas where local tribes control water resources, and can raise legal issues. Moreover, while this reallocation can satisfy the needs of growing urban populations, it can threaten the food security and livelihood of rural communities, particularly farmers. Consequently, plans to reallocate water away from agriculture need to be formulated in such a manner so that they minimize negative impacts on the rural poor.

Within that context, water-saving schemes need to be established and designed in such a way that they promote water transfers to other sectors while aiming to foster rural livelihoods and requirements. Furthermore, a sound strategy must work to deliver alternate sources of employment for the rural poor who are “outside the money economy” and have little incentive “to produce more than their immediate family needs”.<sup>42</sup> This represents a major challenge in the Arab region given that national

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<sup>42</sup> CGIAR, “Trade as a means to food and water security”, which was presented at the Dialogue on Water, Food and Environment organized by the International Water Management Institute (IWMI) (Colombo, 13-16 December 2000).

economies are already faced with some of the highest unemployment rates in the world.

### 2. *Increasing production per unit of land*

Over the past five decades, a number of countries have successfully increased their food production. Between 1961 and the mid-1990s, the rice, wheat and maize crops in China grew by more than 300 per cent. Similarly, the green revolution in India caused that country to be temporarily self-sufficient in food until the high population growth rate outstripped those agricultural gains. The increases in food production were achieved in various ways, including the following: (a) by extending the land used for crops; (b) by intensifying production on existing cropped areas; (c) by increasing the use of fertilizers; and (d) by improving seed varieties with higher yields.<sup>43</sup>

While intensifying production remains an option for farmers in the Arab region, more research is needed, particularly in the area of biotechnology, in order to develop and introduce drought-resistant crops that are suited to water-scarce regions. Moreover, efforts aimed at increasing agricultural productivity directly benefit the rural poor, thereby alleviating national poverty.

### 3. *“Virtual water” and less water-intensive crops*

The Arab region already relies heavily on “virtual water” to feed its fast-growing population.<sup>44</sup> Annual imports of grain and flour increased from 7 million metric tons in the early 1970s to more than 40 million metric tons in the mid-1980s. Such a high volume of imported food, which was second highest in the world after China, was equivalent to approximately 20 per cent of the total freshwater use in the region. Moreover, given that it requires an estimated 1,000 cubic metres of water to produce one metric ton of grain, the regional imports of “virtual water” by the mid-1980s were equivalent to the annual flow of the Nile River into the agricultural sector of Egypt.<sup>45</sup>

The demographic trends and water scarcity of Arab countries is expected to increase this reliance on “virtual water”, even allowing for possible improvements in agricultural productivity. Regional strategies must therefore focus on diversifying economies and on increasing the efficiency of water use in all sectors. Within that latter context, one option for optimizing water use in agriculture involves harvesting crops that have higher yields per unit of water. A number of countries in the region rely heavily on their home-grown cereals, which have a low return per unit of land and

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<sup>43</sup> Ibid.

<sup>44</sup> “Virtual water” is defined as water that a country would otherwise require to produce domestically the goods that it imports.

<sup>45</sup> CGIAR, op. cit.

water. Arab countries could therefore switch to less water-intensive crops, sell the resulting produce in the international market and import cereals. However, while this strategy can help Arab countries conserve water and makes economic sense, the increased reliance on imported food has political and economic ramifications for Governments. Typically, countries feel that it is strategically important and a matter of national pride to produce their own cereals. Furthermore, any strategic change in the agricultural use of water needs to be evaluated and assessed in terms of its impact on the livelihood of the rural populations.

#### 4. *Using effective technologies*

Better technologies in all sectors of the economy, particularly in agriculture, can help reduce long-term costs and improve water efficiency. Within that context, the Arab region can learn from the industrialized countries that, through a successful application of effective technologies, have significantly increased their efficiencies in industrial and agricultural use of water over the past five decades. Prominent among these technologies are the following:

(a) Drip irrigation systems, which reduce water use and increase yields by delivering water directly to the roots of plants through a network of perforated plastic tubes installed on or below the soil surface;

(b) Fertigation, which involves applying fertilizer to irrigation water through the use of computer-controlled drip techniques, thereby economizing on water and fertilizer use and limiting the salinization of soil and the pollution of groundwater;<sup>46</sup>

(c) Wastewater recycling systems, which recover in-plant wastewater for reuse within the plant, thereby providing additional cost-effective opportunities to limit water use in industrial and commercial sectors.<sup>47</sup>

Success stories in water conservation using these technologies suggest that the Arab region can reap significant benefits by adopting such systems. Farms in the Jordan Valley that used tensiometers with drip irrigation conserved 20-50 per cent more water, while increasing their yields of cucumbers and tomatoes by 15-20 per cent.<sup>48</sup> Similarly, in the Tadla region of Tunisia, the adoption of an advanced irrigation

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<sup>46</sup> Committee on Sustainable Water Supplies in the Middle East et al., *Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan* (Washington, D.C.: National Academy Press, 1999).

<sup>47</sup> Within this context, an olive-processing plant in California, the United States of America, was able to reduce its daily water use from 1.3 million gallons to 110,000 gallons by recovering and reusing in-plant wastewater. P.H. Gleick et al., op. cit.

<sup>48</sup> A. Vidal et al., "Success stories in water conservation in the Mediterranean region: a review of technologies and enabling environment for water conservation – lessons learnt", Issue 17 (International Programme for Technology and Research in Irrigation and Drainage (IPTRID), February 2001). Available at: [www.hrwallingford.co.uk/projects/IPTRID/grid/pdf-files/grid17articles/G17pg7.pdf](http://www.hrwallingford.co.uk/projects/IPTRID/grid/pdf-files/grid17articles/G17pg7.pdf).

system resulted in 20 per cent savings in water use and a 30 per cent increase in crop yield for cereals.<sup>49</sup>

Additionally, Arab countries need to address issues of cost and culture, through education and training, to spread the use of new technologies in the region.

#### 5. *Water distribution efficiencies*

Some water in a system, commonly known as “unaccounted-for water”, can be lost due to leaks, evaporation and illegal water-pipe connections. This term is equally used by many water agencies to describe water that reaches customers but is not metered or billed. In the 1990s, approximately half the water in the systems of Amman and Sanaa was lost as “unaccounted for water”.<sup>50</sup> These losses can be limited by repairing leaking distribution systems and sewer pipes, metering water connections, and by rationing and restricting water.

#### 6. *Instituting legal and institutional reforms*

While there have been extensive legal and institutional reforms throughout the region, attempts aimed at streamlining water management have been hampered by complicated and outdated systems of water rights, land rights, social and civic institutions, and legal regimes. Moreover, even where such reforms have been formulated, these have been met with mixed success due to inadequate implementation of laws and to modest performance by the relevant institutions.

Water agencies in the region are generally burdened with substantial administrative costs and dispersed authority. In an effort to ensure a more integrated approach to national water management, Jordan established the Ministry of Water and Irrigation in 1992 and placed all responsibility for planning and monitoring of resources under that Ministry. Prior to that reform, water use was managed by several agencies, which resulted in short-term planning, sporadic enforcement of laws regulating water resources and limited surveillance of water pollution. The Ministry collaborates with other governmental agencies with the aim of advancing efficient use of water. Additionally, construction codes in Jordan have been revised whereby permits for new buildings are only granted if they abide by special water-conservation specifications.<sup>51</sup>

Legal and institutional reforms need to recognize the importance of public-private partnership and to promote the participation of non-governmental

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<sup>49</sup> Ibid.

<sup>50</sup> P.H. Gleick et al., op. cit.

<sup>51</sup> R. Bossi, “Changing water usage behavior in Jordan”, *The Academy News: Newsletter of the Academy for Educational Development* (Fall 2001).



organizations (NGOs) and civil society. Within that context, the Government of Tunisia has encouraged the formation of private associations to assume management of irrigation water, and has developed pilot projects to provide oversight of aquifers to these associations. Depending on successful outcomes, these projects can be adopted in other countries, particularly in areas facing depleted aquifers through over-pumping.<sup>52</sup>

Political stability is a prerequisite for improving institutional and legal frameworks that aim at addressing water needs in an environmentally sustainable manner. Within that context, the continuing conflict in the Occupied Territories represents a major obstacle for the Palestinian Authority with regard to developing appropriate water policies and programmes. A report by the United Nations Environment Programme (UNEP) warns of the severe depletion of natural resources in the Occupied Territories through constant pressure from a growing population, water pollution, climate change, desertification and land degradation.<sup>53</sup>

### 7. Pricing water

One of the major issues in the areas of water management and pricing relates to the definition of water, namely, whether access to water constitutes a basic human right, which must be made available to everyone, or whether water is a commodity that can be controlled by markets, prices and international trading regimes.<sup>54</sup> The former argument, which is supported by CESCR and the international development community, puts the onus on Governments to respect, protect and fulfil the right of individuals to safe drinking water and adequate sanitation; the latter requires citizens to cover some or all of the costs for their water uses.

Water plays a vital social, cultural and ecological role that cannot be protected solely by market forces. Most Arab countries were represented at the United Nations Conference on Environment and Development (UNCED) (Rio de Janeiro, Brazil, 3-14 June 1992), equally known as the Earth Summit, which clearly established that water needed to be managed as both a social and economic good. Consequently, any efforts to commodify water need to be accompanied by certain social and ecological principles that guarantee equitable access to water for poor segments of the population.<sup>55</sup>

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<sup>52</sup> A. Vidal et al., "Case studies on water conservation in the Mediterranean Region", *Knowledge Synthesis Report No. 4* (IPTRID, 2001).

<sup>53</sup> UNEP, "Desk study on the environment in the Occupied Palestinian Territories" (UNEP, February 2003). Available at: <http://postconflict.unep.ch/publications/INF-31-WebOPT.pdf>.

<sup>54</sup> P.H. Gleick et al., op. cit.

<sup>55</sup> Ibid.

Governments can provide water freely to their populations while exacting a consumption price by striking the following balance: (a) provide a set minimum amount of water free of charge to all citizens, particularly the low- to middle-income families, to cover everyday needs, including drinking, cooking and personal and domestic hygienic; and (b) establish a surplus charge for water use beyond the allocated minimum. This model has been applied in Iran where the urban population is entitled to a free 30 litres per capita per day and has to pay increasing per unit charges for additional litres.<sup>56</sup>

Overall, recovering some or all of the cost of freshwater is important for maintaining and improving current water systems and for investing in the development of new ones. Of all the public utilities, water generally has the lowest recovery cost, which is calculated as the price paid by the consumer relative to the cost of the good provided. While Arab Governments have been heavily subsidizing the cost of providing safe water to their populations, they are increasingly looking for ways to transfer part of that cost to consumers. Within that context, strategies include imposing water tariffs, establishing charges for extracting water, pricing water at cost, offering conservation subsidies and charging higher rates for peak hours of the day or peak seasons of the year.<sup>57</sup> International research shows that households, which receive most of the benefit from piped water, are willing to pay 3-5 per cent of their income for access to clean water.<sup>58</sup>

Prices and schemes under which people pay for water vary throughout the Arab region. In 1993, residents of Cairo paid \$0.04 per cubic metre, compared to \$0.91 per cubic metre in Ramallah in 1994.<sup>59</sup> In Lebanon, one report estimates that only 40 per cent of the population pays for water, which is insufficient to cover operation and maintenance costs.<sup>60</sup> However, as described above, any pricing scheme aimed at transferring the cost to consumers and regulating the efficient use of water in the domestic sector must include a safety net for the poor.

Furthermore, industrial and commercial users can be motivated to reduce their water use through price regulations and other legislation related to water-use restrictions, wastewater quality requirements and impact fees. While these regulations

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<sup>56</sup> N.I. Faruqui, "Islam and water management: overview and principles", *Water Management in Islam*, N.I. Faruqui, A.K. Biswas and M.J. Bino eds. (United Nations University Press, 2001).

<sup>57</sup> "Overcoming water scarcity and quality constraints", *Focus No. 9*, R.S. Meinzen-Dick and M.W. Rosegrant eds. (Washington, D.C.: International Food Policy Research Institute, October 2001).

<sup>58</sup> World Resources Institute (WRI) et al., *World Resources: A Guide to the Global Environment – The Urban Environment 1996-97* (Oxford University Press, 1996).

<sup>59</sup> P.H. Gleick et al., op. cit.

<sup>60</sup> "Lebanon risks water shortage by 2025", *The Middle East Times* (2 August 2002). Available at: [www.metimes.com/2K2/issue2002-31/reg/lebanon\\_risks\\_water.htm](http://www.metimes.com/2K2/issue2002-31/reg/lebanon_risks_water.htm).

can prove a challenge to implement and enforce, such incentives can help discourage industrial water pollution and agricultural inefficiencies.

#### 8. *Conservation and public involvement*

Countries have increasingly been adopting ways to encourage voluntary conservation through public awareness programmes and community involvement. Throughout the Arab region, conservation messages have been incorporated into school curricula and the mass media. Religious leaders are often asked to communicate water-conservation messages to their communities. Indeed, some religious leaders have received and benefited from special training with regard to freshwater scarcity and the importance of conservation.

Involving communities in new strategies can increase public acceptance and support of new water systems. Communities can be taught to maintain and operate water systems and can play a proactive role by helping to determine the type of system that is most suited to prevailing conditions. Moreover, their participation is particularly needed when consumers are being asked to cover some or all of the costs for their water uses. In Tunisia, there are an estimated 2,500 water associations that manage drinking and irrigation water systems as part of the decentralization programme of the Government that is aimed at transferring costs to end-users.<sup>61</sup> Water conservation measures that rely on the community are often more effective when they provide income for the members. In Jordan, the Business and Professional Women's Organization trains low-income women to present and sell such water-conservation products as shut-off nozzles for hoses, aerators for taps and waterless soap.<sup>62</sup>

#### C. REDUCING LONG-TERM PRESSURE ON WATER BY IMPROVING REPRODUCTIVE HEALTH

Slower population growth could alleviate pressure on the environment and on the scarce water resources of the region. Both the Earth Summit and ICPD singled out high population growth rates as a major obstacle to sustainable development. ICPD, which was sponsored and organized by the United Nations Population Fund (UNFPA), provided an opportunity for countries across the world to examine the challenges posed by their populations and discuss possible solutions. The Programme of Action that emanated from ICPD, which was adopted by 179 participating countries, provides a comprehensive framework for reducing population growth and achieving sustainable development that is socially equitable. The Programme calls for

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<sup>61</sup> The Water Sector Investment Project in Tunisia, which is funded by the World Bank, aims at improving the capacity of the Government, water associations and private operators to efficiently manage resources and promote conservation of water resources and protection of the environment.

<sup>62</sup> R. Bossi, "Changing water usage behavior in Jordan", *The Academy News: Newsletter of the Academy for Educational Development* (Fall 2001).

a wide range of investments in the areas of health, education and rights, particularly for women and girls, and for the provision of comprehensive family planning services in the context of reproductive healthcare.

Countries that have made social investments in health, family planning and education generally have slower population growth and enjoy faster economic growth than countries that have not made such investments.<sup>63</sup> Equally, international experience indicates that economic growth is the most powerful instrument for reducing poverty, particularly in the Arab region where poverty is not as entrenched as in other developing regions.<sup>64</sup>

Whether population growth restricts, promotes or has no overall effect on economic growth is an old debate that persists to the present day. However, researchers agree that countries that go through a demographic transition from high to low mortality and fertility rates, referred to as “demographic bonus”, can stimulate economies. As fertility rates decline, the proportion of the working-age population increases relative to the population of younger and older dependents, thereby creating a unique opportunity for economic growth. However, countries can only capitalize on this opportunity by making appropriate investments in both family planning and health and education. Moreover these investments must aim at advancing women rights and creating employment opportunities for a young labour force.<sup>65</sup>

By improving the reproductive health of women, families are able to achieve their desired family size. This constitutes an issue both of public health and of human rights, given that such improvements close the gap between poor and rich segments of societies in terms of accessing healthcare services. Such investments encourage societies and national economies to move in the direction of sustainable development that is more socially equitable.

At a regional level, there is a significant gap between the poor and rich with regard to accessing basic healthcare, including reproductive health and family planning. A survey conducted in 1993 in Morocco revealed that antenatal care among the richest quintile of the population was 10-20 times higher than that of the poorest

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<sup>63</sup> UNFPA, *State of world population 2002: people, poverty and possibilities* (UNFPA, 2002). Available at: <http://www.unfpa.org/swp/2002/english/ch1/index.htm>.

<sup>64</sup> W. van Eeghen and K. Soman, “Poverty in the Middle East and North Africa”, *Towards Competitive and Caring Societies in the Middle East and North Africa*, I. Diwan and K. Sirker eds. (the World Bank, 1998). Available at: [www.worldbank.org/mdf/mdf1/menapoor.htm](http://www.worldbank.org/mdf/mdf1/menapoor.htm).

<sup>65</sup> UNFPA, *State of world population 2002: people, poverty and possibilities* (UNFPA, 2002). Available at: <http://www.unfpa.org/swp/2002/english/ch1/index.htm>.

quintiles.<sup>66</sup> Moreover, one-third of women who had not sought antenatal services during their pregnancies reported that they were deterred from seeking care because services were either unavailable to them or were too expensive.<sup>67</sup> Similarly, in Egypt in 1996, women in the richest quintile of the population were 15 times more likely to have at least two prenatal visits and four times more likely to have their babies delivered by a medically-trained person than their counterparts in the poorest quintile.<sup>68</sup>

Despite regional variations, Arab countries face a number of common challenges with regard to meeting the reproductive health needs of women, including the following: (a) poor quality of reproductive healthcare services; (b) widespread ignorance concerning reproductive health issues; (c) financial constraints due to competing national priorities; and (d) entrenched gender inequality. Reproductive health problems, which are often preventable, are compounded by adverse social and economic conditions and gender roles. Within that context, the typically low social status of women plays an important part in keeping their suffering from being recognized and addressed. A pilot study of a rural community in Egypt revealed that women rarely discussed reproductive health problems with their spouses or female relatives and almost never sought professional care for such problems.<sup>69</sup> Moreover, interventions to improve the reproductive health of women needs to involve men, since men are often the key decision-makers with regard to healthcare.

### 1. *History of conferences, policies and programmes on population*

The United Nations held its first meetings on global population in 1954 and 1965, warning that rapid population growth could exacerbate poverty and hinder development in countries with limited resources. In 1969, the United Nations created UNFPA, whose mission included the promotion of national family planning programmes as part of national development strategies. Subsequently, “population programmes” and “family planning programmes” became almost synonymous. Egypt was one of the pioneers among developing countries and was the first Arab country to

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<sup>66</sup> M. Azelmat, M. Ayad and H. el Arbi, *Morocco: Demographic and Health Survey 1995* (in French) (Macro International et al., January 1996); and D.R. Gwatkin et al., *Socio-economic differences in health, nutrition, and population in Morocco* (the World Bank, May 2000).

<sup>67</sup> United States Agency for International Development (USAID) and the Ministry of Health in Morocco, *Morocco: 30 years of collaboration between USAID and the Ministry of Health – a retrospective analysis: safe motherhood* (Tulane University, April 2002).

<sup>68</sup> D.R. Gwatkin et al., *Socio-economic differences in health, nutrition, and population in Egypt* (the World Bank, May 2000).

<sup>69</sup> While half of the women who received a cervical biopsy in the study were found to have genital schistosomiasis, they considered the problem “normal” and rarely discussed it with anyone. M. Talaat et al., “The social context of reproductive health in an Egyptian hamlet: a pilot study to identify female genital schistosomiasis” (Theodor Bilharz Institute, 2001).

sanction family planning as part of its national development plan. The family planning programme in Egypt was initiated in the early 1960s with the goals of improving the health of women and of slowing down population growth.

Conversely, other countries, including Algeria, did not see a need for organized family planning programmes as part of their national development plans. At the United Nations World Population Conference (Bucharest, 19-30 August 1974), Algeria was among the countries leading the opposition to family planning programmes on the grounds that such programmes were an imperialist conspiracy aimed at limiting the population of the developing world. This group of dissenters argued that fertility rates could only decline through an environment conducive to socio-economic development, rather than by the imposition of a national family planning programme. Subsequently, however, Algeria realized that development alone was insufficient to lower fertility rates and, in 1983, that country adopted a population policy that promoted family planning as part of its national development plan.

Governments that attended the regional preparatory conference for ICPD, the Arab Population Conference (Amman, 4-8 April 1993), recognized family planning as an issue of public health and human rights that was sanctioned by Islam. Most countries in the Arab region currently provide family planning information and services, directly or indirectly, as part of their primary healthcare services. Moreover, a number of countries have adopted explicit policies to lower fertility rates as part of their national development plans and have implemented national information and education campaigns to encourage smaller families.

ICPD was a landmark in the series of population conferences organized by the United Nations in that it emphasized the needs and well-being of individuals beyond family planning. Within that context, it called on improving the status of women and promoting comprehensive reproductive healthcare to ensure healthy and safe pregnancies; to prevent sexually transmitted infections, including HIV/AIDS; and to address other factors that contribute to poor health, including sexual trafficking and violence against women. Additionally, the resulting Programme of Action, which was endorsed by all the Governments that participated in ICPD, calls on governmental agencies, NGOs and international development organizations to increase their support for and investments in reproductive health, education of girls and raising the status of women. While touching on such issues as youth sexuality and empowerment of women, the Programme acknowledges that the implementation of its recommendations “is the sovereign right of each country, consistent with national laws and development priorities, with full respect for the various religious and ethical values and cultural background of its people, and in conformity with universally recognized international human rights”.<sup>70</sup>

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<sup>70</sup> See the Programme of Action of ICPD.

## 2. Family planning practice

International experience indicates that access to quality reproductive health services, including family planning programmes, is a key factor in slowing down population growth. The highest rates of contraceptive use in Arab countries are recorded in Algeria, Bahrain, Lebanon and Tunisia, where more than 60 per cent of women in those countries use some method of family planning, compared to the lowest rates of less than 25 per cent in Mauritania, Oman, Somalia, Sudan and Yemen (see table 7).

TABLE 7. CONTRACEPTIVE USE IN ARAB COUNTRIES IN 2001  
(Percentages)

Country and territory	Percentage of women using contraceptives	
	All methods	Modern methods
Algeria	64	50
Bahrain	62	31
Comoros	26	19
Djibouti	..	..
Egypt	56	54
Iraq	..	..
Jordan	56	39
Kuwait	52	39
Lebanon	63	40
Libyan Arab Jamahiriya	45	26
Mauritania	8	5
Morocco	58	49
Oman	24	18
Palestine	51	37
Qatar	43	32
Saudi Arabia	32	29
Somalia	8	1
Sudan	10	7
Syrian Arab Republic	47	35
Tunisia	63	53
United Arab Emirates	28	24
Yemen	21	10

Sources: F. Roudi-Fahimi, *Women's Reproductive Health in the Middle East and North Africa* (PRB, February 2003); and C. Haub, *2002 World Population Data Sheet* (PRB, 2003).

Note: Two dots (..) indicate that data are not available.

Despite the increase in family planning practices and use of modern contraceptives in Arab countries, only in Algeria, Egypt and Tunisia do 50 per cent or more of women use a modern method, compared to the global average of 55 per cent.

Moreover, there is a gap in contraceptive use between rural and urban areas across the Arab region, which can be partly attributed to a comparatively better access to health services for urban women. In the Syrian Arab Republic, a modest 28 per cent of rural women use modern contraceptives, compared to 42 per cent in urban areas. Closing the gap between rural and urban areas in the provision of basic healthcare represents a challenge for most Arab countries.

Arab women generally give birth to more children than they or their spouses would prefer. However, a number of studies reveal that, while women prefer to postpone or avoid pregnancies, they do not use contraceptives. Consequently, these women are defined as having an “unmet need” for contraception. In Yemen, approximately 40 per cent of women have some form of “unmet need”, compared to 16 per cent in Morocco, 14 per cent in Jordan and 11 per cent in Egypt.<sup>71</sup>

Furthermore, access to high-quality family planning information and services is vital for women who are currently using a contraceptive method and for those with an “unmet need” for contraception. Poor quality of information and services, in addition to poor interactions between health providers and clients, discourage women, which can lead to despondency with regard to contraceptive methods and to a general decline in family planning programmes. Within that context, a study estimates that if women in Egypt and Jordan persisted with their contraceptive methods and never experienced contraceptive failure, the total fertility rates in those two countries could drop to less than 2.5 bpw, down from the current values of 3.5 and 3.7 bpw, respectively.<sup>72</sup>

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<sup>71</sup> Central Statistical Organization, *Yemen: Demographic and Maternal and Child Health Survey 1997* (Macro International, November 1998); Department of Statistics, *Jordan: Population and Family Health Survey 1997* (Macro International, December 1998); F. El-Zanaty and A.A. Way, *Egypt: Demographic and Health Survey 2000* (Ministry of Health and Population, January 2001); and M. Azelmat, M. Ayad and H. el Arbi, *Morocco: Demographic and Health Survey 1995* (in French) (Macro International et al., January 1996).

<sup>72</sup> A. Blanc, S.L. Curtis and T.N. Croft, “Monitoring contraceptive continuation: links to fertility outcomes and quality of care”, *Studies in Family Planning*, vol. 33, No. 2 (June 2002).



### III. CONCLUSIONS

Freshwater scarcity is a major concern in the Arab region, which threatens political stability and hinders efforts aimed at promoting health, alleviating poverty and enhancing socio-economic development. While such natural factors as intermittent droughts and limited freshwater reserves can cause water scarcity, high population growth rates create additional pressures. Certain innovations can help to make the best possible use of the available water. However, technology cannot change the rate at which water is renewed in the global water circulation system. Water is a limited natural resource that is critical for human life; sources can be exhausted or polluted to such an extent that they become unreasonably expensive to purify for reuse.

Moreover, tapping new sources of water and using new technologies to meet the increasing demand for water often require substantial investments, which are typically unaffordable to most countries in the region, particularly the low-income States. Equally, given rising water costs, marginalized groups, including the poor in both rural and urban areas, are more liable to be left without adequate access to safe water, which contributes in a cyclical manner to poor health and increasing poverty. While water scarcity is not the cause of poor health or poverty in the region, it hinders Governments in their efforts to improve health and alleviate poverty, and dampens overall development and economic expansion in the region. Transforming the traditional water management framework that underpins water supply is one way of breaking this cycle. Consequently, Arab countries need to explore ways to manage their scarce water resources more effectively and to meet their growing demand for water. Successful policies, strategies and programmes for managing water demand must be designed such that they promote more desirable patterns and levels of water use. Moreover, such policies need to be multifaceted, thereby enhancing water management through a combination of sound regulations, adequate economic incentives, technological innovations and public awareness programmes.

Additionally, Governments need to make stronger commitments and promote investments in the reproductive health needs of women in the region and to meet their demands for family planning. These steps reduce population growth rates by lowering unintended pregnancies, contribute to regional sustainable development, and improve the health of women and children. Failure in this quest, however, could serve to deepen and widen schisms among and within Arab societies and has long-term implications for regional sustainable development.

Within the context of water conservation, there is an urgent need to formulate and implement adequate strategies in all the national sectors, particularly in agriculture, which currently accounts for 89 per cent of total water use in the region. While traditional and innovative technologies are available to economize water, inconsistent implementation and poor management limit such conservation efforts. Voluntary conservation can be encouraged through public awareness programmes that

highlight the issue of water scarcity, and through community participation in all aspects of water management.

Given the fierce competition over scarce freshwater resources, regional cooperation is a vital element in water supply management and is pivotal in resolving present and potential conflicts caused by water and the use of shared resources. Equity in the use of shared water resources must be the guiding principle in such cooperation.