

Water demand management in the Mediterranean, progress and policies

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Regional study

***The impacts of the 2003 CAP reform on water
demand for irrigation in the European Mediter-
ranean countries***



REGIONAL REPORT ON

THE IMPACTS OF THE 2003 CAP REFORM ON WATER DEMAND FOR IRRIGATION IN THE EUROPEAN MEDITERRANEAN COUNTRIES

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RATIONALE OF THE REPORT

1. Irrigated agriculture represents 30% of total water uses at the European scale and as much as 70-80% in Southern Europe. In the past years, irrigation has been encouraged by public policies aimed at achieving development objectives in agricultural and rural areas. Large water works have been often constructed and financed by the State. Water has often been under-priced while the high prices guaranteed to agricultural products by the Common Agricultural Policy have fostered a “productivist” approach and a more intensive use of agricultural inputs, fertilizers and water in the first place.

2. The recent reform of the Common Agricultural Policy (CAP) approved in June 2003, known as Mid Term Review (MTR) and now more often addressed as the 2003 Reform - represents an important shift in the EU approach to sustain farmers’ income and sustainable agriculture. New support schemes have been introduced together with a strengthened rural development policy through new measures to promote environment, quality and animal welfare and to help farmers to meet EU production standards.

3. The effect of the CAP reform raises a lot of interesting questions concerning its impacts on water management sustainability, as well as on farmers’ welfare. While it seems quite arguable that the reform is going in the direction of reducing the incentive to increase soil productivity and therefore weaken the pressure on water resources, it is not clear what magnitude this effect would have in terms of water demand as well as of farmers’ income (Massarutto, 2002).

Objective of the Regional Study

The main objective of the regional study on “The Impacts of the CAP on Water Demand for irrigation” is to give a comprehensive overview about the impacts of the MTR on the total water demand of the European agricultural sector.

Based on the existing literature, the most likely effects of MTR implementation will be identified through focusing on some major attributes, namely—: main trends of reallocation of cultivated land area (e.g. cultivated *versus* non cultivated, irrigated *versus* non irrigated land, etc), total water demand, water demand per hectare, farmers’ income and public revenue.

1. INTRODUCTION

Agricultural Policy Instruments & Potential Effects on Irrigation: some evidence from international experience

In many parts of the world, irrigation practice and irrigated agriculture have been heavily supported by public subsidies in many different ways. Agricultural structural policies have largely financed both big irrigation investments -large dams and collective distribution systems - and irrigation investments at the farm level. Subsidies for intermediate inputs, aimed at sustaining farmers' income, have resulted in water under-pricing. Market-price support policies and administrative prices regimes, by favouring a "productivist" approach, have boosted water use to maximize productivity.

All the complex system of agricultural policy measures directly or indirectly affected irrigation-related farmers' decisions and, together with other factors, they contributed to foster irrigation in many areas and encourage very high water use up to a level that is no longer sustainable nowadays (Massarutto, 2002).

Table 1 – The agricultural policy tool-bag and the potential direct and indirect effects on irrigation

INSTRUMENT	DESCRIPTION / EXAMPLES	LIKELY EFFECTS ON IRRIGATION DEMAND
Price support	<ul style="list-style-type: none"> ▪ Intervention price ▪ Deficiency payment ▪ Import bans / tariffs 	<ul style="list-style-type: none"> ▪ The cultivation of marginal land is encouraged ▪ Incentive to maximize productivity of land ▪ Incentive to the use of those inputs that increase soil productivity
Structural policies	<ul style="list-style-type: none"> ▪ Subsidies to investment ▪ Provision of collective facilities 	<ul style="list-style-type: none"> ▪ Cost of water subsidized ▪ Investment less costly
Income compensations	<ul style="list-style-type: none"> ▪ Compensative payments ▪ Management agreements 	<ul style="list-style-type: none"> ▪ If not fully decoupled and linked to production, they might continue to subsidize water-intensive crops
Promotion of quality	<ul style="list-style-type: none"> ▪ Trademarks ▪ Valorization of environmental benefits 	<ul style="list-style-type: none"> ▪ In case quality products are irrigated, water demand becomes less elastic

From: Massarutto, 2002

The integration between sectoral policy and environmental concerns is gathering momentum in the arena of policy debate and actions and, starting from the '90s, both national and international agricultural policies have been reformed in order to integrate general and specific environmental objectives and mitigate the negative environmental impacts created by agricultural policies so far. Water quality and quantity concerns are major issues that have attracted growing attention. Some important measures and pieces of legislation address these problems though their actual effects still need to be carefully assessed.

A report published by the OECD offers a selected review the work published in recent years to assess the **impacts of the European agricultural policies on environment**. Among the several policies assessed, the measures aimed at the **control of water demand** are supposed to result in immediate, intermediate and ultimate effects, respectively being the reduction in the amount of water abstracted, recovery of groundwater, recovery of wetlands.

The main conclusions of the study can be summarized as follows:

- the environmental effects of reforming agricultural policies can still hardly be isolated from the many other interacting factors. Market conditions (*e.g.* price fluctuations on the world market, fluctuating exchange rates between currencies, world supply and demand for food) and other types of policy intervention (*e.g.* environmental protection measures) also need to be considered;
- time and scale are crucial dimensions when considering the environmental effects of agricultural policies. Distinguishing between immediate, intermediate and ultimate (long-term) responses to changes in agricultural policies is very important but, while immediate impacts related mainly to changes in farming practices are relatively easy to assess, evidence regarding ultimate impacts related to improvements in ecosystems and water-quality is still limited;
- a regional perspective is needed when attempting to assess the environmental effects of agricultural policy except, perhaps, in small and homogeneous countries;
- the specific conditions and methods by which policy measures are implemented are major elements to determine their final impacts and they can account for the opposite results the same policy can produce. This aspect is much more important when larger flexibility is given to national and regional authorities to set specific criteria and implementation details;
- farmers react both to price-support and direct income-support measures and it seems widely agreed that market interventions and price-support measures have encouraged greater agrochemical use than would otherwise have been the case. Also, they may have promoted farming on marginally productive land. Reducing the overall levels of agricultural price support measures may therefore lead to environmental improvements, either by encouraging a more efficient use of inputs or by a shift to more extensive production systems. However, this is not always the case, especially in regions where agriculture has positive externalities to environmental and recreational goods and services, landscape and biodiversity and agricultural policies can enhance them;
- there is limited evidence of environmental effects on the use of inputs, *i.e.* agrochemicals and water, when reducing price support measures because the price elasticity of their demand – tends to be low in the short run;
- agricultural support tends to be capitalized into land values, with intensification and specialization of production as a result. This encourages the development of capital-intensive and geographically specialized farming, especially on farms with a high productivity potential

or those close to urban centres. A reduction in price support may lead to the cessation of farming on economically marginal land;

- farm management practices and farm aversion to risk need to be considered when identifying the interactions between agricultural policy and the environment. Farmers' response to changes in farm-support programmes could be wide and varied.

Decoupling of agricultural support from production decisions is one of the central issue among the several implemented measures. Through decoupling, agricultural policies intend to support farmers' income while minimizing the international trade distortions associated with the coupled payments. It can be site or land cover specific (for example in less-favoured area, LFAs) and when subject to cross-compliance, it can also enhance the production of positive externalities of the agricultural process, that would otherwise be undersupplied.

Though theory predicts a drop in the production level and, consequently, in the level of input use, the actual consequences of removing the guarantee price and detaching incentives from quantity depend on several conditions, namely: the effective degree of decoupling and the permanence of some residual requirements linked to production or resource use; the adjustment effects; the reference *status quo*, where actually not all crops benefited from payment with the results that decoupling may have a very biased effect depending on the crops affected; the farmers' objectives other than profit maximization in the short term; the wealth and insurance effects; the trend of the market price. All these are empirical issues and should be carefully assessed and evaluated (Swinbank, 2004).

Decoupling interacts with the overall farm strategy, so that the results are, indeed, very much affected by the farm cropping system and organization. For example, even if decoupling could make vegetable production more profitable, the ability to grow and sell vegetables may imply adequate farm organization, individual skills and attitudes that are not available in all farms. As a consequence, expected substitution of vegetables for cereals may not occur even if it would be profitable. Scaling up the point of view, market constraints on the aggregate may play a role in limiting expansion of certain crops.

2. IRRIGATION IN EUROPEAN AGRICULTURE

At the European level, wide heterogeneity in available water resources, climate and soil characteristics and farming systems leads to different patterns in water demand and to a different role of irrigation practices.

Irrigation can have four main purposes in relation to agricultural production: allowing crop production where water would otherwise be a limiting factor; enhancing quantity of output; enhancing quality of output; mitigating farmers' risk to crop by preventing or reducing damage caused by unexpected climatic events.

In more humid and temperate areas of central and northern Europe, irrigation is generally used to ensure high yields of summer crops in dry years and shallow soils and it plays a minor

role in the agricultural sector. In arid and semi-arid areas of southern Europe (including much of Spain, Portugal, Italy, Greece and southern France), irrigation is an essential element of agricultural production and it was heavily boosted and subsidized in the past. In this group of countries is characterized by a strong sectoral competition for water use, severe problems in the environmental quality of water bodies strongly correlated with over-exploitation and – from the supply-side - it is facing increasing costs for new sources. Public funds and public agencies are often deeply involved both in the investment and in the management of the water services (EEA, 2000).

The **irrigable area** in the EU-15¹ increased from 12.3 million ha to 14.1 million ha between 1990 and 2003, i.e. an increase of 14 %. This is fully accounted for by France, Greece and Spain, where the irrigable area increased from 5.8 million ha to 7.4 million ha during the same timeframe, representing an increase of 29 %.

An increase in irrigable area may potentially boost the demand for water even though the adoption of improved irrigation technology could improve the water use efficiency of irrigation systems and thus reduce gross water requirements.

Table 2 - Irrigable Area in the EU-15 *ha*

	1990*	1993*	1995	1997	2000	2003
Total EU-15	12,342,910	12,382,530	12,829,910	13,602,550	14,126,600	
France	2,099,700	2,415,240	2,510,410	2,698,650	2,633,680	2,727,700
Greece	1,130,570	1,233,380	1,235,300	1,276,740	1,321,300	1,521,600
Italy	3,857,710	3,648,480	3,648,480	3,639,100	3,851,310	3,977,000
Spain	2,540,310	2,768,450	2,891,050	3,268,300	3,478,050	3,828,110

Source: Eurostat Datawarehouse * Austria, Finland and Sweden not included

In the same period, **the area of irrigated land extended** from 11 million hectares to 13.5 million hectares, approximately 80% of which in the four Southern Mediterranean members countries.

Table 3 - Irrigated Area in the EU-15

	1990*	1995*	2003*
EU-15*	11,070,000	11,716,000	13,477,876
France**	1,300,000	1,630,000	2,602,239
Greece**	923,980	1,235,300	1,294,400
Italy**	2,711,000	2,698,000	3,103,737
Spain**	2,433,700	2,607,000	3,437,369

Source: our elaboration on Eurostat* and FAO** data

¹ Austria, Belgium, Germany, Denmark, Spain, Finland, France, United Kingdom, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Sweden.

The irrigated area is expected to increase further following new irrigation development in some countries, while in the central EU Accession Countries, changes in the economic structure and land ownership and the consequent collapse of large-scale irrigation and drainage systems and of agriculture production have produced a stable irrigated area equal to 5 million hectares.

On average, 34 % of total **water abstraction** in Europe is used for agriculture, 50% for industry (included energy production) and 15% for urban use.

Table 4 - Sectoral water use in the EU-15, 2003

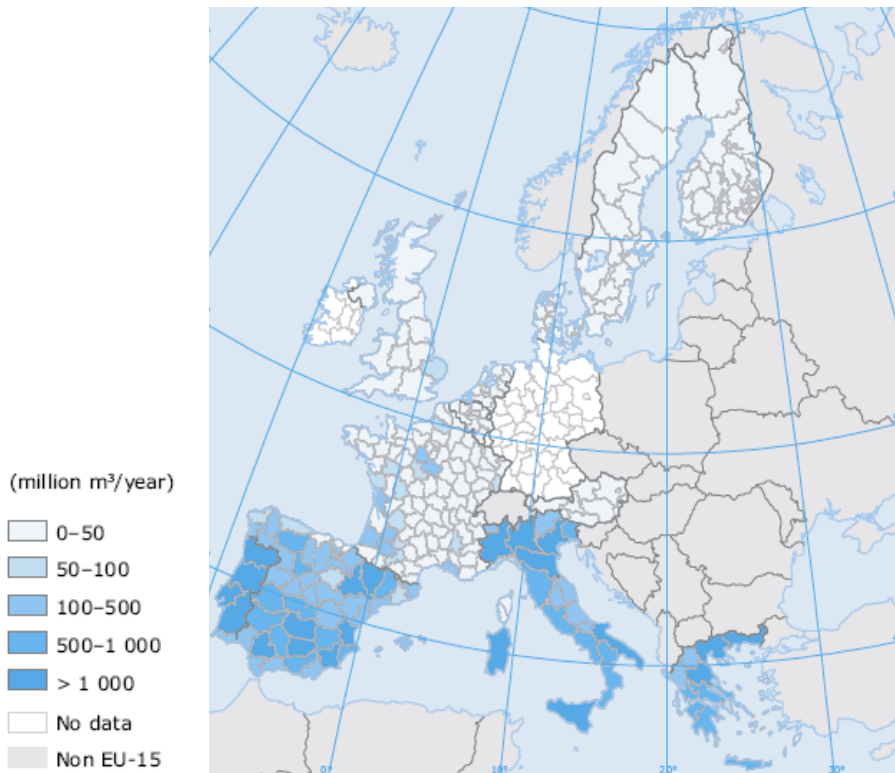
	Agricultural water withdrawal $10^9 \text{ m}^3/\text{yr}$	Domestic water withdrawal $10^9 \text{ m}^3/\text{yr}$	Industrial water withdrawal $10^9 \text{ m}^3/\text{yr}$	Total water withdrawal $10^9 \text{ m}^3/\text{yr}$	Agricultural water withdrawal out of total %	Domestic water withdrawal out of total %	Industrial water withdrawal out of total %
Total EU-15	76.51	33.89	112.05	222.45	34.39	15.24	50.37
France	3.92	6.28	29.76	39.96	9.81	15.72	74.47
Greece	6.25	1.27	0.25	7.77	80.44	16.34	3.22
Italy	20.01	8.07	16.29	44.37	45.10	18.19	36.71
Spain	24.24	4.79	6.60	35.63	68.03	13.44	18.52

Source: our elaboration on FAO data

The breakdown of water consumption between the various economic sectors varies considerably from one region to another, depending on natural conditions and economic and demographic structures. In France (64%), Germany (64%) and the Netherlands (55%), for example, most of the water abstracted is used to produce electricity. In Greece (80%) and Spain (68%) water is mostly used for irrigation. In Northern European countries such as Finland and Sweden, little water is used in agriculture. Water is abstracted mainly for industrial purposes (66% and 28% respectively of total abstractions) and, in particular, for highly intensive water-consuming industries like cellulose and paper production.

In northern EU-15 Member States, the reported mean annual water allocation rates decreased from 757 to 349 $\text{m}^3/\text{ha}/\text{year}$ between 1990 and 2000. During this period the, reported water abstraction decreased from 1,622 million m^3/year to 716 million m^3/year , and the irrigable area decreased from 2.1 million to 2.0 million ha. In southern EU-15 Member States, the mean annual water allocation rates declined from 6,578 to 5,500 $\text{m}^3/\text{ha}/\text{year}$ between 1990 and 2000. The reported water abstraction rates decreased from 69,103 million m^3/year to 66,424 million m^3/year , whereas the irrigable area increased from 10.5 million ha to 12 million ha. This indicates a likely reduction in water application rates per hectare of irrigated land and implies an increase in water use efficiency.

Graph. 1 - Regional water abstraction rates for agriculture (million m³/year) during 2000



Source: EEA- IRENA Project

France. The irrigable area of the country increased steadily from 2,099,700 ha in 1990 to 2,510,410 ha in 1995 and 2,727,700 ha in 2003. The main irrigated crops are maize (56% of the irrigated area), vegetables and potatoes (12% of irrigated area) and fruits and vines (9% of the irrigated area).

In 2003, irrigated area represented 13.3% of the total cultivated area and is concentrated in the south of the country: about 60% of the total irrigated area is located in five regions, PACA, Languedoc-Rousillion, Poitou-Charentes, Aquitaine and Midi-Pyrenées .

As for the irrigation methods, sprinkler irrigation accounts for 80% and mainly on field crops, gravity irrigation 14% and drip or micro-sprinkling 6%. At the national level, irrigation accounts for 14% of total water abstraction. Surface water (rivers, lakes and reservoirs) supplies 75% of total usable resources for irrigation, groundwater resources supply 23%.

Greece. Uneven rainfall distribution in space and time, diminishing precipitation and the special country geomorphology resulted in water scarcity during the peak irrigation period. Notwithstanding this situation, irrigation practices have widely spread in the past decades and they are currently extended to arable crops such as cotton (95% under irrigation), maize (100% under irrigation), tobacco, (45-50% under irrigation), sugar beet as well as to horticulture and

tree crops traditionally irrigated. Also vineyard is being increasingly irrigated (27% under irrigation).

In Greece, the area reported to be irrigable increased from 1,130,570 ha in 1990 to 1,235,300 ha in 1995 and 1,521,600 ha in 2003. The area actually irrigated also increased from 932,980 ha in 1990 to 1,235,300 ha in 1995 and 1,294,400 ha in 2003². The increase in irrigated area was higher in the plains than in semi-mountainous areas and it remained almost constant or decreased in mountain areas. In 2003 irrigated area accounted for 37.9% of the cultivated land at the national level. The main irrigated regions are on the eastern coast of the country and are: Macedonia with 438,698 ha of irrigated land (40.6% of the cultivated area in the region), Thessalia with 269,344 ha of irrigated land (54.2% of the cultivated area in the region) and Sterea Ellada with 232,181 ha of irrigated land (37.2% of the cultivated area in the region).

Sprinkler irrigation is the dominant irrigation technique in Greece, applied on 52.2% of the irrigated hectares, while drip irrigation is applied to only 10.3% of the irrigated land.

Irrigation accounts for 80% of total water abstraction. The use of surface water (rivers, lakes and reservoirs) accounts for 73.7% of total usable resources for irrigation; 23% is abstracted from drills and the remaining 3.2% use water from drainage reuse.

Italy. Italy is characterized by a high diversity of ecosystems and landscapes and by a wide range of climatic conditions (rain and temperature). Total rainfall per year, unevenly distributed between seasons, varies from 2000 to 3000 millimeters in the north of the country (alpine zone) to 500 millimeters in the south. These elements together with long and dry summers make irrigation a fundamental condition for agricultural activity, mainly in the southern regions of the country.

Irrigable area of Italy was 3,855,920 ha in 2000 and 3,977,210 ha in 2003, while the area actually irrigated was 2,453 460 ha in 2000.

Again, some significant differences are evident among regions of Italy. Due to high water availability, irrigation has been traditionally developed in the North of the country (Piedmont, Lombardia, Veneto and Emilia-Romagna regions) where nearly two thirds of agricultural surface and 1/3 of the farms are irrigated while in the centre hardly 18% of the farms are irrigated amounting to approximately 300,000 hectares of irrigated land. In Southern Italy (including Sicily and Sardinia islands) irrigation is practiced on 25% of farms with a total irrigated area of 800,000 ha.

The main irrigated crops are maize (58% under irrigation) and vegetables (73% under irrigation), fodder crops (17% under irrigation), citrus (86% under irrigation), vineyard (25% under irrigation) and other fruit crops such as peach, apple, pear and kiwi trees. Irrigated maize and fodder crops are mainly concentrated in the North, while citrus fruit and vineyard in the South where also olive oil trees and durum wheat are largely irrigated.

According to the last census data of 2001, 33% of irrigated area is under surface and furrow irrigation, 40% under sprinkler irrigation and 14% under localized irrigation method (drip and micro-irrigation).

² National statistical sources sometime report different figures both for irrigable and for irrigated land. We prefer to use data from international statistical source to make figures from different countries comparable.

Agriculture water withdrawals amount to about 20 billion m³ and represent nearly 2/3 of available water resources and 50% of the total withdrawal. About 72% of irrigation water comes from surface water (rivers and reservoirs) and 28% from wells and springs.

Spain. Water resources in Spain depend on uneven spatial distribution of rainfall with the most rainy area located in the North of the country and the driest one in the east–southern area. Furthermore, very marked seasonal water shortages make irrigation a practice of utmost importance in many areas of the country.

Area equipped for irrigation was 2,540,310 ha in 1990 and increased to 2,891,050 ha in 1995, 3,478,050 ha in 2000 and 3,828,110 ha in 2003. A similar trend was observed for the area actually irrigated that was reported to be 2,433,700 ha in 1990, 2,609,920 ha in 1995, 3,235 510 ha in 2000 and 3,437,370 ha in 2003. Spanish irrigated land is the largest area in the EU, representing 13% of all arable land at national level. The main irrigated regions are in the southern part of the county: Valencia with 350.5008 ha of irrigated land (41.1% of the cultivated area in the region) and Murcia with 192,700 ha of irrigated land (30.9% of the cultivated area in the region). The main irrigated crops are permanent crops, olive and citrus, annual crops, wheat, maize and rice, and a wide range of vegetable crops that in the southern coastal zone are also cultivated in glasshouses. Surface gravity irrigation is the dominant irrigation technique in Spain, and it is applied on 59% of the irrigated hectares, followed by sprinkler applied on 34% of the irrigated hectares; on the remaining part of the irrigated area, localized methods are adopted.

Irrigation accounts for 68% of total consumption equal to 23.8 billion m³. About 68% of irrigation water comes from surface water (rivers and reservoirs) and 28% from underground water; the remaining part comes from the desalinization process used in few localized areas, Murcia, Almeria and Canary Islands, where high value products such as fresh vegetables, fruits and flowers are grown.

3. A BRIEF HISTORY OF THE “MEDITERRANEAN COMMON AGRICULTURAL POLICY”

Agriculture, together with other important sectors like energy, was one of the fields where, from the very beginning of its life, the European Community introduced common rules in the Member States in order to achieve the strategic objectives set out upon its institution.

In the early ‘60s and ‘70s, the objectives of the CAP were to increase the productivity of European agriculture; to achieve self-sufficiency in food supply; to protect the domestic market; to assure the viability of the agricultural sector.

Accordingly, the main measures set out at the beginning of the CAP were subsidies and guaranteed prices and financial assistance for restructuring of farming.

Two decades later, some objectives were achieved and the EU had to contend with almost permanent surpluses of the major farm commodities, some of which were exported (with the help of subsidies), others had to be stored or disposed of within the EU with high budgetary costs and severe distortions in some world markets. The CAP became more and more unpopular with consumers and taxpayers.

The radical reform of CAP adopted in 1992, aimed at complying with the Uruguay Round, lowered guaranteed prices for the main agricultural products (COP -30% and beef -15%) and introduced compensation payments to the farmers as direct support based on their historical levels of production. Compensation payments were linked to mandatory set-aside on 10% percent of the land and were still coupled to production through a requirement to plant on land not subject to set-aside. Agri-environmental measures were introduced.

From then on, CAP has been oriented to increasingly separate support from production, shifting a substantial share of payments from price support to direct area payments, though still related to regionalized yields. The process was reinforced by Agenda 2000 that has been the most radical reform of CAP since its inception. Its main objectives were: the reinforcement of competitiveness of European agriculture; strengthening rural development policy (promotion of the standard of life and diversification); the integration of more environmental, food quality and animal health considerations into CAP; the simplification of agricultural legislation and the decentralisation of its application; preparing the EU for the enlargement to the East.

Agenda 2000 envisaged the so called Arable Premium Payments, set in Euro/ton at the EU level and translated into area payments Euro/ha at the national or regional level, based on the regionalized yields. Through the regionalization plan, Members States could decide to differentiate area payments between irrigated and non-irrigated land with the result of giving higher support payment to irrigated cultivation. With Agenda 2000 guaranteed prices were further reduced (COP -15% and beef -20%); partial compensation payments were introduced and qualified by the observance of some environmental practices to prevent soil and water pollution; agri-environmental measures were confirmed.

The Mid Term Review, now more appropriately called 2003 reform, moved beyond such an approach and separated - to some extent - income support from crop area.

The 2003 CAP reform focused on a market-oriented revision of EU intervention in agriculture.

Decoupling is the main innovation of the reform. It means that the area or quantity payments are cumulated into a unique payment, called Single Farm Payment. This payment is an entitlement of the farmer, in principle independent from crop choice. As such, the payment should contain no particular incentives in favour of specific crops. In fact, the perception of the SFP is subordinated to the management of a certain area (corresponding to the number of payment rights) with at least the minimum practices represented by the good agricultural and ecological conditions (GAEC). Also, the same land cannot be cultivated with fruit and vegetables. This limits, indeed, the expected effect of decoupling.

Countries can opt to maintain coupled payments up to 25% of the previous area payments. The calculation of the SFP may be based on a regionalized model or on a historic model. In the former case, payments are distributed on all eligible surfaces attributing an average payment to each unit. In the latter, the SFP is calculated for each farm on the basis of the historic payments and the area it had in 2000-2002.

Table 5 - Summary of the 2003 reform implementation in selected Mediterranean countries

country	start year	model	decoupling in dairy payment	what sectors remain coupled	implementation of the second wave
France	2006	Historic	2006	<ul style="list-style-type: none"> - cereals 25% - suckler cows 100% - ewe premium 50% - veal slaughter premium 100% - adult slaughter premium 40% - outermost regions 100% - seeds (some species) 	<ul style="list-style-type: none"> - 10% deduction in the olive oil sector for the funding of working programmes established by producer organisations (Art 110 (i) of 1782/2003 and Art. 8 of Reg. 865/2003) - hops payments 25% annex VII point H and I: - olive oil coefficient for decoupling: 1 - tobacco coefficient for decoupling: 0.4
Greece	2006	Historic	2007	<ul style="list-style-type: none"> - seeds - article 69 application: <ul style="list-style-type: none"> ▪ 10% of the ceiling for arable crops, ▪ 10% of the ceiling for the beef sector, ▪ 5% of the ceiling for the sheep and goat sector. 	<ul style="list-style-type: none"> - article 69 application: <ul style="list-style-type: none"> ▪ 2% of the ceiling for tobacco, ▪ 4% of the ceiling for olive oil ▪ 10% of the ceiling for sugar - 2% deduction in the olive oil sector for the funding of working programmes established by producer organisations (Art 110 (i) of 1782/2003 and Art. 8 of Reg. 865/2003). annex VII point H and I: - tobacco and olive oil sectors 100% decoupled
Italy	2005	historic	2006	<ul style="list-style-type: none"> - seeds 100% - article 69 for quality production <ul style="list-style-type: none"> ▪ 8% of the ceiling for the arable sector, ▪ 7% of the ceiling for the bovine sector, ▪ 5% of the ceiling for the sheep and goat sector 	<ul style="list-style-type: none"> - article 69 application: 8% of the ceiling for sugar - 5% deduction in the olive oil sector for the funding of working programmes established by producer organisations (Art 110 (i) of 1782/2003 and Art. 8 of Reg. 865/2003) annex VII point H and I: - olive oil coefficient for decoupling: 1 - tobacco coefficient for decoupling: 0.4 - for the region Puglia the decoupling coefficient for tobacco is 100%
Spain	2006	historic	2006	<ul style="list-style-type: none"> - seeds 100% - arable crops 25% - sheep and goat 50% - suckler cow 100% - slaughter premium calves 100% - adult slaughter premium 40% - Article 69 application: <ul style="list-style-type: none"> ▪ 7% of the ceiling for the bovine sector ▪ 10% of the ceiling for dairy payments - outermost regions 100% 	<ul style="list-style-type: none"> tobacco decoupling coefficient: 0.4 olive oil decoupling coefficient: 0.936 article 69: 5% of the ceiling for the tobacco 10% of the ceiling for the cotton sector 10% of the ceiling for sugar

Source: EU

The other piece of reform that could have direct environmental implication is cross-compliance. With cross-compliance, the Single Farm Payment is conditioned by the fulfilment of a number of environmental requirements. Requirements are defined by member States within a menu of (mostly existing) regulations.

Cereals and other arable crops are affected by the “first wave” of the 2003 reform, while tobacco, olive oil and cotton are affected by the “second wave”. CMO fruit and vegetables is still under discussion while writing this report. The attitude towards decoupling is different in different countries. In particular, Italy and Greece opted for full decoupling of cereal production, while Spain and France, retained 25% of the payment as area based. The same different attitude is partially reflected in the tobacco and olive oil sectors.

The way the reform is designed leaves it open to a number of potential effects. Generally speaking, the crops previously subject to area payment should witness a reduction of cropped area. However, this is conditioned by the actual opportunities for substitution. Also the expected extensification effect could be not straightforward for crops which already had payments decoupled from production.

In terms of expected impact on irrigated agriculture, the products included in the second wave may potentially bring stronger effects while arable crops, in most cases, are only relevant as an alternative to irrigated production and their reform affects the “opportunity” cost of irrigated crops.

4. IMPACT OF CAP ON THE IRRIGATED AGRICULTURE OF EUROPEAN MEDITERRANEAN COUNTRIES (France, Greece, Italy and Spain): A REVIEW OF THE LITERATURE

Impacts of the CAP reform on irrigated agriculture are a particular aspect of a wider issue related to CAP effects on the agricultural sector as a whole.

Elements contributing to determine such effects are many: macroeconomic conditions, trends of international agricultural markets, local economic and social characteristics of farms and farmers in the different regions, national government decisions related to the degree of decoupling, sector-specific national ceilings, transfer of entitlements, regionalisation plans and modulation options.

Of course, the considered literature could not exhaustively investigate all these factors because much information was missing. Comparisons between results could possibly be heavily affected by the various and heterogeneous contexts of the investigated case studies.

In the following paragraphs the main results of 35 studies will be illustrated. Seven studies were collected and reviewed for France, one for Greece, twelve for Italy, seven for Spain and eight regarding more than one countries. The one study for Greece referred to a pre-MTR situation, but we decided to include it in our review because some of the scenarios simulated can be assimilated to the MTR scenario in terms of liberalization of the market. Twenty-three studies were specifically targeted to investigate MTR effects on irrigated agriculture.

Main CAP measures affecting irrigation water demand

Each component of the CAP reform is likely to affect irrigated agriculture and water irrigation demand. Those expected to produce the main effects are: decoupling and single farm payment, cross-compliance, market policy. Depending on structural, social and economic characteristics of farms and agricultural markets, each component can exert a different influence on the different contexts and situations.

One of the main goals of the 2003 CAP reform was to promote more extensive farming in Europe and thereby encourage **environmental protection**. The results obtained show no such an improvement in the new CAP decoupled scenarios unless additional measures to protect the environment are introduced. From the obtained results we can infer that cross-compliance and good agricultural and environmental conditions (GAEC) could substantially contribute to improving and protecting the environment but they imply an additional cost to farmers.

For France, the measures concerning COP crops are likely to be the most significant ones for French agriculture and for irrigation water demand. Cross compliance is not considered to have notable impacts since some measures, more directly linked to irrigation, had been already included in the previous Agenda 2000 reform. Further, cross compliance measures seem to be more effective for water quality preservation, and biodiversity and landscape safeguard than for water quantity management (Inra, 2006).

For Greece, the major CAP measures are tobacco CMO and the upcoming reforms of vegetables CMO. For Italy, decoupling is identified as the main measure with some impact on irrigated crops, together with tobacco and vegetables CMO reforms. Changes in the dairy and beef sector may also affect irrigation through their impact on feed maize. Cross-compliance is not considered to have significant impacts at this stage. For Spain, decoupling is the main and more analysed measure with notable impacts on COP crops, together with market reform in the cotton and rice sector.

Scenario simulated in the reviewed studies

In most of the reviewed studies, single components of MTR Agreement were simulated according to specific national options. Only few studies analysed the combined effects of several measures such as decoupling + agri-environmental measures or decoupling + reform of specific Common Market Organizations. Sometimes, (Manos et al., 2004, Varela-Ortega, 2006; Gallerani et al., 2004; Bartolini et al., 2007) combined market and water policy scenarios are simulated and distinction must be made between hypothetical scenarios and scenario more addressed to describe current policy changes.

Scale and time horizon

Due to the heterogeneity of European agriculture, almost all the analysed studies were carried out at a sub-national scale. Sometimes case study areas were chosen on an administrative basis, other times basin or irrigation districts were selected. Of course, case studies were nearly

always localized in the main irrigated area of the different countries. Scenarios are identified for both medium and long-term but no dynamics is considered.

Approaches and methods of the reviewed studies

Both mathematical programming models and simpler approaches based on the comparison between net and gross margins of the different crops are used.

The first approach allows for an *ex ante* simulation of water demand, through parametrization of different parameters such as water price, level and type of farm support, product prices and so on.

In the second case, neither hypothesis nor simulation of farmers' behaviour are explicitly considered and long-term validity of results is questionable.

Main impacts on irrigated agriculture

In France, in the short-term, decoupling has no effect on the COP sector as a whole but within the sector itself. Significant changes are likely to occur in cereals, oilseed and protein, from one side and forage and fallow from the other side with a reduction of cereals (-2%), in general, and of soft wheat (-8%), in particular. A regional polarisation is likely to occur between regions already specialized in COP cultivations and susceptible of specializing and growing further, and regions that are likely to regress above all in the inland and mountain areas (INRA, 2004).

In the mid term, total decoupling cancels the "over-support" given to the irrigated agriculture and eliminates the incentive to irrigate. Of course, partial decoupling, as in the French option, has a weaker effect and causes a more limited reduction in irrigated surface than the full decoupling option. In the long term, decoupling will affect farmers' investment decisions in irrigation equipment and its effect will be more marked. Both in the mid and in the long term, partial decoupling will reduce the CAP reform effects on the irrigated surface.

Effects of decoupling on irrigated surface are very different from one region to another. They depend upon a range of factors including the relevance of irrigated crops subsidised in the previous scheme and the amount of the existing differences among the subsidies for irrigated and non irrigated crops as envisaged in the previous scheme of regionalization.

At the national level, different estimates exist about irrigated surface and water demand. According to Buisson (Buisson, 2005) there will be a reduction both in irrigated surface (-8 %) and in water demand (-7%) mainly due to the decline of irrigated maize and protein crops. At the regional level, in the southern-western regions, where water conflicts are stronger, water demand for irrigation falls more than at the national level (-21% in Midi-Pyrénées, -12% in Poitou-Charentes). The considerable reductions of water demand in the South-Western regions are due to the importance of maize cultivation that is a very high water-demanding crop. In the same regions, irrigation water demand elasticity to irrigated surface is higher than 1 suggesting an extensification trend of agriculture. The sensitivity of these results to market price trends is

also stressed and it is found that an increase in the price of maize reduces or completely reverses the reduction of the cultivated surface and the reduction in water demand.

According to the study carried out by the Compagnie d'Aménagement des Coteaux de Gascogne, the CAP reform leads to a 20% reduction in the irrigated surface mainly due to the reduction in irrigated surface of peas, soybean and maize and located in the area of Hautes-Pyrénées. Water demand is reduced by 4%, less than irrigated surface since farmers intensify irrigation in order to obtain higher yield.

The effect of the CAP reform on the farm revenue is very limited: it is expected to be -15 Euro/ha.

The results of Buisson have been partially confirmed in a study realized by ARVALIS (Arvalis, 2005), where the effects of MTR on maize production are specifically investigated. The outputs of the research conclude that where water is not a limiting factor, yield of maize is higher than other cereals and maize remains the most profitable crop. Where water is limited, like in the southern regions, reduction in maize yields due to water stress should be considered in order to foresee possible changes in the cropping pattern due to the introduction of decoupled payments.

In Greece, the reduction of cotton is the main effect of the World market scenarios. Tomato and sugar beet grown area drops in some areas or remain stable in others. This leads to a reduction in the irrigated surface, as area shifts to non irrigated or less irrigated crops, such as barley. However, also alfalfa and corn do increase.

World market causes contrasting effects. In at least a region out of three, it produces a reduction in water demand and an increase in elasticity at lower prices. In the others, the demands under Agenda 2000 and world markets cross each other.

Farm income decreases by about 15-30%.

According to the literature review, in Italy, the CAP reform has a notable impact on land allocation, in particular for cereals, oilseeds and fodder plants. All cereals and oilseeds cultivated show wide reductions in their acreage, equal to 15.6% and 9.5%, respectively, while fodder plants increase by 17.6% and area under Good Agricultural and Environmental Conditions reaches more than 200,000 hectares (Arfini et al., 2007). As for the other crops, a considerable increase is observed for rice (+24.8%), a slighter one for sugar beet (+5.3%) and vegetables (+4.5%) while tobacco area collapses (-65%). In all the country, cereals are substituted by both fodder crops and good practices that benefit from their relative profitability due to the single payment and the low costs of production or maintenance. In certain areas, like in Southern Italy, durum wheat is substituted with sunflower.

As for farms' economic results, the gross saleable production under the application of the CAP reform decreases by over 7% (compared with the base-line scenario of Agenda 2000), the value of subsidies increases, while the level of production costs is significantly reduced. In northern Italy these results are mainly due to the new payment based on milk quotas that positively contribute to their performance. Meanwhile, central and southern Italy show a decrease in gross margins induced by more limited land allocation options than in the North, and a lower weight of the animal production systems.

In the case study of Oristano Irrigation District (Dono, 2006) the 2003 reform causes a decrease in durum wheat, tomato and uncultivated surface, while it causes an opposite effect on vegetables and other cereals. The same happens under sugar beet reform, except in the case

where processing plants shut down. In this case, sugar beet cultivation stops and its area is reallocated to all other crops - except durum wheat - thus making their area to increase. In the case study of Tarquinia Irrigation District the trends are similar for durum wheat, while tomato decreases under all scenarios.

Consequently, water demand slightly decreases under the 2003 reform and sugar beet reform and income slightly falls under all alternative scenarios as compared with the baseline.

Finally, in Spain the deployment of the new CAP doesn't lead to drastic changes in land use and cropping patterns in the current situation. Under the scenario of partial decoupling, a reduction of about 2% occurs in the area used for farming with a decrease smaller than 1% and 5% for COP crops and grassland and fodder crops, respectively (Júdez et al., 2007). Durum wheat, maize and other cereals (rye, oats) show widest reduction, -18%, -11% and -7.5% respectively, while soft wheat area increases by 7%. Irrigated crops are affected differently from non-irrigated crops since the acreage of irrigated COP crops extends or is reduced less than the acreage of their non-irrigated counterparts. The only non-irrigated crop with an increase in area in all scenarios is wheat, while the area for irrigated wheat, barley and sunflower increases at the expense of the area of other COP and non COP crops. In irrigated farming, COP crops compete with other crops that are more penalized in terms of decoupling or price reductions (sugar beet, potatoes, alfalfa and cotton). Areas for other crops, such as sugar beet, cotton and potato (all irrigated) decline by 13%, 10% and 9%, respectively, while horticultural crops such as, pepper, asparagus, melon, tomato, pepper, artichoke, cauliflower, garlic, onion and green bean, essentially located in specialised farms in Navarre, Castille-La Mancha, Murcia and Extremadura increase and replace irrigated COP and non-COP crops in the simulated year.

As for farms' economic results, the gross margin under the application of the CAP reform shows a slight negative variation (-1.2%) essentially due to a wider negative variation of the gross margin net of aid, partially compensated by the increase in total aid after the MTR. The exceptions are the regions La Rioja, Aragon, Castilla-La Mancha, Murcia and Extremadura for the importance of sheep husbandry.

These results are partially confirmed by a study carried out in Castilla and Andalucia regions (Varela Ortega, 2006). In general, crops with a substantial comparative advantage in the production-based coupled payments (such as maize, cotton and durum wheat) will be reduced. The only cereal benefiting from the reform is soft wheat since it provides farmers with a high gross margin, that is, at equal support levels, soft wheat production costs are lower than for other crops. These reductions in COP crops will be more prominent in the inland region of continental agriculture (Castilla) than in the Mediterranean region (Andalucia) with a more varied cropping mix and productive potential.

In Aragon region (North-East), where some cereals such as wheat and barley are cultivated in rainfed regime and other cereals such as maize and rice are cultivated in irrigated farms, the changes in the cropping pattern lead to the abandonment of non irrigated agriculture that becomes unprofitable. Farms are boosted toward more water intensive agriculture through the introduction of new irrigation technologies and expansion of more profitable irrigated crops such as horticultural and fruit crops. Economic viability and environmental effects of this shift of production must be carefully addressed (Albiac-Murillo et al, 2004).

The effects in terms of farmers' income level will be quite sizeable, and the reduction will be directly proportional to the de/coupled percentage applied. Some differences in farmers' income were observed between partial and full decoupling scenarios. Partial and full decoupling have repercussions on farmers' income level. Results differ depending on whether the farms are irrigated, where the income level increases, or rain-fed, where income falls considerably. Therefore, the reform leads to land abandonment in less-productive rain-fed marginal areas. Examining the results for both policy instruments grouped under cross-compliance (prohibition of mono-cropping and obligation to keep up buffer strips), the distribution and the corresponding output of the different crops remain almost unchanged with respect to the first scenario. However, farmers' income level is found to change. In this case, the drop in income is higher on irrigated farms than rain-fed farms (Varela- Ortega, 2006).

Farm income decreases by about 7.5% with a more marked reduction for irrigated farms (-11%) than for non irrigated farms (-3%) (Albiac and Murillo, 2006).

In the south of the country (Guadiana and Guadalquivir Irrigation districts), where COP are irrigated, decoupling induces farmers to change cropping patterns and to reduce the irrigated area. COP irrigated surface decreases and new dryland crops appear. These crop substitution effects are more acute in the Guadalquivir study area where cotton production is very important. Also, differences in productivity between irrigated and dryland crops are much higher in the Guadiana area, so the shift to dryland crops is softer in this area than in the Guadalquivir irrigation district. As a consequence of this trend to a diminution of irrigated lands, the partial decoupling scenario induces a decrease in water use in both irrigated areas (Blanco Fonseca, 2006).

As for cotton that represents the most important irrigated arable crop in Andalusia, the CAP reform is likely to seriously threaten the profitability of its cultivation and consequently the survival of the sector in the area. Decoupling of subsidies probably leads farmers to sow the current cotton area but in a semi-abandonment system of cultivation, that is minimizing the use of inputs, irrigation water included, and leaving the raw cotton in the field (Arriaza, Gomez-Limon, 2006).

THE IMPACT OF AGRI-ENVIRONMENTAL MEASURES ON ENVIRONMENT

The difficulty to assess the impact of agri-environmental measures (AEM) is generally recognized. "Such impacts although likely to be significant are difficult to evaluate at this stage. First, a lot of flexibility is given to Member States to set specific criteria and implementation details. Second, it is not yet known how these issues will be addressed. Third, *ex ante* evaluation is difficult in such areas and only an *ex post* examination can assess the effectiveness of measures" (OECD, 2004). Apart from their immediate impacts on farming practices, results on changes in water quality and ecosystems are still limited. In 2005 Oréade-Brèche published the results of an evaluation study of AEM, financed by the European Commission. Main findings are reported as follows:

▪ **Effects of Agri-environmental programmes on water quality**

Water quality is a priority in Finland, Sweden, Greece, Ireland, France and Denmark while all countries have defined zones for water quality. The Agri-environmental Measures portfolio in this area varies a lot.

Scientific studies state an effective input reduction due to Agri-environmental measures. If water quality measurements are carried out directly on the plots where Agri-environmental Measures are implemented, they often show quicker and more concluding results than those done at water basin level, that include other plots, out of Agri-environmental Measures. Studies confirm the favourable effects of the following measures:

– *Reduction of agricultural inputs measures*: measures have favourable effects, but not always, and rarely rapidly.

– *Transfer reduction of agricultural pollutants*: in particular, "grass strips" are really effective in catching fertilisers and pesticides, but also in their degradation. Fallow lands can also act on nitrate (or other element) reduction when they are sown.

– *Diversification of rotations, maintenance of grasslands, arable reversion to grassland and extensification*: in particular the conversion of arable land into grassland has significant effects on nitrate reduction. Soil coverage in winter can also be a very effective nitrate catch crop.

– *Organic farming*: has an effect on water quality by reducing inputs.

▪ **Effects of Agri-environmental programmes on water resources (quantity)**

Only Spain, France and Portugal have defined quantitative water management as one of their main agri-environmental issues. This is nevertheless an area where much could be done, notably about overexploitation of water resources, in particular in Southern Europe. It should be noticed however, that Agri-environmental programmes have in some cases obtained results in the reduction of water consumption and in recovering water tables, e.g. in Castilla -La Mancha. (from [ORÉADE- BRÉCHE, 2005](#)).

SOME CONCLUSIONS

The impact of the MTR is clearly quite heterogeneous in terms of cropping pattern and water demand, on one hand, and farmers' income on the other. Notwithstanding, we will try to single out some similarities that though generalised can give some useful information:

▪ Main changes in cropping pattern occur within the COP sector that decreases as a whole; both irrigated and non irrigated COP crops decrease. Durum wheat and maize reduce almost everywhere, soft wheat, barley, oilseeds – sunflower - and fodder crops somewhere replace them. Fruit and vegetables also increase. Cotton, tobacco and sugar beet are heavily affected by the MTR. Under some conditions, these crops completely disappear. On the contrary, olive oil seems not to be affected by the MTR. Alternative land management strategies, such as set-aside and minimum cultivation (GAEC) gain momentum since their relative profitability, above all in marginal areas, increases. Results for tree crops should be treated with caution because of the long term nature of the respective choices. When the production for some crops - such as

cotton and tobacco - is highly concentrated in marginal areas, special consideration should be given to the impacts of decoupling payments since abandoning production generates significant negative impacts on rural development.

- A regional polarisation occurs between regions already specialized in COP cultivations and not specialized regions that are likely to regress especially in inland and mountain areas.

- Effects on water demand depend on a lot of factors: if the “decoupled” crop was irrigated before the reform; if the “new” crop is more or less water intensive; if decoupling causes a change in the irrigation technique; if crop alternatives are possible.

- The variety of the effects of the reform may be summed up in two (alternative) patterns of behaviour connected to irrigated surface and water demand:- in the former, the irrigated surface area of “reformed” crops decreases, rain-fed and less water demanding techniques and crops appear and, as a result, water demand decreases. This effect is more remarkable when: the water intensity of the “decoupled” crops is higher; the differences between irrigated and non irrigated crops are lower; the irrigation costs are higher and there are few alternative crops and irrigation techniques. This result prevails in most reviewed cases such as in Southern and Central France -7% (Buisson, 2006), Midi-Pyrenées -4% (CACG, 2006), Guadalquivir irrigation district, -20% (Blanco-Fonseca, 2006), Pella, -8% (Manos et al., 2004), Central Italy, -3% (Dono, 2006);- in the latter, the irrigated surface area of “reformed” crops decreases, more water demanding irrigation techniques and crops like horticultural and fruit crops occur; as a result, we have an increase in the water demand. This effect is more notable when: the water intensity of the “decoupled” crops is lower; there are more alternative crops; the differences between irrigated and non irrigated crops are higher; the irrigation costs are lower. This result prevails in the less specialised farms localised in the most productive area: Guadiana irrigation district, 2% (Blanco-Fonseca, 2006), Aragon (Albiac-Murillo, 2004).

- Results on water demand are sensitive to product market price trend as well; in the present scenarios, with strong price variability and major restructuring of the processing industry worldwide, markets often appear much more powerful drivers than policies.

- Also the huge structural change affecting agriculture should not be forgotten. Farm abandonment, on one hand, and farm enlargement through land rent, on the other, are characterising the present pattern of change in many rural areas. Again, their effects may be reinforced by policies, but social (e.g. ageing) and economic (e.g. land prices) drivers look generally more effective.

- More marked effects in terms of reduction of water demand are expected from the forthcoming reform of CMO of fruit and vegetables and the wine sector.

- Cross-compliance and good agricultural and environmental conditions could contribute to achieve the objective of water saving even though no clear evidence of their effects is available at this stage. Specific analyses of the potential of these instruments are needed.

- Even though environmental protection is one of the main goals of the MTR, Water Demand Management does not constitute a major concern of CAP and, accordingly, CAP impacts on

water quality and - even more so - on water quantity issues are limited as confirmed by the results obtained that show no definitive reduction in water demand unless additional measures are introduced.

▪ Decoupling tends to free irrigated crops from agricultural policy drivers, likely providing the basis for making water regulation (including pricing) work. This may also happen within explicit measures within or outside CAP. For example, specifically WDM-oriented policy measures are now included in CAP in order to “facilitate” other policies such as the new article introduced by the Commission under the last Rural Development Regulation to “*..compensate for costs incurred and income foregone resulting from disadvantages in the areas concerned related to the implementation of [...] Directive 2000/60/EC*”.

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