Mediterranean Water Forum

6th World Water Forum
Marseille, France '12
Time for Solutions

Contribution to the first Mediterranean Water Forum
Marrakech, December 19-20, 2011

What are the current and the future demands for water and supply sources in the Mediterranean countries?

IME

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« Time for solutions » is the chosen subject for the 6th World Water Forum and for which the Mediterranean water community is mobilized in the perspective of a strong participation in March 2012 in Marseille (France).

During the First Mediterranean Water Forum of Marrakech (Morocco), Mr.Jean Margat, Vice President of the Mediterranean Water Institute, offers an updated contribution of the situation of the demands for water and of current and future water supply sources of the Mediterranean countries.

In the behalf of the Steering Committee of the Regional Mediterranean Process for the 6th World Water Forum, I would like to thank him for his contribution.

Hachmi Kennou,
Coordinator of the Regional Mediterranean Process

WHAT ARE THE CURRENT AND THE FUTURE DEMANDS FOR WATER AND SUPPLY SOURCES IN THE MEDITERRANEAN COUNTRIES?

By Jean Margat,
Vice President
Mediterranean Water Institute

Summary

The updated tables and figures on the present state of demands for water and supply sources in the Mediterranean, as well as the projections under the business-as-usual scenario towards 2025 highlight marked contrasts between the northern Mediterranean countries (Europe) and the southern and eastern ones (Northern Africa and Middle East), both in terms of the sectorial compositions of the uses of water and the unevenly sustainable means of supply, as well as regarding their evolution through the 20th century and in the coming years.

This state of affairs and these projections are the starting point for the implementation of solutions to Mediterranean water issues.

Foreword

The figures on the current and foreseen demands for water from all uses and supply sources in the Mediterranean countries are the basis for an analysis of the situation on water issues and guidelines for their resolution in the Mediterranean.

The update produced on the statistics presented in the previous World Water Fora by the IME and Plan Bleu, in particular in the Hague in 2000 ("Mediterranean Vision on water, population and the environment for the 21st Century"), renews them while attempting to coherently cross the current sectors of use and supply sources with those projected for 2025, under the business-as-usual scenario.

The matrices of data for each country, based on the national statistics available, show the following:

- **Five sectors of use:**

Local authorities (drinking water supply), irrigation agriculture, non-served industry, thermoelectric energy (cooling), reservoir evaporation, often neglected in national statistics.

- **Six supply sources:**

Extractions on conventional renewable resources, surface water or groundwater (distinguishing the share of external resources), extractions from non-renewable resources (fossil water), extractions from secondary resources, non-conventional resources: reuse, desalination.

Summaries of these matrices are hereby presented for the whole Mediterranean region and for each of the two sub-regions: the north (Europe) and the south and east (Northern Africa and the Near East) hereby referred to as the "South" or "PSEM" in French (*Pays du Sud et de l'Est de la Méditerranée*, or countries of the South and East of the Mediterranean).

Let's recall that the grouped figures presented are related to the gross supply and demand of water – meaning extractions or other (non-conventional) productions of water – to be distinguished from net uses (with reductions for conveyance or storage losses prior to its use) and consumption (amounts of water not returned after use) which are largely inferior to the quantities used in particular by local authorities and industry.

This real consumption, highly dependent upon the efficiency of use, in particular in irrigation, is also quite unevenly subject to reliable estimations and available statistics, as is also the case for waste and wastewater return.

What are these figures worth?

The national statistics collected are neither rigorously synchronous, nor exempt from uncertainty (the majority are based on estimations rather than on measurements, etc.). They are above all useful in terms of the orders of magnitude, in which the differences are significant.

Table 1

Mediterranean region - Northern European countries
Matrix of links between water supply sources and sectors of use

Sum of the matrices by country Units: Km^3/year Date of the value: 2000-2005		Water supply sources							
		Extractions					Production (non-conventional resources)		Total
		Conventional renewable primary water resources			Non-renewable water resources (groundwater)	Secondary water resources			
		Surface water	Groundwater *	total			Reuse	Desalination	
Sectors of use	Local authorities for drinking water supply	12.1	9.5	21.6	0	0	0	0.6	22.2
	Irrigation agriculture	38.6	15.8	54.4	0	0	0.5	0	54.9
	Non-served industry	10.2	2.6	12.8	0	0	0	0	12.8
	Thermoelectric energy (cooling)	31.5	Σ	31.5	0	0	0	0	31.5
	Reservoirs (evaporation)	4.8	0	4.8	0	0	0	0	4.8
	Total	97.2	27.9	125.1	0	0	0.5	0.6	126.2
		Including external resources		~4					

* Including overdrafting ~1.1
Source: Plan Bleu / JM (2008), EUROSTAT, (2011), AQUASTAT (2008)
and the most recent national sources

Table 2

Mediterranean region - southern and eastern countries (Northern Africa, Middle East, Turkey)
Matrix of links between water supply sources and sectors of use

Sum of the matrices by country Units: Km^3/year Date of the value: 2000-2005		Water supply sources							
		Extractions					Production (non-conventional resources)		Total
		Conventional renewable primary water resources			Non-renewable water resources (groundwater)	Secondary water resources			
		Surface water	Groundwater *	total			Reuse	Desalination	
Sectors of use	Local authorities for drinking water supply	10.2	5.4	15.6	0.3	0	0	0.3	16.2
	Irrigation agriculture	83.5	17.2	100.7	5.7	6	9.6	0	122.0
	Non-served industry	5	2	7	0	0	0	0	7.0
	Thermoelectric energy (cooling)	6.97	0.03	7	0	0	0	0	7.0
	Reservoirs (evaporation)	18	0	18	0	0	0	0	18.0
	Total	123.67	24,63*	148.3	6.0	6.0	9.6	0.3	170.2
		Including external resources		~60					

* Including overdrafting ~4.4
Source: Plan Bleu / JM (2008), AQUASTAT

Table 3

Mediterranean region - whole
Matrix of links between water supply sources and sectors of use

	Units: Km³/year Date of the value: 2000-2008	Water supply sources							
		Extractions					Production (non-conventional resources)		Total
		Conventional renewable primary water resources			Non-renewable water resources (groundwater)	Secondary water resources			
		Surface water	Groundwater *	total			Reuse	Desalination	
Sectors of use	Local authorities for drinking water supply	22.3	14.9	37.2	0.3	0	0	0.9	38.4
	Irrigation agriculture	122.1	33.0	155.1	5.7	6	10.1	0	176.9
	Non-served industry	15.2	4.6	19.8	0	0	0	0	19.8
	Thermoelectric energy (cooling)	38.5	0.1	38.6	0	0	0	0	38.6
	Reservoirs (evaporation)	22.8	0	22.8	0	0	0	0	22.8
	Total	220.9	52.6	273.5	6	6	10.1	0.9	296.5
		Including external resources		~ 64					

* Including overdrafting ~ 5.5

Source: Plan Bleu/JM (2008), EUROSTAT, FAO/AQUASTAT (2008)

Table 4

Mediterranean region - whole
Projection based on the business-as-usual scenario ⟶ 2025
Matrix of links between water supply sources and sectors of use

Sum of the matrices by country Units: Km³/year Date of the value: ~ 2025		Water supply sources							
		Extractions					Production (non-conventional resources)		Total
		Conventional renewable primary water resources			Non-renewable water resources (groundwater)	Secondary water resources			
		Surface water	Groundwater *	total			Reuse	Desalination	
Sectors of use	Local authorities for drinking water supply	24	20	44	0	0	0	3	47
	Irrigation agriculture	139	39	178	6	10	16	Σ ?	210
	Non-served industry	22	7	29	2	0	4	0	35
	Thermoelectric energy (cooling)	33	Σ	33	0	0	0	0	33
	Reservoirs (evaporation)	28	0	28	0	0	0	0	28
	Total	246	66	312	8	10	20	3	353
		Including external resources		~70					

* Including overdrafting (~5 à 10?)

Source: Plan Bleu (2008)/ JM "L'eau des Méditerranéens", corrected table 31

Table 5

Mediterranean region-Northern European countries
Projection based on the business-as-usual scenario ⟶ 2025
Matrix of links between water supply sources and sectors of use

Sum of the matrices by country Units: Km^3/year Date of the value: ~ 2025		Water supply sources							
		Extractions					Production (non-conventional resources)		Total
		Conventional renewable primary water resources			Non-renewable water resources (groundwater)	Secondary water resources			
		Surface water	Groundwater *	total			Reuse	Desalination	
Sectors of use	Local authorities for drinking water supply	11	8	19	0	0	0	1	20
	Irrigation agriculture	39	15	54	0	0	1	Σ ?	55
	Non-served industry	10	5	15	0	0	0	0	15
	Thermoelectric energy (cooling)	30	0	30	0	0	0	0	30
	Reservoirs (evaporation)	5	0	5	0	0	0	0	5
	Total	95	28	123	0	0	1	1	125
		Including external resources		~4					

* Including overdrafting (~5 à 10?)
Source: Plan Bleu (2008) / JM "L'eau des Méditerranéens", corrected table 31

Table 6

Mediterranean region - southern and eastern countries (Northern Africa, Middle East, Turkey)
Projection based on the business-as-usual scenario ⟶ 2025
Matrix of links between water supply sources and sectors of use

Sum of the matrices by country Units: Km^3/year Date of the value: ~2025		Water supply sources							
		Extractions					Production (non-conventional resources)		Total
		Conventional renewable primary water resources			Non-renewable water resources (groundwater)	Secondary water resources			
		Surface water	Groundwater *	total			Reuse	Desalination	
Sectors of use	Local authorities for drinking water supply	13	12	25	0	0	0	2	27
	Irrigation agriculture	100	24	124	6	10	15	Σ	155
	Non-served industry	12	2	14	2	0	4	0	20
	Thermoelectric energy (cooling)	3	0	3	0	0	0	0	3
	Reservoirs (evaporation)	23	0	23	0	0	0	0	23
	Total	151	38	189	8	10	19	2	228
		Including external		~66					

* Including overdrafting (~5 à 10?)
Source: Plan Bleu (2008) / JM "L'eau des Méditerranéens", corrected table 31

What do these figures indicate?

First, regarding the present state of demands on water

For the whole Mediterranean region, the currently demands on water are close to 300 km^3/year and are a little higher in the south (170km^3) than the north (126km^3 / year).

The dominant use is irrigation (60%), whereas supply to local authorities and energy-related uses are on the same level (13% each) and industrial uses are lower (7%).

However, there are several noticeable differences between the north and south (figure 1):

- Irrigation is more predominant in the south (72%) than in the north (44%), as well as reservoir evaporation (11% in the south, mainly due to the Aswan dam, and 4% in the north).

- The difference between uses for drinking water supply by local authorities is the opposite (18% in the north, 9% in the south), as is also the case for energy use (cooling, 25% in the north, 4% in the south).

Furthermore, as regards the 2010 population, per capita extractions for drinking water supply are on average exactly double in the north (114m^3/year) the value in the south (57m^3/year).

Two major factors accentuate the north/south contrast:

- Between current evolution trends in the total demands for water (figure 2):

  Whereas in Europe a levelling out or even a drop was noticed at the end of the 20th century –in particular in France and Italy- the growth continued in the south, where all demands have exceeded those in the north since 1990.

  The comparison between the evolution in the total demand for water and the population in the two sub-regions reveals a highly-contrasting mean per capita evolution in demand in the 20th century: regular growth in the north (less than 500 to 700m^3/year), a decrease in the south, where the population has grown faster than the demand for water (from more than 1000m^3 /year before 1950 to almost 700m^3 at the end of the century) with a trend towards levelling out.

  (In the south, this indicator is highly influenced by the weight of irrigation in some countries, in particular Egypt). At the dawn of the 21st century, the per capita demand in the two sub-regions is drawing closer and is jointly tending to decrease (figure 3).

- Between the evolution trends, during the second half of the 20th century, pressures on the conventional renewable and exploitable water resources, internal and external, that are sought. These pressures have been noticeably growing more in the south, where they now exceed 100% on average, than in the north, where they show a trend to level out at 40% (figure 4).

Current extractions, which constitute essential supply sources, reach the following estimated proportions of real resources (renewable and exploitable):

	1 Estimated exploitable resources (mean annual)* km^3 / year	2 Current extractions km^3 / year	Pressure ratio 2 / 1 %
North	310	125	40
South	190	148	78
Whole Mediterranean region	500	275	55

* *Without doubly considering the exchanges of transboundary water.*

Naturally these pressures are still higher in some countries in the south: 90% in Israel, more than 100% in Algeria and Libya due to overexploitation, and in Egypt due to reiterated use ("secondary resource").

How are these demands covered?

Globally, the large majority (93%) of the present demands are covered by using conventional renewable water resources, mostly surface water (221km^3 / year: 81%) and groundwater (53km^3 / year: 19%), but also partly through overexploitation (at least 5 km^3 / year).

However, whereas these conventional exploited water resources are almost entirely internal in the north (96%), apart from Slovenia and Croatia, a large part of those extracted in the south are external (40% on the whole), located especially and mainly in Egypt (90%), Israel (55%) and Syria (43%).

Similarly, supply by extractions of non-renewable or secondary resources, and by non-conventional productions (reuse, desalination) are only significant –apart from Cyprus and Malta- in the south, where they reach almost 15% of total demands (without considering reservoir evaporation), and more in some countries: 64% in Libya, 26% in Algeria, and 25% in Tunisia.

A significant proportion of demands for water in the southern and eastern Mediterranean countries is thus currently dependent upon non-sustainable supply sources (overexploitation, fossil water): 86% in Libya, 40% in Gaza, 37% in Tunisia and 29% in Algeria.

Furthermore the control of irregular surface water by reservoir dam sis made more complicated – other than through their irremediable losses through evaporation – by silting which reduces the useful capacity of the water stored: causing a current annual average loss of 137hm^3 in all the Maghreb region's current reservoirs, for example.

Finally, the variety of supply sources brings about great differences in cost –development, production and transport costs- supported by water savings in Mediterranean countries. If the cost of preserving water resources and protecting them against polluted waters is included, it has been estimated that the financial costs of water for the whole Mediterranean region should currently be more than 50 billion Euros per year.

Virtual water

It may also be instructive to compare real water supply with "virtual water" imports, meaning the amount of water used to produce goods in exporting countries, especially foodstuffs, calculated on the basis of trade exchange statistics.

At the dawn of the 21st century, these gross imports were estimated for the whole Mediterranean region at more than 320 km^3/year[1], a little more than the actual demands for water which are close to 300km^3/year, and unevenly spread out between the countries in the north (72%), with Italy leading (90 km^3/year), and southern and eastern countries (28%). These imports should grow more in the south where no country, with the exception of Turkey, is currently able to ensure its food-related self-sufficiency.

What future?

The same structure of relationship between sectors of water use and supply sources can be projected to the 2025 timeline, drawing on the business-as-usual scenario for the Mediterranean countries elaborated by Blue Plan (2005) generally referring to national plans–to the 2025 or 2030 timeline-, although the latter apply more to the future demands for water in each sector than to their coverage according to supply sources, logically.

Without being necessarily the most likely, this business-as-usual scenario is without doubt the most homogenous for the whole region, because more committed (and desirable) scenarios / with the objective of a more "sustainable development" will depend more on specific national policies which are likely to be more differentiated.

Thus the same matrices of projected figures to 2025 for the Mediterranean region and each sub-region are presented.

The foreseen evolutions would extend the trends identified to the beginning of the 21st century:

- Moderate growth of all demands for water: around an additional 50 km^3/year (+18%).

An extended and contrasting difference between demands in the north, where the slow decrease would persist, and those in the south, where the growth would become more marked (+58 km^3/year) and would reach 182% of those in the north, instead of 135% currently (figure 2).Broader progressions in Turkey (+39%), Egypt (+21%), Libya (+88%), Morocco (+66%) and Israel (+44%).

- Whereas in the north the decrease would affect all sectors, except non-served industries, in the south the demands for all sectors (apart from energy) would grow: supply for local authorities (+67%), irrigation (+27%) and non-served industries (+185%).
- Similarly the supply sources used would be stable in the north, with a light growth in non-conventional sources (desalination in Cyprus, Malta and Spain), whereas in the south all sources would be more solicited: renewable resources, including external and overexploited groundwater, non-renewable and secondary resources, and non-

[1] M.M. Mekonnen and A.Y. Hœkstra (2011)

conventional resources: reuse (doubling) and desalination (which could increase six-fold and reach 2 km^3 / year).

The per capita demands for water, for all uses, would tend to diminish in the north and the south, whereas the difference between the north and south would be reduced (figure 3)

Two particular uncertainties nevertheless affect these business-as-usual projections:

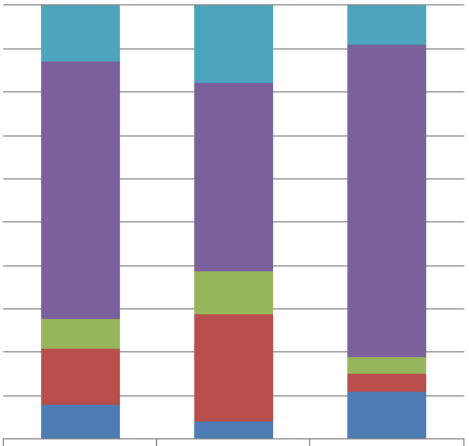
- One on the demands for water: the impacts of climate change, in particular as regards the demands for irrigated agriculture, which could further grow.
- The other on supply sources: the risk of reduction in the external resources available as a result of the possible growth of their consumption in upstream countries (problems in the Nile, the Euphrates, etc.).

Finally the increasing pressures on water resources will be noticeable especially in the south, in particular as a result of the increase of extractions from potential renewable resources whose exploitation indices will be close to or even more than 100% in the Near East, in Egypt and Libya – and more as compared to exploitable resources (figure 4).

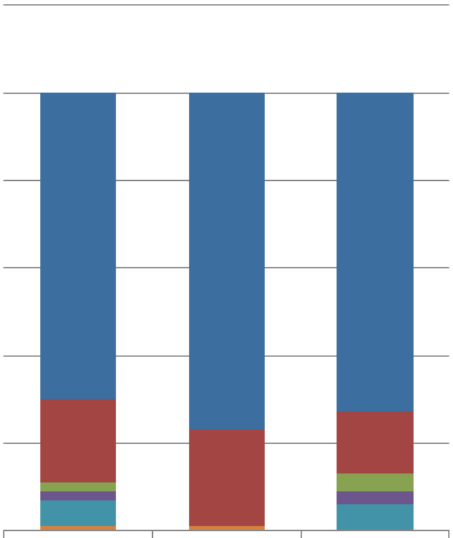
To conclude: what solutions?

The priority objectives of the Mediterranean countries' water policies which will have to face water crises–in terms of quantity -, are the following:

- Water demand management aiming to its reduction, including climate change adaptation.
- The completion of prospective water development: artificial recharge and more active management of aquifers, sediment management to attenuate reservoir silting, inter-basin or inter-region transfers, channelling underwater sources.
- The growing use of non-conventional supply sources (wastewater and drainage water reuse, desalination).
- The negotiated secure of external water resources.
- The progressive withdrawal of non-sustainable supply sources.
- Taking into account "virtual water" and "water saving" in water policies.



	%	%	%
Local authorities for drinking water supply	13	18	9
Irrigation agriculture	60	44	72
Non-served industry	7	10	4
Cooling for energy	13	25	4
Reservoir evaporation	8	4	11



	%	%	%
Surface water	70	77	73
Groundwater	19	22	14
Non-renewable resources	2		4
Secondary resources	2		3
Reuse	6		6
Desalination	1	1	0

Fig.1- Uses of water and supply sources present in proportions of the total amounts

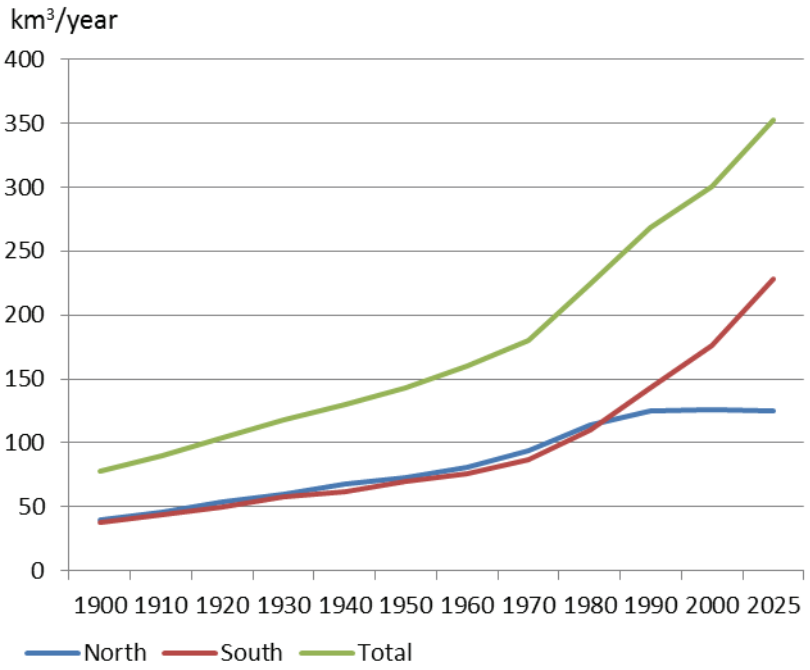


Fig.2- Evolution throughout the 20th century and projections up to 2025 in the total demand for water (including reservoir evaporation) in the Mediterranean region and each sub-region.

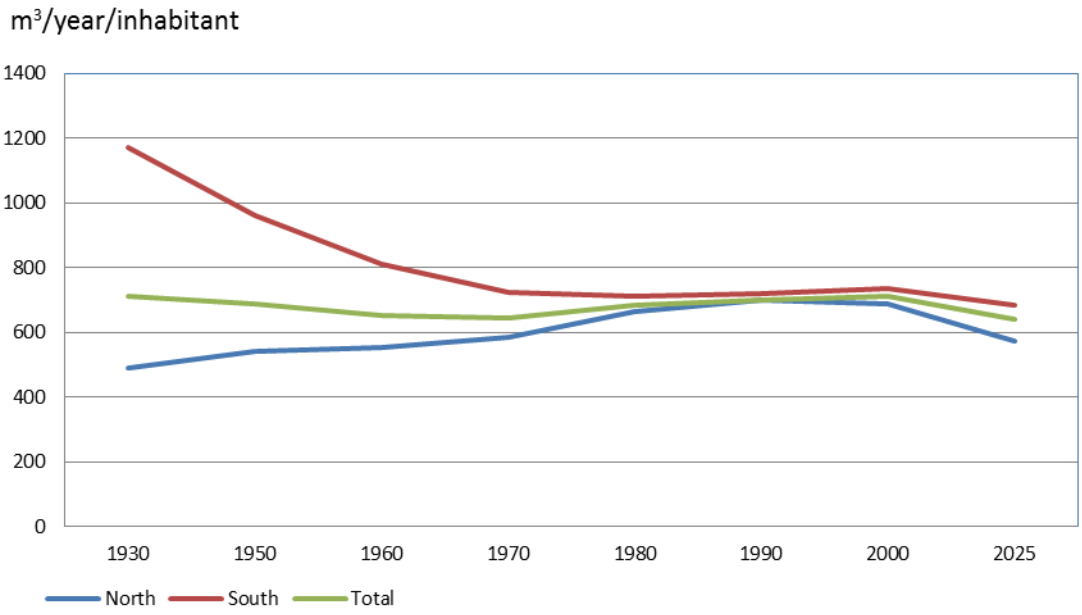


Fig. 3- Evolution in the second half of the 20th century and projections up to 2025 for the average per capita demands for water (for all uses) in the Mediterranean region and each sub-region.

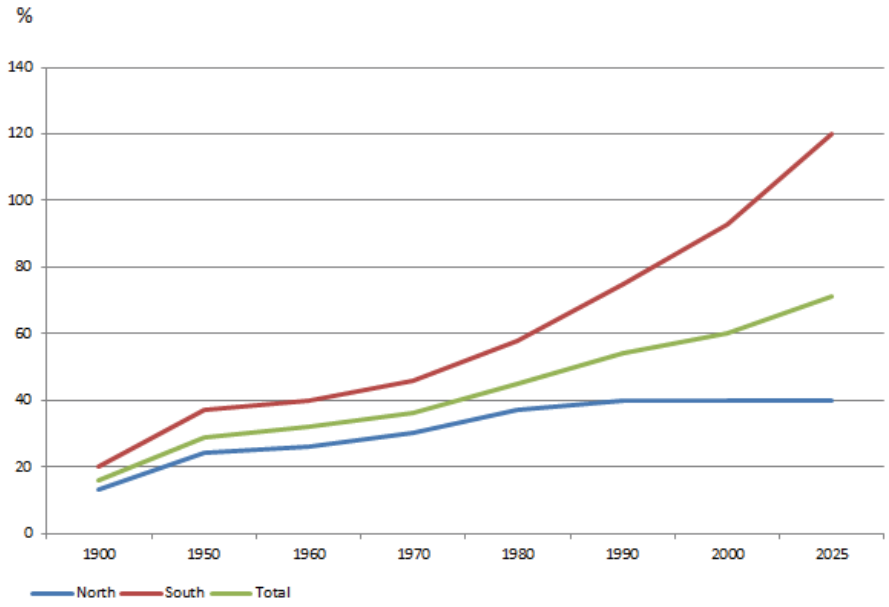


Fig.4- Evolution throughout the 20th century and projections up to 2025 in the ratio between the total demands for water (including reservoir evaporation) / internal and external renewable and exploitable conventional water resources, the indicator of water stress, in the Mediterranean region and each sous-region.

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