

It hopes that in 2.025 it goes down under 4.000 m³/year. On this year it is predictable that the third part of the world population endures a strong increase of water.

In the arid and semi-arid zones, like Mediterranean ones, the water lack is associated with a strong overexplotation of aquifers

Dynamics of water use in the world over the kinds of economic activities (km3/year)

Sector		A s s e s s m e n t						Forecast			
	1900	1940	1950	1960	1970	1980	1990	1995	2000	2010	2025
Population (millions)			2542	3029	3603	4410	5285	5735	6181	7113	7877
Irrigated land area (mln.ha)	47.3	75.9	101	142	169	198	243	253	264	288	329
Agricultural Use	513	895	1080	1481	1743	2112	2425	2504	2605	2817	3189
	321	586	722	1005	1186	1445	1691	1753	1834	1987	2252
Municipal Use	21.5	58.9	86.7	118	160	219	305	344	384	472	607
	4.61	12.5	16.7	20.6	28.5	38.3	45.0	49.8	52.8	60.8	74.1
Industrial Use	43.7	127	204	339	547	713	735	752	776	908	1170
	4.81	11.9	19.1	30.6	51.0	70.9	78.8	82.6	87.9	117	169
Reservoirs	0.30	7.00	11.1	30.2	76.1	131	167	188	208	235	269

Remarks: Nominator - water withdrawal, denominator - water consumption

Source: Shiklomanov (2000)

Caput water withdrawal for domestic and municipal usages in different regions of the world

Region Africa	m³/year-
Asia	31
North and central America	167
South America	86
Europe	92
Former USSR	90
World estimation	52

Source: FAO

Caput water withdrawal for agricultural usages in different regions of the world

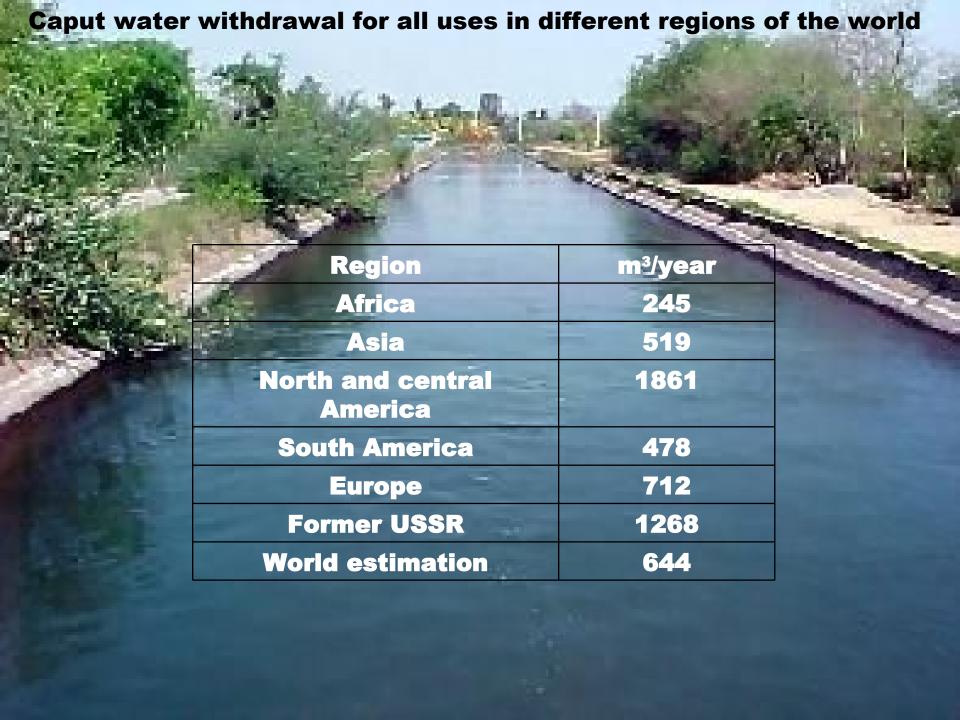
Region	m³/year
Africa	216
Asia	446
North and central America	912
South America	282
Europe	235
Former USSR	832
World estimation	444

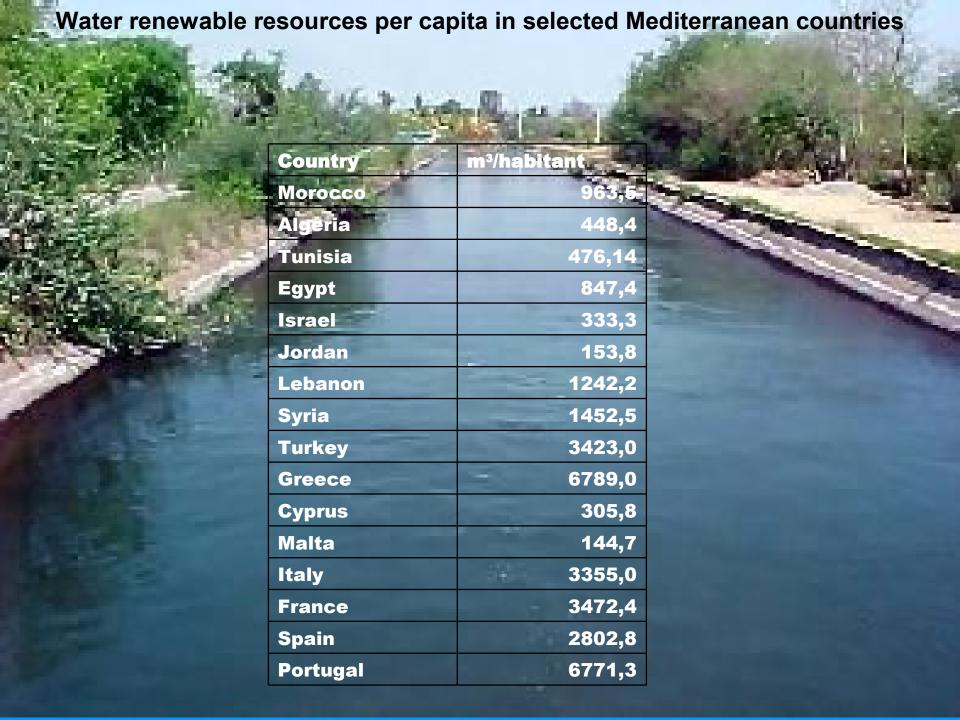
Source: FAO

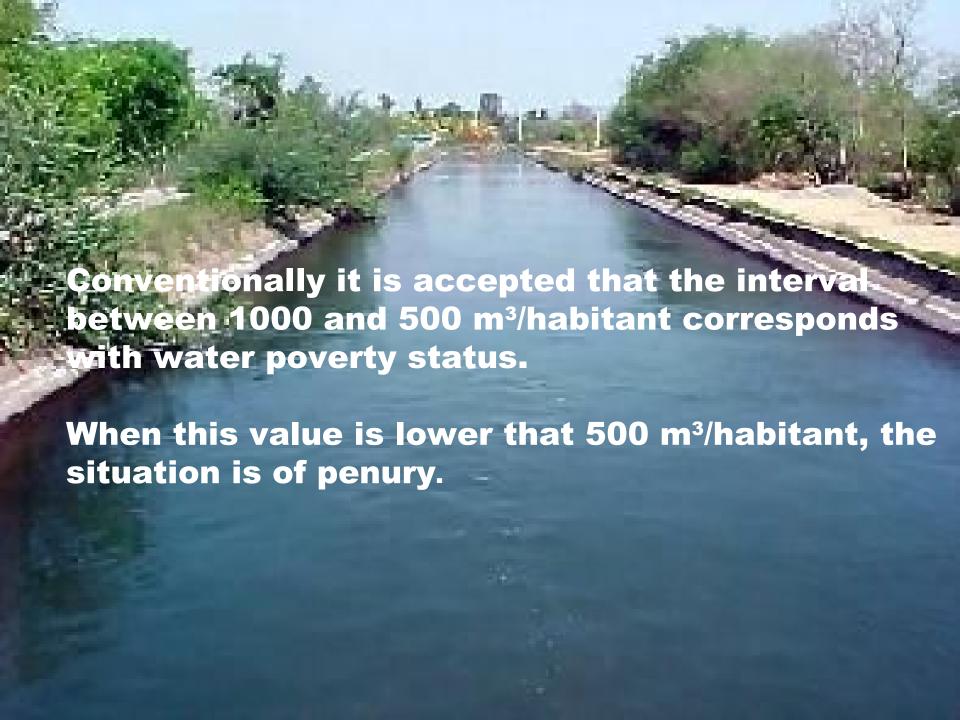
Caput water withdrawal for industrial usages in different regions of the world

Region	m³/year
Africa	12
Asia	42
North and central	782
America	
South America	110
Europe	385
Former USSR	346
World estimation	148

Source: FAO







Exploitation index of natural and renewable water resources in selected Mediterranean countries

Country	Index (%)
Morocco	41
Algeria	25
Tunisia	57
Egypt	91
Israel	95
Jordan	n.a.
Lebanon	27
Syria	- 48
Turkey	15
Greece	10
Cyprus	27
Malta	50
Italy	23
France	21
Spain	33
Portugal	n.a.

Source: Plan Bleau, 1999

Water renewable resources, water withdrawal and water consumption in selected Mediterranean countries (Km³/year) (2000)

Country	WRR	WW	WC	WC/WW (%)	WC/WRR (%)	WW/WRR (%)
Morocco	29	11,7	7,75	66,23	26,72	40,34
Algeria	13,9	5,91	2,9	49,06	20,86	42,51
Tunisia	4,59	3,14	2,63	83,75	57,29	68,40
Egypt	58,3	54,3	38	69,98	65,18	93,13
Israel	2	2,03	1,3	64,03	65,00	101,50
Jordan	1	1,19	0,66	55,46	66,00	119,00
Lebanon	4	1,75	1,05	60,00	26,25	43,75
Syria	26	11,6	8,2	70,68	31,53	44,61
Turkey	229	35	21,3	60,85	9,30	15,28
Greece	74	8,7	na	na	na	11,75
Cyprus	0,2	0,211	na	na	na	1
Malta	0,05	0,055	na	na	na	1
Italy	191	56,6	29,2	51,59	15,28	29,63
France	204	37,7	10,5	27,85	5,14	18,48
Spain	112	44,1	25,1	56,91	22,41	39,37
Portugal	69	8,3	4,43	53,37	6,42	12,02
TOTAL	1.018,04					

Remarks. WRR: water renewable resources. WW: water withdrawal. WC: water consumption.

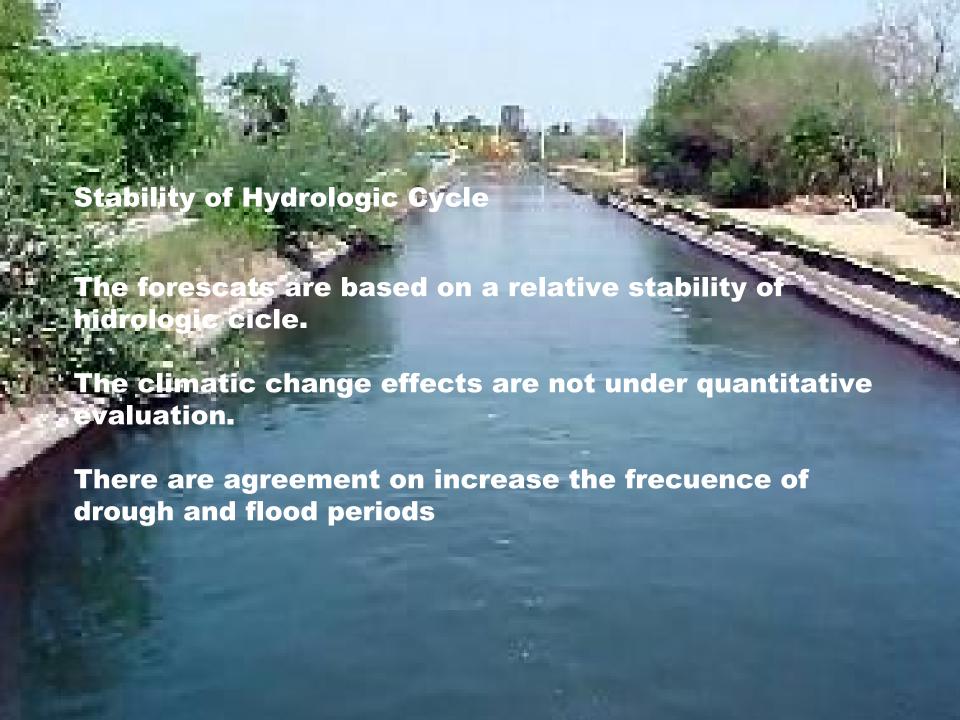
Water renewable resources, water withdrawal and water consumption in selected Mediterranean countries (Km³/year) (2025)

Country	WRR	WW	WC	WC/WW (%)	WC/WRR (%)	WW/WRR (%)
Morocco	29	15,1	10,3	68,21	35,51	52,06
Algeria	13,9	9,9	4,24	42,82	30,50	71,22
Tunisia	4,59	3,5	2,89	82,57	62,96	76,25
Egypt	58,3	67,7	40,4	59,67	69,29	116,12
Israel	2	2,3	1,3	56,52	65,00	115,00
Jordan	1	2,5	1,44	57,60	14,00	250,00
Lebanon	4	3	1,49	49,66	37,25	75,00
Syria	26	17,9	11,8	65,92	45,38	68,84
Turkey	229	50,1	28,7	57,28	12,53	21,87
Greece	74	na	na	na	na	Na
Cyprus	0,2	na	na	na	na	Na
Malta	0,05	Na	na	na	na	Na
Italy	191	58,9	27,3	46,34	14,29	30,83
France	204	42,2	12	28,43	5,88	20,68
Spain	112	50	27	54,00	24,10	44,64
Portugal	69	8,5	4,63	54,47	6,710	12,31
TOTAL	1.018,04					

Remarks. WRR: water renewable resources. WW: water withdrawal. WC: water consumption.

Population growth inference for the period 2000-2025 in selected countries of Mediterranean Region (Thousands of habitants)

Sub-region	Countries	2000	2025	Difference	Annual growth
South	Morocco	29231	40280	11049	1,511
	Algeria	30463	42871	12408	1,62
	Tunisia	9563	12028	2465	1,03
	Egypt	67285	101092	33807	2,00
	TOTAL	136542	196271	59729	1,74
East	Palestina	3150	6422	3272	4,15
	Israel	6084	8734	2650	1,74
	Jordan	4972	8134	3162	2,54
	Lebanon	3398	4297	899	1,05
	Syria	16813	28081	11268	2,68
	Turkey	68234	90565	22331	1,30
	TOTAL	102651	146233	43582	1,69
North	Greece	10975	11173	198	0,07
	Cyprus	786	1014	228	1,16
	Malta	392	432	40	0,40
	Italia	57715	56307	-1408	0,09
	Francia	59278	63407	4129	0,27
	Spain	40717	44244	3527	0,34
	Portugal	10225	10924	699	0,27
	TOTAL	180088	1875501	7413	0,16



Water use by the main demands in selected countries of Mediterranean region (%)

The second secon	The second second			THE RESERVE THE PERSON NAMED IN
Country	Agriculture	Industry	Domesti c	Year
Morocco	88	2	10 -	1998
Algeria	- 52	14	34	1995
Tunisia	86	1	13	1996
- Egypt	82	11	7	1996
Israel	54	7	39	1997
Jordan	75	3	22	1992
Lebanon	67	6	27	1996
Syria	90	2	8	1995
Turkey	72	12	16	1997
Greece	87	3	10	1997
Cyprus	83	0	17	1998
Malta	97	0	3	1998
Italy	47	34	19	1998
France	10	72	18	1997
Spain	68	19	13	1997
Portugal	48	37	15	1990

Values of gross domestic product, in thousand millions USD, and its agricultural participation (%)

400			%	
Country	GDP	Agriculture	Industry	Services
Morocco	128,3 (4)	22,9	35,45	
Algeria	196,0 (3)	10,2	56,5	33,4
Tunisia-	68,23 (4)	13,9	32,2	53,9
Egypt	294,3 (3)	17,0	33,0	50,0
Israel	120,9 (4)	2,8	37,7	59,5
Jordan	23,64 (4)	3,6	29,0	67,4
Lebanon	17,82 (4)	12,0	21,0	67,0
Syria	58,01 (4)	28,5	29,4	42,1
Turkey	455,3 (3)	11,7	29,8	58,5
Greece	212,2 (3)	6,7	22	71,2
Cyprus (Gr)	8,90 (3)	4,9	19,9	75,6
Cyprus (Tk)	1,22 (3)	10,6	20,5	68,9
Malta	7,082 (3)	3,0	23,0	74,0
Italia	1.552 (3)	2,2	28,9	68,9
Francia	1.654 (3)	2,7	24,4	72,9
España	885,5 (4)	3,6	28,6	67,8
Portugal	181,8 (4)	5,8	30,7	63,2

Specific water demand for primary vegetal products

Products	Specific water demand
Oranges -	378
Patatoes	105
Pineapples	418
Pulses	1.754
Rice	1.408
Rye	1.159
Sorghum	542
Soybeans	2.752
Sugar beet	193
Sugar cane	318
Sunflower	3.283
Tomatoes	130
Tree nuts	4.936
Wheat	1.159

Source: FAO, WATER COUNCIL, 2003

Specific water demand for primary vegetal products

Products	Specific water demand (m³/t)
Apples	387
Bananas_	499
Barley	1910
Dates	1660-
Grapes	455
Grapefruit	286
Groundnuts	2547
Lemons, limes	344
Maize	710
Oats	2374
Olives	2500
Onions	168

Source: FAO, WATER COUNCIL, 2003

Virtual water is the water "embodied" in a product, not in real sense, but in virtual sense.

It refers to the water needed for the production of the product.

Arien Hoekstra (2004)

	Volume	Percenta
	billion	ge
	m³/yr	%
Crops and crop products	695	67
Livestock and livestock		
products	245	23
Industrial products	100	10
Total	1040	100

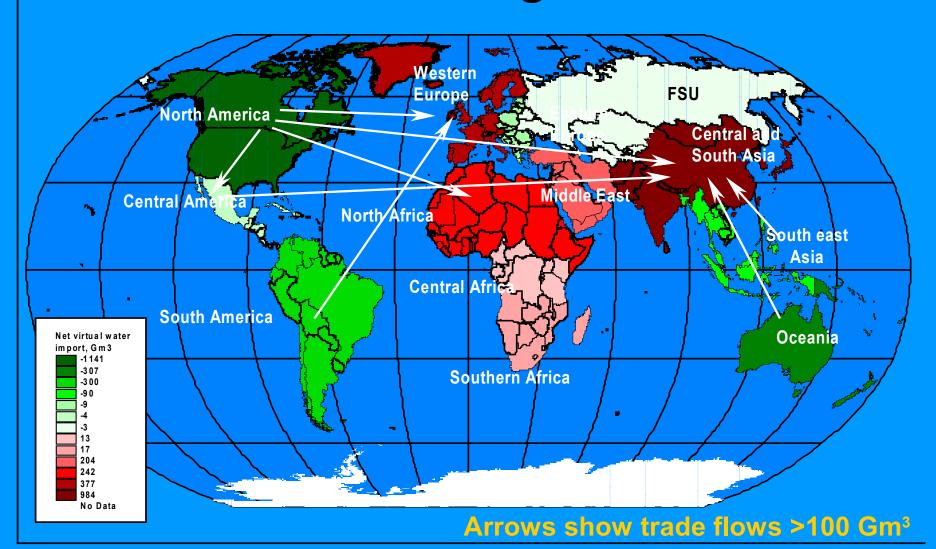
	Volume	Percenta
	billion	
	m³/yr	30% wheat 17% soybean
		15% rice
Crops and crop products	695	9% maize 7% raw
Livestock and livestock	245	sugar 5% barley
products		
Industrial products	100	
Total	1040	100

	Volume billion m³/yr	34% bovine meat 16% bovine hides and leather 12% cow milk & milk
Crops and crop products Livestock and livestock	695	products 10% swine and its products 8% live bovine
products	245	4% sheep and its products
Industrial products	100	its products
Total	1040	100

	Volume billion m³/yr	Percenta ge %
Crops and crop products	695	67
Livestock and livestock		
products	245	23
Industrial products	100	10
Total	1040	100
= 16% of global water	ГІ	lookotro

= 16% of global water use!

Virtual water trade balances of thirteen world regions (1995-1999)



1. Virtual water: an alternative source of water

Many national economies depend on (net) import of virtual water. For the period 1995-99:

Jordan	80%	Italy	20%
Netherlands	80%	Egypt	20%
Japan	40%	South Africa	20%
Tunesia	50%	China	4%

2. Virtual water trade: global water savings

Much of the international virtual water trade takes place from nations where water productivity is relatively high to nations where water productivity is relatively low.

→ global real water saving!

450 billion m³/yr saving due to global food trade

= 8% of global water use for crop production!

[Oki et al., 2003]

Population and surface under irrigation in selected countries of the Mediterranea region (2000 – 2025)

Country	Population x 1000 (2000)	Population x 1000 (2025)	Irrigated surface has x 1000 (2000)	Irrigated surface has x 1000 (2025)
Morocco	29231	40280	1313	1552
Algeria	30463	42871	385	425
Tunisia	9563	12028	410	560
Egypt	67285	101092	2650	3100
Israel	6084	8734	193	193
Jordan	4972	8134	154	395
Lebanon	3398	4297	101	85
Syria	16813	28081	1280	1780
Turkey	63234	90565	2679	3595
Greece	10975	11173	1500	1500
Cyprus	786	1014	39	39
Malta	392	432	0,763	0,763
Italia	57715	56307	3110	3020
Francia	59278	63407	1400	1400
España	40717	44244	3840	4020
Portugal	10225	10924	750	820
TOTAL	411131	523583	19804,763	22484,763

A real experience: water demands in river Segura basin (Spain)



Practical references

- Per caput gross urban demand: 109,5 m³/year
- Per hectare gross irrigation demand: 6.176 m³/year
- Gross industrial demand: 8 % of urban demand



Theoretical water demands for main uses in selected countries of Mediterranean region (2000)

Country	Population x 1000	Irrigated land has	Water Demands Km³/year		
		ж 1000	Urban	Agrarian	Industrial
Morocco	29231	1313	3,2007945	8,109088	0,25606356
Algeria	30463	385	3,3356985	2,37776	0,26685588
Tunisia	9563	410	1,0471485	2,53216	0,08377188
Egypt	67285	2650	7,3677075	16,3664	0,5894166
Israel	6084	193	0,666198	1,191968	0,05329584
Jordan	4972	154	0,544434	0,951104	0,04355472
Lebanon	3398	101	0,372081	0,623776	0,02976648
Syria	16813	1280	1,8410235	7,90528	0,14728188
Turkey	63234	2679	6,924123	16,545504	0,55392984
Greece	10975	1500	1,2017625	9,264	0,096141
Cyprus	786	39	0,086067	0,240864	0,00688536
Malta	392	0,763	0,042924	0,00471229	0,00343392
Italia	57715	3110	6,3197925	19,20736	0,5055834
Francia	59278	1400	6,490941	8,6464	0,51927528
España	40717	3840	4,4585115	23,71	0,35668092
Portugal	10225	750	1,1196375	4,632	0,089571
TOTAL	411131	19804,763	45,0188445	122,314216	3,60150756

Theoretical water demands for main uses in selected countries of Mediterranean region (2025)

Country	Population x 1000	Irrigated land has	Water Demands Km³/year		
		x 1000	Urban	Agrarian	Industrial
Morocco	40280	1552	4,41066	9,585152	0,3528528
Algeria	42871	425	4,6943745	2,6248	0,37554996
Tunisia	12028	560	1,317066	3,45856	0,10536528
Egypt	101092	3100	11,069574	19,1456	0,88556592
Israel	8734	193	0,956373	1,191968	0,07650984
Jordan	8134	395	0,890673	2,43952	0,07125384
Lebanon	4297	85	0,4705215	0,52496	0,03764172
Syria	28081	1780	3,0748695	10,99328	0,24598956
Turkey	90565	3595	9,9168675	22,20272	0,7933494
Greece	11173	1500	1,2234435	9,264	0,09787548
Cyprus	1014	39	0,111033	0,240864	0,00888264
Malta	432	0,763	0,047304	0,00471229	0,00378432
Italia	56307	3020	6,1656165	18,65152	0,49324932
Francia	63407	1400	6,9430665	8,6464	0,55544532
España	44244	4020	4,844718	24,82752	0,38757744
Portugal	10924	820	1,196178	5,06432	0,09569424
TOTAL	523583	22484,763	57,3323385	138,865896	4,58658708

Water renewable resources, water withdrawal, water consume and theoretical Demands of water in selected countries of Mediterranean Region (2000) (km³/year)

Country	WRR	ww	wc	TD
Morocco	29	11,7	7,75	11,56
Algeria	13,9	5,91	2,9	5,98
Tunisia	4,59	3,14	2,63	3,66
Egypt	58,3	54,3	38	24,32
Israel	2	2,03	1,3	1,91
Jordan	1	1,19	0,66	1,53
Lebanon	4	1,75	1,05	1,02
Syria	26	11,6	8,2	9,89
Turkey	229	35	21,3	24,02
Greece	74	8,7	na	10,56
Cyprus	0,2	0,211	Na	0,33
Malta	0,05	0,055	Na	0,05
Italy	191	56,6	29,2	26,03
France	204	37,7	10,5	15,65
Spain	112	44,1	25,1	28,53
Portugal	69	8,3	4,43	5,84
TOTAL	1.018,04			170, 93

Water renewable resources, water withdrawal, water consume and theoretical Demands of water in selected countries of Mediterranean Region (2025) (km³/year)

Country	WRR	ww	wc	TD
Morocco	29	15,1	10,3	14,34
Algeria	13,9	9,9	4,24	7,69
Tunisia	4,59	3,5	2,89	4,88
Egypt	58,3	67,7	40,4	31,10
Israel	2	2,3	1,3	2,22
Jordan	1	2,5	1,44	3,40
Lebanon	4	3	1,49	1,03
Syria	26	17,9	11,8	14,31
Turkey	229	50,1	28,7	32,91
Greece	74	na	na	10,58
Cyprus	0,2	na	na	0,36
Malta	0,05	Na	na	0,055
Italy	191	58,9	27,3	25,31
France	204	42,2	12	16,14
Spain	112	50	27	30,06
Portugal	69	8,5	4,63	6,35
TOTAL	1.018,04			200,78

LEGAL NATURE OF WATER

In general, it is accepted all over the region that water is a natural wealth under the authority of State.

The main problem is to harmonize this principle with traditional rules into rural colectivities.

WATER IRRIGATION MANAGEMENT

PUBLIC ADMINISTRATIONS

• WUOs:

- User communities
- User associations
- Irrigation and drainage district
- Irrigator communities
- Syndical associations
- Public interest associations

MAIN TASKS OF WUOS

Frequenty, WUOs are very close to the Public Administrations and colaborate in water distribution.

The management of water into irrigation districts are one of the most important tasks.

Often, they are responsible of operations and maintenance of irrigation districts.

STRUCTURE OF WUOS

The structure of WUOs, mainly, consist in:

- General assembly
- President or legal representative
- Executive body
- Discipline body
- Administrative staff
- (Technical staff)

