Freshwater Resources

Source: AQUASTAT--FAO's Information System on Water and Agriculture, with updates from the Blue Plan.

	Renewable Water Resources (annual) {a}						Water Withdrawals (annual)							Desalinated Water Production (million m3) {g}
	Internal Renewable Water Resources (IRWR)				Natural Renewable Water Resources {b}					as a % of Renewable Water Resources	Sectoral Share (percent) {c}			
	Groundwater Recharge (km3) {e}	Surface Water (km3) {e}	Overlap (km3)	Total {d} (km3)	Total (km3)	Per Capita (m3) {f}	Year	Total (million m3)	Per Capita (m3)		Agriculture	Domestic	Industry	
Iran, Islamic Rep	49	97	18	129	138	1,900	1993	70,034	1,122	59	92	6	2	2.9
Iraq	1.2	34	0	35	75 h	3,111 h	1990	42,800	2,478	80	92	3	5	0
Israel	0.5	0.3	0	0.8	2	265.0	1997	1,620	287	108	54	39	7	X
Jordan	0.5	0.4	0.2	0.7	1	169.4	1993	984	255	151	75	22	3	2.0
Kuwait	0	0	0	0	0.02	9.9	1994	538	306	3,097	60	37	2	231
Lebanon	3.2	4.1	2.5	4.8	4 h	1,219.5 h	1996	1,300	400	33	68	27	6	0
Oman	1.0	0.9	0.9	1.0	1	363.6	1991	1,223	658	181	94	5	2	34
Saudi Arabia	2.2	2.2	2.0	2.4	2	110.6	1992	17,018	1,056	955	90	9	1	714
Syrian Arab Rep	4.2	4.8	2.0	7.0	26 h	1,541 h	1995	12,000	844	55	90	8	2	0
Turkey	69	186	28	227	229 h	3,344 h	1997	35,500	558	17	73	16	12	0.5
United Arab Emirates	0.1	0.2	0.1	0.2	0	55.5	1995	2,108	896	1,614	67	24	9	385
Yemen	1.5	4.0	1.4	4.1	4	205.9	1990	2,932	253	123	92	7	1	10

a. Although data were obtained from FAO in 2002, they are long-term averages originating from multiple sources and years. For more information, please consult the original source at http://www.fao.org/ag/agl/aglw/aquastat/water_res/index.stm. **b**. Natural Renewable Water Resources include Internal Renewable Water Resources plus or minus the flows of surface and groundwater entering or leaving the country. **c**. Sectoral withdrawal data may not add up to 100 because of rounding. **d**. At the country level, Total Internal Renewable Water Resources = Surface water + Groundwater - Overlap. Regional and global totals represent a sum of available country-level data. **e**. Groundwater and surface water cannot be added together to calculate total available water resources because of overlap--water that is counted in both the groundwater and surface water totals. **f.** Calculation is based on withdrawals from various years and population data from 2002. **g**. Data on desalinated water originate from FAO country surveys conducted various regions between 1992 and 2000 (see the technical notes for specifics). **h**. Data account for the portion of flow secured through treaties or agreements to other countries.

Sources and Technical Notes

VARIABLE DEFINITIONS AND METHODOLOGY:

Internal Renewable Water Resources (IRWR) are measured in cubic kilometers per year (km3/year). IRWR include the average annual flow of rivers and the recharge of groundwater (aquifers) generated from endogenous precipitation--precipitation occurring within a country's borders.

Groundwater Recharge is the total volume of water entering aquifers within a country's borders from endogenous precipitation and surface water flow. Groundwater resources are estimated by measuring rainfall in arid areas where rainfall is assumed to infiltrate into aquifers. Where data are available, groundwater resources in humid areas have been considered as equivalent to the base flow of rivers.

Surface Water produced internally includes the average annual flow of rivers generated from endogenous precipitation and base flow generated by aquifers. Surface water resources are usually computed by measuring or assessing total river flow occurring in a country on a yearly basis.

Overlap is the volume of water resources common to both surface and groundwater. It is subtracted when calculating IRWR to avoid double counting of water resources. Two types of exchanges create overlap: contribution of aquifers to surface flow, and recharge of aquifers by surface runoff. In humid temperate or tropical regions, the entire volume of groundwater recharge typically contributes to surface water flow. In karstic domains (regions with porous limestone rock formations) a portion of groundwater resources are assumed to contribute to surface water flow. In arid and semi-arid countries, surface water flows recharge groundwater by infiltrating through the soil during floods. This recharge is either directly measured or inferred by characteristics of the aquifers and piezometric levels.

Total Internal Renewable Water Resources is the sum of surface and groundwater resources minus overlap; in other words, IRWR = Surface Water Resources + Groundwater Recharge – Overlap.

Natural Renewable Water Resources, measured in cubic kilometers per year (km3/year), is the sum of internal renewable water resources and natural flow originating outside of the country. Natural Renewable Water Resources are computed by adding together both internal renewable water resources (IRWR—see above) and natural flows (flow to and from other countries). Natural incoming flow is the average amount of water which would flow into the country without human influence. In some arid and semi-arid countries, actual water resources are presented instead of natural renewable water resources. These actual totals, labeled with a footnote in the freshwater data table, include the quantity of flows reserved to upstream and downstream countries through formal and informal agreements or treaties. The actual flows are often much lower than natural flow due to water scarcity in arid and semi-arid regions.

Per Capita Natural Renewable Water Resources are measured in cubic meters per person per year (m3/person/year). Per capita values were calculated by using national population data for 2002. For more information about the collection methodology and reliability of the UN population data, please refer to the technical notes in the population data table.

Water Withdrawals (annual), measured in million cubic meters, refers to total water removed for human uses in a single year, not counting evaporative losses from storage basins. Water withdrawals also include water from nonrenewable groundwater sources, river flows from other countries, and desalination plants.

Per capita annual withdrawals were calculated using national population data for the year the withdrawal data were collected. **Water withdrawals as a percentage of renewable water resources** is the proportion of renewable water resources withdrawn on a per capita basis, expressed in cubic meters per person per year. The value is calculated by dividing water withdrawals per capita by actual renewable water resources per capita.

Sectoral Share of water withdrawals, expressed as a percentage, refers to the proportion of water used for one of three purposes: agriculture, industry, and domestic uses.

Agricultural uses of water primarily include irrigation and, to a lesser extent, maintenance of livestock.

Domestic uses include drinking water plus water withdrawn for homes, municipalities, commercial establishments, and public services (e.g. hospitals).

Industrial uses include cooling machinery and equipment, producing energy, cleaning and washing goods produced as ingredients in manufactured items, and as a solvent.

Desalinated water production, expressed in million cubic meters, refers to the amount of water produced by the removal of salt from saline waters--usually seawater--using a variety of techniques including reverse osmosis. Most desalinated water is used for domestic purposes.

AQUASTAT collects its information from a number of sources--national water resources and irrigation master plans; national yearbooks, statistics and reports; FAO reports and project documents; international surveys; and, results from surveys made by national or international research centers. In most cases, a critical analysis of the information was necessary to ensure consistency between the different data collected for a given country. When possible, cross-checking of information between countries was used to improve assessment in countries where information was limited. When several sources give different or contradictory figures, preference was always given to information collected at national or sub-national level. This preference is based on the assumption by FAO that no regional information can be more accurate than studies carried out at the country level. Unless proven to be wrong, official rather than unofficial sources were used. In the case of shared water resources, a comparison between countries was made to ensure consistency at river-basin level.

For more information on the methodology used to collect these data, please refer to the original source or the following methodology paper: Food and Agriculture Organization of the United Nations (FAO): Water Resources,

Sources and Technical Notes

Development and Management Service. October, 2001. *Statistics on Water Resources by Country in FAO's AQUASTAT Programme* (available on-line at ftp://ftp.fao.org/agl/aglw/aquastat/water_res.pdf). Rome: FAO.

FREQUENCY OF UPDATE BY DATA PROVIDERS:
AQUASTAT was developed by the Food and Agriculture Organization of the United Nations in 1993; data have been available on-line since 2001. Most freshwater data are not available in a time series, and the global dataset contains data collected over a time span of up to 30 years. AQUASTAT updates their web site as new data become available, or when FAO conducts special regional studies. Studies were conducted in Africa in 1994, the Near East in 1995-96, the former Soviet republics in 1997, selected Asian countries in 1998-99, and Latin America & the Caribbean in 2000. Data from the Blue Plan on Mediterranean water withdrawals were last updated in 2002. Most data updates include revisions of past data. Data may therefore differ from those reported in past editions of the *World Resources Report*.

DATA RELIABILITY AND CAUTIONARY NOTES:
While AQUASTAT represents the most complete and careful compilation of country-level water resources statistics to date, freshwater data are generally of poor quality. Information sources are various but rarely complete. Some governments will keep internal water resources information confidential because they are competing for water resources with bordering countries. Many instances of water scarcity are highly localized and are not reflected in national statistics. In addition, the accuracy and reliability of information varies greatly among regions, countries, and categories of information, as does the year in which the information was gathered. As a result, no consistency can be ensured among countries on the duration and dates of the period of reference. All data should be considered order-of-magnitude estimates.

Groundwater infiltration tends to be overestimated in arid areas and underestimated in humid areas.
Natural Renewable Water Resources vary with time. Exchanges between countries are complicated when a river crosses the same border several times. Part of the incoming water flow may thus originate from the same country in which it enters, making it necessary to calculate a "net" inflow to avoid double counting of resources. In addition, the water that is actually accessible to humans for consumption is often much smaller than the total renewable water resources indicated in the data table.
Renewable Water Resources Per Capita contains water resources data from a different set of years than the population data used in the calculation. While the water resources data are usually long-term averages, inconsistencies may arise when combining it with 2002 population data.
Water withdrawals as a percent of actual water resources are also calculated using per capita data from two different years. While this ratio can indicate that some countries are depleting their water resources, it does not accurately reflect localized over-extraction from aquifers and streams. In addition, the calculation does not distinguish between ground and surface water.
Sectoral withdrawal data may not add to 100 because of rounding. Evaporative losses from storage basins are not considered; users should keep in mind, however, that in some parts of the world up to 25% of water that is withdrawn and placed in reservoirs evaporates before it is used by any sector.
Desalinated Water Production may exist in some countries where the volume of production is indicated to be zero, since AQUASTAT assumes that production is zero if no value has been given for those countries where information on water use is available.

SOURCES:
Renewable Water Resources: Food and Agriculture Organization of the United Nations (FAO): Water Resources, Development and Management Service. 2002. *AQUASTAT Information System on Water in Agriculture: Review of Water Resource Statistics by Country*. Rome: FAO. Available on-line at http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastat/water_res/index.htm.
Water withdrawals: Food and Agriculture Organization of the United Nations (FAO): Water Resources, Development and Management Service. 2002. *AQUASTAT Information System on Water in Agriculture*. Rome: FAO. Available on-line at http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastat/dbase/index.htm. Data for Mediterranean countries were provided directly to WRI from: Margat, J. 2002. *Present Water Withdrawals in Mediterranean Countries*. Paris: Blue Plan.
Population Data (for per capita calculations): Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat. 2002. *World Population Prospects: The 2000 Revision*. New York: United Nations. Dataset on CD-ROM.