



Water Availability and Security
in Southern Europe and the
Mediterranean
<http://www.wassermed.eu>

Macroeconomic Effects of Climate Change in the Mediterranean Region



The WASSERMed approach: Premises and tools

Economic macro-models are used for assessing changes in competitiveness, economic structure, trade flows and implicit trade in water (i.e. virtual water), that can originate from changes in water availability.

WASSERMed analysed the impacts of water scarcity at the Mediterranean level, placing particular emphasis on two water-sensitive sectors: agriculture and tourism. The analysis was supported by a Global Computable General Equilibrium Model (CGE), which was developed specifically for the study of water-related issues and

policies, on the basis of virtual water trading. The analysis was undertaken at the national level, with detailed data for the Mediterranean economies. The rest of the world economy was represented by a few blocks. Parameters for numerical models have been calibrated on the basis of national economic accounts and trade data. Simulations were performed by assessing counterfactual scenarios, through changes in exogenous parameters and variables (e.g., changes in agricultural productivity induced by variations in water availability).

In brief:

- WASSERMed assessed the system-wide, macroeconomic effects of climate and global changes on two sensitive sectors in the Mediterranean: Agriculture and Tourism
- A Global Computable General Equilibrium Model for the Mediterranean area was used to evaluate the effects of water balance changes on strategic sectors of the economy
- Results indicate that several Mediterranean countries will likely face water shortages, with significant implications in terms of agricultural productivity, income and welfare
- The tourism industry may be positively affected; however this would result to a net reduction in water consumption in many Mediterranean countries

Macroeconomic effects on agriculture

Agriculture is a strategic sector in the Mediterranean economy. Our projections for the agricultural valued added in the year 2050 indicate that agriculture will more than double its value added in most southern Mediterranean economies. On the other hand, agricultural value added will only slightly increase in the northern Mediterranean countries, which implies a reduction of its share in the total Gross Domestic Product (GDP).

The analysis of climate change impacts on the agricultural industry starts from building scenarios on water availability for agriculture, considering estimates for future precipitation and temperature, as well as economic and demographic growth and environmental policies. On the basis of an estimated water productivity relationship for a range of crops, we examined how potential changes in water resources may affect industry production volumes, prices, income and well-being in the region.

It can be anticipated that several Mediterranean countries will likely face water shortages. This can have significant implications in terms of agricultural productivity, income and welfare. However, the water gap in the Mediterranean area will be affected by different external drivers. In Northern Mediterranean countries, this will be due to increased temperature and decreased precipitation. In Southern Mediterranean countries, the growing non-agricultural water needs (induced by strong economic and demographic development) will be the main cause of water shortages in agriculture.

Improvements in water efficiency appear to curb the economic impact of water scarcity quite significantly, especially in the Northern Mediterranean countries. Instead, the Middle East and North Africa economies will likely find it difficult to put aside precious water resources for the purpose of environmental preservation.

Summary of assessment results for selected countries – Agricultural sector

Country	Reduction in agricultural productivity (%)	Variation in real national income (%)
Egypt	-20.25%	-16.0%
France	-16.81%	-0.6%
Italy	-13.86%	-1.0%
Morocco	-0.21%	-0.2%
Tunisia	-4.43%	-1.3%
Rest MENA	-3.99%	-0.4%

Further Information

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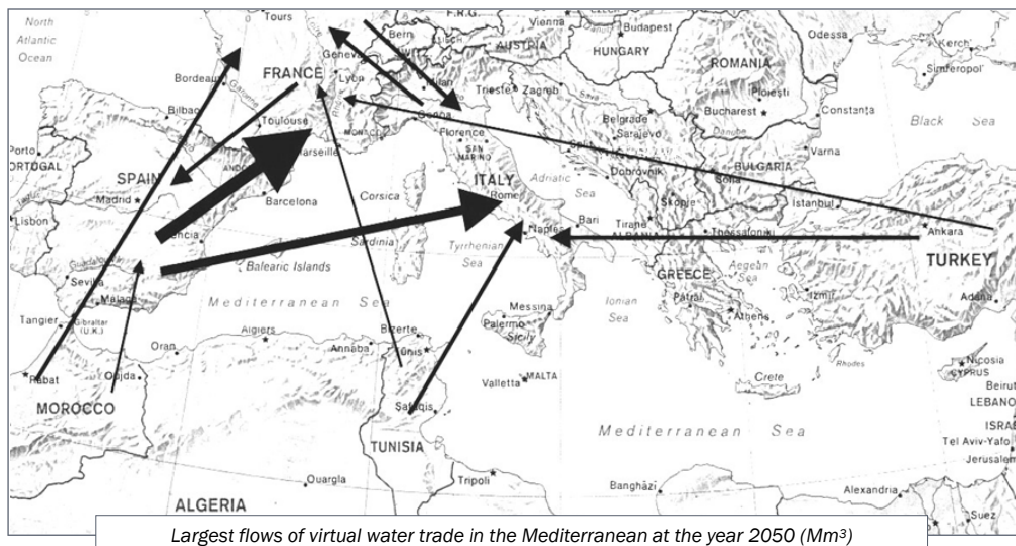
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Another issue which has been investigated is the analysis of virtual water trade flows in the Mediterranean. The analysis of the current virtual water flows reveals that most Mediterranean countries are net importers of virtual water, thereby realising sizable water “savings”.

Much of the intra-Mediterranean virtual water trade occurs among the largest northern economies (Spain, France, Italy). However, in per capita terms, the country which gets the largest amount of virtual water from abroad is Cyprus.

This picture will likely change in the time ahead, because of the evolution of the world economy, as well as of international trade, which will ultimately be reflected in varying virtual water flows.

Both northern and southern countries will be affected by water gaps, although for different reasons. Implications of this scenario in terms of virtual water entail a reduction of intra-Mediterranean trade and an increase in virtual imports from central and northern Europe, and from the rest of the world.



Macroeconomic effects on the tourism industry

Tourism contributed to the Mediterranean economy with 260 billion US\$ in the year 2010. This has been steadily rising, although growth has somewhat slowed down recently in the last five years, particularly in some countries (Egypt, Italy, Turkey, Spain).

The WASSERMed analysis of climate change impacts on the tourism industry starts from the computation of a composite index of “climate suitability” for recreational activities, known as the Tourism Climate Index (TCI). The index measures the appropriateness of climate conditions for outdoor activities (see Factsheet No 4).

Estimates of monthly TCIs for the period 2036-2065 suggest that tourism flows are generally expected to increase, with only a few exceptions (e.g., Cyprus in July and August, Malta in April). The largest improvements in climate conditions and tourism flows are expected to occur in Malta (February, November, January and May), Cyprus (April), Spain (May), Greece (October), France (September), Croatia (May) and Slovenia (September), thus slightly benefitting tourism in the northern Mediterranean countries and penalising the southern side of the Mediterranean.

It may be expected that traditional destinations could respond quicker to the challenge of adaptation, for example by developing shoulder season tourism and all weather attractions and activities. This will probably lead to a marginal recovery of competitiveness for traditional

Mediterranean destinations, at the expense of the emerging ones. This would therefore partly reverse the trend of the past decade that saw the emerging destinations as relative winners, and the traditional ones as relative losers in the global tourism market.

A simple projection exercise highlights that the total number of international arrivals in the Mediterranean Area would almost double, from 160 million in 2010 to 340 million in 2020, increasing the total tourist expenditure from 220 billion US\$ in 2010 to 660 billion US\$ in 2020. This increase in tourist arrivals and stays would imply a higher demand for water by the tourism industry. Our analysis through a numerical macroeconomic model reveals that the tourism expansion (hotels, transportations, restaurants, etc.) would nevertheless bring about a reduction in production volumes for other sectors, among them agriculture, because it would trigger a real valuation of the national currency and a loss of relative competitiveness in international markets. However, even a small reduction in the agricultural output would bring about significant reductions in water consumption, as agriculture is the most water demanding industry. The analysis highlights some interesting and unexpected consequences in terms of water consumption, namely that a growth in the tourism industry may be associated with a net reduction in water consumption in many Mediterranean countries.