UNITED NATIONS E

UN-ESCWA UNSD UNEP

Distr.
LIMITED
E/ESCWA/SCU/2007/WG.2/CP.3
17 May 2007
ORIGINAL: ENGLISH

Economic and Social Commission for Western Asia (ESCWA)

Expert Group Meeting on the Production of Statistics
on Natural Resources and Environment
Cairo, 5-7 June 2007

COUNTRY PAPER

WATER STATISTICS AND WATER ACCOUNT IN JORDAN

JORDAN
DEPARTMENT OF STATISTICS

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07-0284

Water Statistics and Water Account in Jordan

Introduction

Water is an essential element for life. It is a key element in growing food, generating energy, producing many industrial products as well as in ensuring the integrity of ecosystems and the goods and services they provide. Increasing competition for freshwater between agriculture, urban and industrial use as well as population growth result in putting pressure on water resources, with many countries rapidly reaching conditions of water scarcity or facing limits to economic development. Moreover, water quality continues to worsen further limiting the availability of freshwater resources.

Water resources in Jordan consist of surface water which is springs and water catchments in Jordan's Rift valley, renewable and nonrenewable ground water and treated waste water. Water resources provide several functions for survival, production and consumption activities. The focus of water accounting is on the interactions between water resources and the economy where the economy is thought of as the system which abstracts water for consumption and production activities, and puts in place the infrastructure to mobilize, store, treat, distribute and return water into the environment.

Jordan is considered among the poorest countries in the world in terms of water resources. Primary sources of water in Jordan are aquifers and basins fed and recharged through annual precipitation, which is characterized as rain events in all regions with high fluctuation in quantity and time. Most of total areas (90%) receive less than 200 millimeters/year. Total amount of the rainfall in 2005 is 9304.0 M.C.M., most of them (93%) is lost as evaporation. Per capita water supply is around 143 Litter/day for all uses which is among the lowest in the world. Scarcity of water resources is the main challenges for economic development. In addition to the limited water resources is exceeding the safety limits and depleting ground water resources which led to water salinity.

A-Water Statistics

Water Resources

The total amount of the precipitation is 9304.0 M.C.M. which form 114.4 % of the long term rainfall volumes in 2005. The amount of infiltration is 364.1 M.C.M. form 3.9 % of the total rainfall and the amount of floods is 269.7 M.C.M. which form 2.2% of the total rainfall (Table A-1)

Table A-1 Comparison of surface water budget for 2004/2005 with long-term average 1937-2005

	Rainfall	Evaporation		Floods		Infiltration	
Period	Volume	Volume	%	Volume	%	Volume	%
2004/2005	9304.0	8671.0	93.9	269.7	2.2	364.1	3.9
1937-2002	8352.0	7726.0	92.5	197.0	2.4	432.0	5.2

Ground water is abstracted by public and private sectors (mainly for irrigation purposes), government abstract water for the other uses. The total amount of ground water abstracted in 2005 is 506.0 M.C.M. exceeding the safe yield by 172% (Table A-2) The current abstraction of ground water highly exceeds the safe limits which lead to exploitation of this important water resource because of high water demand.

Table A-2 Total quantity of ground water, Number of wells and % of safe yield by source of ground water 2005

Source	Quantity	% of total ground water	Safe limits	Total no. of wells	Balance	% of safe yeild
Ground water	**506.0**	**53.8****	**294***	**2779**	**-211.9**	**172%**
-Renewable	429.1	84.8	294.0	2700	-150.6	
-Non-renewable	76.9	15.2	125.0	79	-61.3	

Safe yield is 294.0 M.C.M. Only for renewable

*** % of total water use*

As a result of urbanization there is an increase in the production of waste water around the world but the disposal methods of this water are not under control. Still the capacity of waste water treatment plants is far less than waste water generated. Treated waste water is an unconventional water resource used in Jordan for irrigation and contributes to 8.9% of the total water used (Table A-3). The biological treatment plants are expected to remove more than 90% of biological oxygen demand.

Table A-3 Quantities of treated waste water and used for irrigation M.C.M.

Source	1997	1998	1999	2000	2001	2002	2003	2004	2005
Treated waste water	76.8	82.0	86.5	83.1	73.44	83.2	85.5	88.4	89.3
Used for irrigation	54.9	-	69.7	72.0	73.44	72.4	75.4	86.4	83.6
% of treated water from other used water	6.2	-	13.3	8.81	15.06	14.0	14.9	10.0	8.9

- not available

B- Water Supply

Total water supply in 2005 is 941 M.C.M., surface water supply for different uses is 351.4 M.C.M. which contribute to 37.3 (70.2 % is from Jordan's rift valley) from the total water supply. Renewable and non renewable water supply share is 53.8% and treated waste water share is 8.9%. Most of the total water supply is used for irrigation as high as 64.1 %, 38.4% for industrial use and 30.9% for household uses. The contribution of treated waste water is high because of the scarcity of water resources in Jordan. Ministry of Health-environment health directorate gives us detailed information on the state of waste water treatment plants by design and operation capacity to hydraulic and organic load, detailed and specialized results of the chemical tests, microbial and parasite status of the waste water. Government is the main supplier of water for public sectors. Also ground water is abstracted by public and private sectors (Table B-1)

Table B-1 Quantity of water use by resource (M.C.M.) in 2005

Source	Livestock	irrigation	Industrial	Municipal	Total
1. Surface Water	**7.0**	**265.2**	**4.5**	**74.7**	**351.4**
-Jordan Rift Valley	0.0	187.8	4.2	54.6	246.6
-Spring	0.0	36.7	0.3	20.1	57.0
-Floods	7.0	40.8	0.0	0.0	47.8
Ground Water	**0.8**	**254.7**	**33.9**	**216.6**	**506.0**
-Renewable	0.8	203.2	24.3	200.8	429.1
-Non-Renewable	0.0	51.5	9.6	15.9	76.9
Treated Waste water	**0.0**	**83.6**	**0.0**	**0.0**	**83.6**
Total	**7.8**	**603.5**	**38.4**	**291.3**	**941**

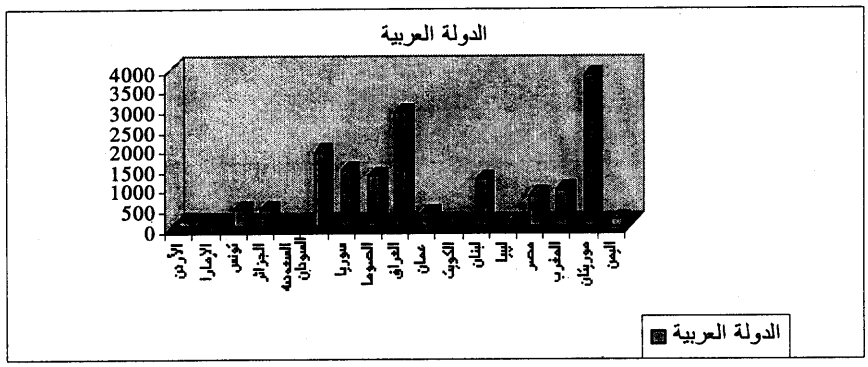
Source: Ministry of water and irrigation-water authority

Per capita water supply for all uses is considered low in ESCWA region and it's around 990 m^3 (Table B-2) in which Jordan among the lowest. Jordan adopts strategies for water resources such as ground water management, irrigation, agriculture policies and water efficiency.

Table B-3 Per capita water supply for Arabic countries M^3/year

Country	Per capita Water supply
Jordan	52.3
U.A.E.	49
Tunisia	459
Algiers	443
Saudi Arabia	96
Al Sudan	1879
Syria	1441
Iraq	2917
Lebanon	1189
Kuwait	8

Figure 1:



C-Water Account

Integrated environmental and economic accounting for water resources provides a framework for water information to study the interaction between the economy and the environment by linking physical information on water with economic accounts. Water resources provide services to economy by providing input into production and consumption activities, habitat for living beings and sink for waste materials.

Water is in continuous movement because of solar radiation and gravity, the inland water resource system is composed of all resources inside certain territory such as river, lakes, artificial reservoirs and groundwater. The main input for water

resources is precipitation and inflow from other territories. The main natural flows that decrease the stock are evaporation and outflow to other territories.

Table C-1 physical stock of renewable freshwater resources M.C.M.

Jordan	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Precipitation	8746.0	8746.0	9110.0	2973.0	3651.0	7375.0	7545.0	9708.03	6951.0	9304.0
Evaporation	7921.0	8207.2	8463.2	2919.0	3473.9	6815.2	7011.8	9026.4	6550.5	8671.0
Internal flow (1+2)	**825**	**538.8**	**646.8**	**54**	**177.1**	**363.2**	**533.2**	**681.6**	**400.5**	**633.0**
Inflow of surface and ground water	-	-	-	-	-	700.6	737.4	734.7	779.5	738.1
Renewable fresh water resources	-	-	-	-	-	**1013.6**	**1270.6**	**1416.7**	**1180**	**1376.2**

The first step in the preparation for water account is to fill the standard physical and supply use for water in the country. The definitions of the terms in the table are at the end of the paper (Table C-2).

Table C-2 physical use table M.C.M. in 2005

		Irrigation	**Industry**	**Household**	**Livestock**	**Total**
From the environ-ment	U 1 Total Abstraction	**603.5**	**38.4**	**291.3**	**7.8**	**941**
	a.1 for own use	603.5	38.4	291.3	7.8	941
	a.2 for distribution	0	0	0	0	0
	B.1 from water resource	**603.5**	**38.4**	**291.3**	**7.8**	**941**
	-surface	265.2	4.5	74.7	7.0	351.4
	-ground	254.7	33.9	216.6	0.8	506.0
	Treated waste water	83.6	0	0	0	83.6
	Soil*					
	B.2 from other resources	0	0	0	0	0
	Collection of precipitation					
	Abstraction from the sea	0	0	0	0	0
Within economy	U 2 use of water from other economic units	-	-	-	-	-
U= U1+U2	**Total use of water**	**603.5**	**38.4**	**291.3**	**7.8**	**941**

- Not available (direct collection of precipitation)

**** Water for rainfed agriculture is not quantified (rainfed area contributes to 67.6% of the total agricultural area 1673415.5 dunum)***

Table C-2 physical use table

		Irrigation	**Industry**	**Household**	**Livestock**	**Total**
From the environ-ment	S1 Supply to other economic activity*	**223.3**	**14.2**	**107.8**	**2.8**	**348.2*****
	Reused water					
	Waste water	89.3				89.3**
	S2 total return					
	D1 to water resource					
	Surface water					
	Ground water					
	Soil					
	D 2 to other resources					
	Total Supply of water	**312.6**				**437.5**
	Consumtion	**290.9**	**24.2**	**183.5******	-	**503.5**

** Losses in distribution*

***Waste water is for any entity accessed to sanitation*

**** assuming loss during transportation about 37% The loss in 1999 was 57.2% and a repair for network occur*

***** per capita water supply is lower than 134 litter /day if we consider losses during transportation (92 L/day)*

Information on the physical supply and use of water can be obtained from specific surveys by asking them on water related issues (water abstracted from the public network, wells and tanks, also total sewage water from these sectors)

Table C-3 water used in certain sectors (M.C.M.)

Sector	2002	2003	2004	2005
Dangerous industries	6.99	4.75	-	7.68
Medical Services	1.3	1.6	1.6	1.2
Construction	0.86	1.2	1.5	
Industry	33.2	-	-	-
Mining and Quarrying*	21.6	-	-	-

** The consumption of water here included in the industrial sector*

The price of water provide inadequate indicator on its economic value. This situation is applicable to Jordan because of water scarcity. The monetary value of water used in different sectors of industry, services, transportation and construction are available depending on water price considering the water as commodity enter in production process (Table C-4). It's difficult to determine the stock of water resources at specific point of time to evaluate water stocks. But in environmental statistic division we are trying to estimate water values in these sectors based on the residual value, change in net income and production function approach. Here the total value of production exactly equals the opportunity costs of all non-water inputs at the market price, so the value of the water is the difference.

Value of marginal product of water=Total value of commodity-cost of non-water inputs to production/quantity of water

Table C-4 Prices of the total amount of water in specific sectors (000 JD) in 2005

Sector	مخزون بداية العام	المشتريات خلال العام	التغير في المخزون	المباع دون تصنيع بسعر الإنتاج	التالف والمفقود	Consumption cost
Industry	0.0	28135.7	0.0	0.2	0.0	28135.4
-electricity generation and distribution	0.0	1198.1	0.0	0.0	0.0	1198.1
Wholesaler and retailer	0.0	4173.6	0.0	0.0	0.0	4173.6
***Services**	0.0	8710.8	-0.9	0.0	0.0	8711.7
Construction	0.0	2614.8	-0.1	0.0	0.0	2614.9
***Transportation and communication**	0.0	2790.1	0.0	0.0	0.0	2790.1
Insurance	-	79.0	0.0	0.0	0.0	79.0

** 2004*

In Jordan several specific studies takes place in universities to evaluate natural resources such as coral reef in Aqaba gulf. Surveys were conducted to ask target people (tourists) about willingness to pay for visiting Aqaba and interesting in diving and coral reef view (Travel cost method) and the effect of increasing price of admission on the travel cost. Since travel cost is varying from one person to another it is possible to construct a demand function for recreation. In the same manner different studies evaluate Dibbeen and Jarash forests. These studies are expensive and need specialist researchers for collecting data and filling specialized questionnaires prepared for this purpose.

D- Difficulties in Environmental Statistic Division

1. Deficiency in detailed data related to natural resources ex. Water asset account describe stock at the beginning and end of an accounting period which is not available
2. Need of specialized studies related to degradation and pollution of resources which is expensive (effect of air pollution on health and valuation of water in agriculture depending on change in productivity approach)
3. Fear of under or over estimating of a resource
4. Training on calculation methodologies

E- References

1. Integrated Environmental and Economic Accounting for Water Resources, United Nation Statistic Division
2. Estimating the cost of environmental degradation-A training manual
3. Environment Statistics Annuals 1997-2005 Department of Statistics
4. Guide to Environment Statistics-Water Statistics by Khamis Raddad