Linking Water Management, Agriculture and Rural Development within the Mediterranean Context

Report of the JP Working Group on Agriculture

Joint Process (JP), Phase I 2005-2006

Compiled by M. Cherlet, EC DG JRC, Ispra October 2006

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Report on the Phase I activities and preliminary results
Compiled by M. Cherlet, EC DG-JRC

Introduction

Progressively, legislations are identifying links through common environmental issues and although their implementation remains still focused on single thematic topics, efforts are being made to increasingly integrate planning and execution. However, implementation and impact management in the field does not yet fully succeed in profiting from a strategic combination of the environmental commitments in the various policies. Hence, planned effects on the sustainable use of the ecosystem might, or could, not be reached as long as a vertical thematic approach is followed. Environmental links between various policy fields, such as water and agricultural management, might be intuitively known but lack real evidence. Shortage of concrete facts makes it more difficult for policy makers to create a common base for discussion and liaise their planning.

Within the EU part of the Mediterranean, the Water Framework Directive (WFD[1]) and the Agriculture Policy (CAP) are at this moment the main policy structures to address resource management and rural planning. The WFD aims at reaching good water status

[1] DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2000

by 2015 and within its Common implementation Strategy looks at how best to develop programmes of measures.

The EU Common Agriculture Policy (CAP[2]), being one of the first policies to be tackled by the Cardiff process, aims now at heading off the risks for soil and environmental degradation. Rural Development programmes, under the CAP Pillar 2 structure, that introduce environmental measures in support of sustainable agriculture became an explicit part of the CAP. For improved rural development programming and evaluation, methods and tools need to be developed to establish the relational tendencies of their impact on the environment, taking into consideration the quality and use of water resources, agriculture, the multipurpose use of the environment and the socio-economic dimension of the livelihoods. Having a legislative budget, the RD is currently the most viable option for implementing measures that contribute to meeting WFD goals.

Agriculture practices, related soil conservation and pesticide and fertilizer use are impacting not only on the land and water quality on-site, but also on the water quality and quantity off-site within the water catchment area. Water management at watershed level is to be considered an effective and advanced mechanism for policy planning and implementation. Especially now that Member Countries are expected to compile River Basin Management Plans (RBMP) as a compulsory measure for putting the Water Framework Directive into action. Successful basin planning, however, needs to take into account other influencing 'land use related' factors or policies. It seems therefore opportune to investigate the linking and integration of management decisions, especially related to sustainable agriculture and rural development, for better policy planning, implementation and impact assessment at watershed level.

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- COUNCIL REGULATION (EC) No 1290/2005 of 21 June 2005
- On the financing of the common agricultural policy
- COUNCIL REGULATION (EC) No 1782/2003 of 29 September 2003
- Establishing common rules for direct support schemes under the common agricultural policy and
- Establishing certain support schemes for farmers and amending Regulations (EEC) No 2019/93,
- (EC) No 1452/2001, (EC) No 1453/2001, (EC) No 1454/2001, (EC) 1868/94, (EC) No 1251/1999,
- (EC) No 1254/1999, (EC) No 1673/2000, (EEC) No 2358/71 and (EC) No 2529/2001
- COUNCIL REGULATION (EC) No 1698/2005 of 20 September 2005
- Council Regulation on support for rural development by the European Agricultural Fund for Rural Development (EAFRD)
- COUNCIL REGULATION (EC) No 144/2006 of 20 February 2006
- Council Decision on Community strategic guidelines for rural development (programming period 2007 to 2013)

The general framework for the Rural Development is set at the Community level, integrating environmental priority areas such as biodiversity, water and climate change. National strategies are then designed based on country policy and specific environmental challenges. Eventually, the success of implementation depends on the ultimate managers of the agricultural natural resources. Local Rural Development plans (RDP) are scaled to farm level tackling local problems that however have far reaching off-site effects.

Assessing environmental effectiveness of this multitude of RDPs with very focalized measures covering a huge variety of geographic areas is not an easy task. However, experiences from one area can be very valuable to other regions that may face slightly different situations, but need similar approaches for their planning and evaluation. Moreover, aggregation of results is needed to scale up to larger regions in Europe for Community policy impact assessment. This requires compatibility between approaches, methods and indicators throughout the Union.

This topic has been discussed at the Brindisi Meeting[3] resulting in the establishment of a specific Working Group (WG) on “Linking Rural Development Into Water Management” or shorter WG-Agriculture.

The WG - Agriculture

The purpose of this Working Group on Agriculture within the Joint Process Phase I was to contribute to policy responses related to watershed-based management of agricultural resources impacting on water quality and quantity. The WG planned to provide some recommendations on technical possibilities on how to obtain better information on these linkages and how to convey messages to the planning stakeholders. Experiences on implementing good practices based on the WFD guidelines could be exchanged between partners in Northern and Southern Mediterranean countries, while e.g. experiences on integrated rural development, as often found in Southern Mediterranean countries, could be made available.

The WG aimed at

- Fostering technical solutions through knowledge and experience exchange;

[3] For info on the Brindisi meeting, see website: http://viso.ei.jrc.it/prb_im/index.html

- Organizing in-situ testing and verifying of integrated impact assessment techniques to recommend management issues. Case studies organized in collaboration/contracts with local partners.
- Constituting a bridging between the technical people and the political decision makers by organizing proper feedback mechanisms creating synergies between field level, EU policy and international convention level.

This WG was being established as result of the Brindisi Workshops (Sep.2004)[4] parallel to a WG on Groundwater and a WG Water Scarcity. The latter two WGs already had a formal statute through the WFD Common Implementation Strategy (CIS). For the WG on Agriculture no decision was or has been taken defining its statutory nature. The WG would function within the framework of the MED Joint WFD/EUWI process and the Strategic Steering Group on Agriculture under the Common Implementation strategy (CIS) of the WFD.

The initial list of members of the WG are in Annex 1.

The full functioning of this WG has been hampered by a lack of official statute, limited funds and re-organization of the initial working framework of the lead partner. Working budget was mainly only available through the Institutional budget of the lead partner, the JRC Rural, Water and Ecosystems Resources Unit.

Further to the WG creation meeting in Brindisi (Sept. 2004), a meeting was held at the JRC, Ispra, during November 2005[5]. The minutes of that meeting, which was also extended to partners of a Rural Development Network, are attached in Annex 2. A further meeting was planned for end 2006, but is being postponed to early 2007.

The contributions and results in this document are based on work from partners from the WFD CIS Pilot River Basin Group on Agriculture and from preliminary results of Case Studies launched under JRC contracts during this period of the WG. The timing of these studies is slightly out of phase for this document as all of these activities have in fact a timetable up to end of 2006 when end results are due. Therefore this report is to be considered preliminary and mainly setting the basis and background for the launch of the 2nd phase of the JP.

[4] International Workshops on Mediterranean River Basins, 22-24 September 2004, Brindisi, Italy. For information, see website: http://viso.ei.jrc.it/prb_im/index.html
[5] http://agrienv.jrc.it/activities/rdi/

Specifics of the Mediterranean context

Due to the erratic character of the Mediterranean climate, water resources in the Mediterranean area are very diverse and not equally distributed. This is reflected in the specific seasonality of the vegetative land cover where coastal areas show a maximum in biomass activity during the winter, representing the typical Mediterranean cycle; see figure 1. Since long, land use is adapted to this situation by using adapted crops and increasingly irrigation. Greater than before population, inclusive pressure from heavy tourism, combined with regional to global market requirements – or opportunities - have lead to rather unsustainable growth in irrigated agriculture. Water demand from agriculture is the largest before drinking water and other uses. Continued agriculture intensification causes this demand to still grow. Furthermore, potential climate change might enhance this pressure due to decreasing average precipitations, increase in erratic character and more severe droughts. In Mediterranean countries roughly between 50 and 70 percent of water use relates to agricultural demands hence in order to realize many of the WFD objectives or good status in general, proper and sustainable agricultural land management is required.

The importance of use of irrigation is illustrated in figure 2. Irrigation systems become more efficient, e.g. through introduction of drip irrigation, but still include significant losses in distribution networks[6]. The below reported Turkey Case Study indicates that more adapted cropping systems can be considered along with system improvements to optimize use of water in Mediterranean agricultural systems. One of the specific challenges in the Mediterranean is linking agricultural land management closely to the water management and vice versa, including all stakeholders at all stages.

[6] source: Plan Blue: A Sustainable Future for the Mediterranean, 2005

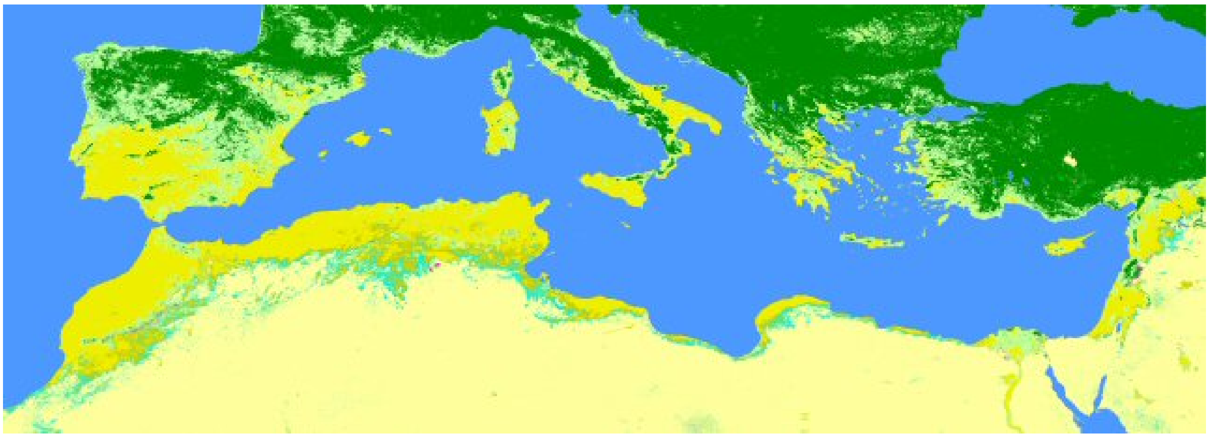
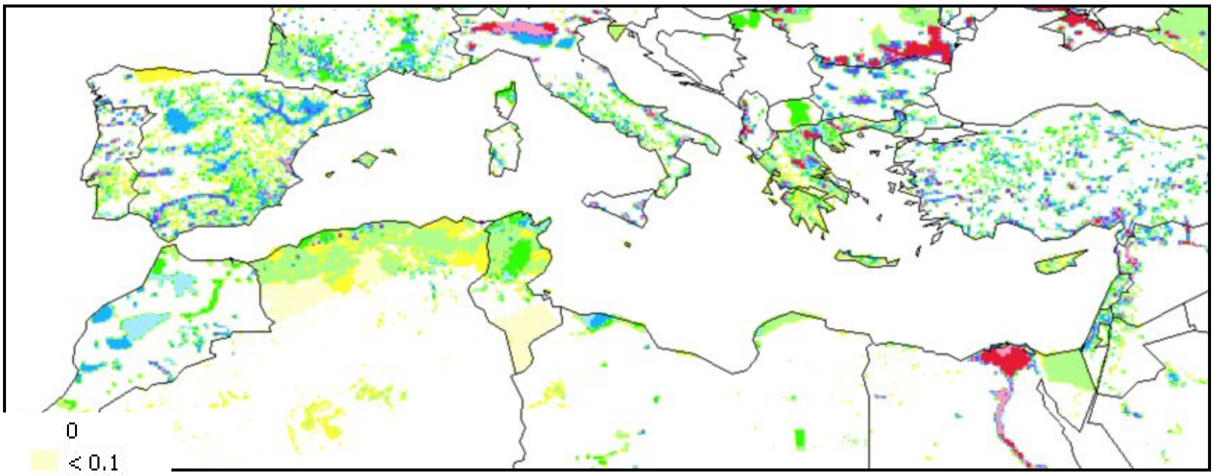


Figure 1: Seasonality in land cover in the Mediterranean area
(Based on SPOT VGT satellite data 1999-2003)
(pale yellow = desert; dark yellow = winter maximum; dark green = summer maximum; other colours = no marked seasonality)

Water quantity is a main concern for water management in the Mediterranean due to the explicit climatic conditions and increased use that impacts substantially on the renewable water resources. This also has far reaching repercussions on the refilling of aquifers, creating saline intrusion in coastal areas. Furthermore, changes in water regimes, such as organized in the Guadalquivir basin, can regulate flow and use of water resources. Creating such artificial annual flows could also lead to more intensive agricultural irrigation land uses in a-typical areas.

Concerns for water quality and degrading of the natural water resources still comes second to water quantity in many areas. However, as run-off rates tend to be high and especially in the Southern rim, soil permeability is high, diffuse pollution by the use of agro-chemicals is an important resource-degrading factor to consider in water and agricultural management. Furthermore, quantities of use are often higher than EU standards. However, tolerating the application of the higher EU standard of e.g. 170 kgN/ha can still be found in Agri-environmental schemes in EU countries, where restrictions would be expected to be more thorough.



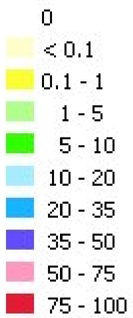


Figure 2: Main irrigation areas in the Mediterranean (source FAO).
(in percentage of UAA)

In summary, the Mediterranean characteristics reinforce specific problems related to water quantity, but modern agriculture creates pollution stresses that are very common to more Northern European areas. The main stresses can be listed as follows:

- In many Mediterranean areas, intensification of agriculture leads to increased irrigation and when combined with non-proper practices has irrational impacts on the quantity of water resources and influences quality of groundwater.
- Pesticide and fertilizer use, the latter also for irrigated organic farming, are an increasing practice and create diffuse pollution of water resources. In certain areas together with erratic rainfall this can result in either slow residual water pollution or contribute to peak pollution concentrations creating chock impacts in e.g. coastal areas.
- Non adequate agricultural land management practices often increase vulnerability to soil erosion which can negatively disturb the soil water house holding and can increase sediment loads in water, combined with increased Phosphorus pollution.

The objective of this Working Group was to provide a forum for information exchange and to provide examples of analysis to help responding to this main Mediterranean challenges of combining water management plans with rural development programmes in view of mitigating negative impacts of:

- Intensification of agriculture
- Increase of irrigation and unsustainable water use practices
- Diffuse water pollution by agricultural land management
- Soil erosion related to non adapted land management practices influencing sediment loads and soil-water balances

Analysis of pressure from agriculture: some examples

During the two meetings of this WG (extended to Rural Development issues), it was suggested to set up a forum to network current and future experience on approaches for analysis of pressures and impact from agriculture on the environment, by providing further input to relevant initiatives and to identify and indicate potential pilot sites and partners. The JRC RWER Unit consolidated this suggestion of the WG by (1) taking the lead technical coordination role for the WFD CIS Pilot River Basin Group on Agriculture under the Strategic Steering Group on Agriculture led by the EC and UK. And (2) by launching calls for tender for undertaking specific case studies on environmental impact assessment of Rural Development schemes with the goal of providing evidence in support of better integration of environmental aspects with the various community policies.

(1) Within the PRB-AG Group only two PRBs are in the Mediterranean area: the Guadalquivir and the Pinios. Figure 3 shows the distribution of the PRB-AG basins. The PRB-AG exercise started in September 2005 and a report on the final results is due by the end of this year 2006.

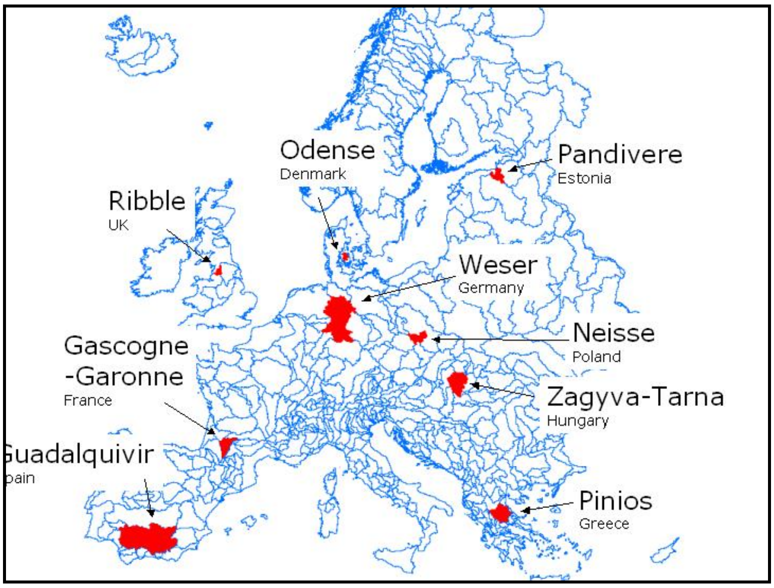


Figure 3. Distribution of the PRB-AG Basins (2006 exercise)

(2) During 2006, three contracts were initiated and funded through JRC RWER Institutional budget, got active and will produce a final report on their case study by early next year 2007. In view of EU enlargement and Neighbourhood policy within the Mediterranean area, contracts are also being tendered for countries as Turkey and Tunisia.
The Status of case studies is as follows:

- Italy (Basilicata region) started early 2006, due in February 2007
- Turkey (Seyhan River Basin) started early 2006 due by end 2006
- Poland (Bialystok Vovoidship) started early 2006, due in February 2007
- Spain (Andalusia region) to start late 2006, due at end of 2007
- Tunisia (to be decided) to start late 2006, due at end of 2007

The following section of the report is based on interim contributions of the above-mentioned partners and it is clear from the timetables that the content presented here is to be considered preliminary and not exhaustive.

Basilicata (IT) Case Study

(Based on contribution from G. Caramori, G. Minarelli, A. Pagnoni from Istituto Delta Ecologia Applicata, Ferrara, Italy)

The overall purpose of the study is to identify, assess and map environmental impacts of Rural Development Agri-Environmental measures. Approaches are based on spatio-temporal analysis of bio-geo-physical and socio-economic data in view of establishing cause-effect relations.
The main flow of the study looks at:

- Compiling spatial land use information,
- Inventorying farming practices linked to the main (agriculture) land uses

- Relating and mapping environmental stresses caused by these practices to the three main EC community priorities: water quality, biodiversity, and climate change.
- Inventorying and mapping data on implementation of Agri-environmental measures
- Assessing real impact of the measures considering the goal of mitigating the stresses

In general the main stresses identified by the Region, and confirmed through the case study data, are:

- Excessive use of fertilizers and agro-chemicals
- Irrational consumption of water for irrigation
- Deep ploughing
- Continuous cultivation, influences Soil Organic Matter with effects on erosion (and P pollution)

For the most distributed crops of the area, Durum wheat, tomato, olives, citrus and vines, the main farming practices were inventoried. For each of these the potential environmental stresses were identified using literature and stakeholder information. Table 1 shows an overview. It is clear that with further cooperation with water managers more quantitative information can be linked improving final results. Figure 4 and 5 give a spatial distribution of the potential stresses.

Similar output has been compiled on potential impact of farming practices on biodiversity, climate change (CO2 increase) and soil erosion. The latter is of importance as increased soil erosion influences transport of phosphorus used in agriculture. Erosion potential has been successfully crosschecked with desertification risk maps as produced by projects such as DISMED and Desertlinks.
Geographically linking these potential stresses on water and other natural resources with spatial data on implementation of Agri-environmental measures provides more insight in the probable or expected mitigation of these stresses through policy programmes. This exercise also targets and limits the areas for which monitoring or time series data is needed. The ultimate step will then be to check with real monitoring data if the expected effect of the measure is observable and/or reached.

Crop or use	Agricultural practices	Expected impact soil	Expected impact water quantity	Expected impact water quality	Expected impact biodiversity	Expected impact climate
Arable crops	***Tillage***	***Erosion***[2]		***Pollution of surface waters***[3]	***Pedofauna biodiversity decreases, biodiversity decrease of species depending from invertebrates for foraging***[4]***. Loss of birds insectivorous species***[5]***.***	***CO_2 increase***[6]
Wheat	Tillage	Erosion		Pollution of surface waters	Pedofauna biodiversity decreases, biodiversity decrease of species depending from invertebrates for foraging[3]. Loss of birds insectivorous species[4].	CO2 increase
Wheat	Fertilizer use			Pollution of surface waters	Pedofauna biodiversity decreases, biodiversity decrease of species depending from invertebrates for foraging[3]. Loss of birds insectivorous species[4].	
Wheat	Herbicide use			Pollution of surface waters	Pedofauna biodiversity decreases, biodiversity decrease of species depending from invertebrates for foraging[3]. Loss of birds insectivorous species[4].	
Citrus	Mechanical passages	Erosion			Pedofauna biodiversity decreases	
Citrus	Fertilizer use			Pollution of surface waters	Pedofauna biodiversity decreases	
Citrus	Herbicide use			Pollution of surface waters	Pedofauna biodiversity decreases	
Citrus	Irrigation		High rate of water use			
Vegetables*	Mechanical passages	Erosion			Pedofauna biodiversity decreases, biodiversity decrease of species depending from invertebrates for foraging[3]. Loss of birds insectivorous species[4]	

Table 1. Environmental stresses related to the main conventional agricultural practices

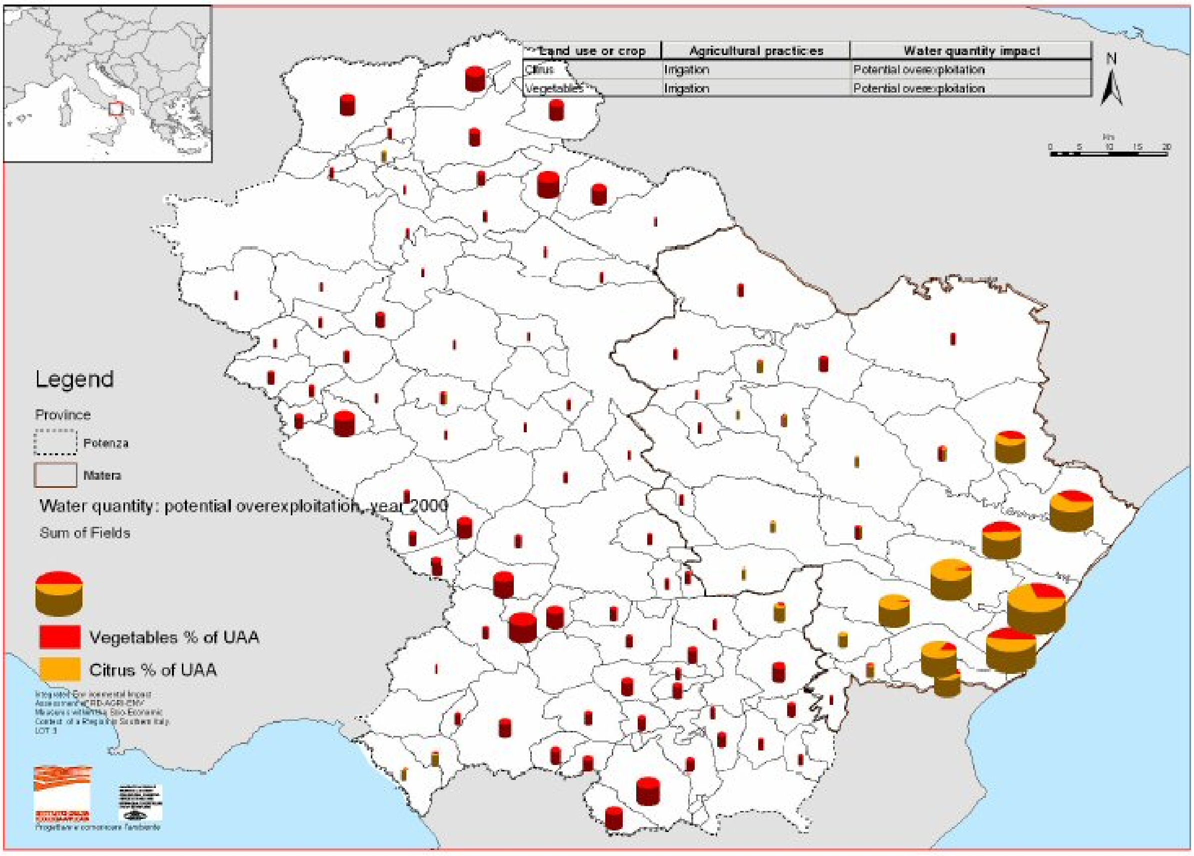


Figure 4.: potential impact of farming practices on water quantity (over use) expressed as percentage per crop and related farming practices (year 2000)

In the Basilicata Region, as follow-up of Agri-env measures since 1992, for the 2000-2006 Rural Development Campaign (EC Council Regulation 1257/99), Organic Farming has been introduced as measure. Figure 6 shows the uptake of the measure over the region, while Figure 7 gives the spatial distribution

The implemented regulations and guidelines do not provide quantitative indications on fertilizers and the active ingredients that can be used in organic agriculture. This task was assigned to regional implementing bodies. This makes it impossible to directly compare the data found on the quantity of fertilizers and plant protection products used in conventional agriculture in the time scale for the study. Only one body limits the maximum quantity of nitrogen that can be distributed per hectare to 170 kg/ha of UAA/year, without distinction according to cultivation. This is, however, for an agri-environmental measure still a high limit, which corresponds to ‘minimum requirements’ under the WFD.

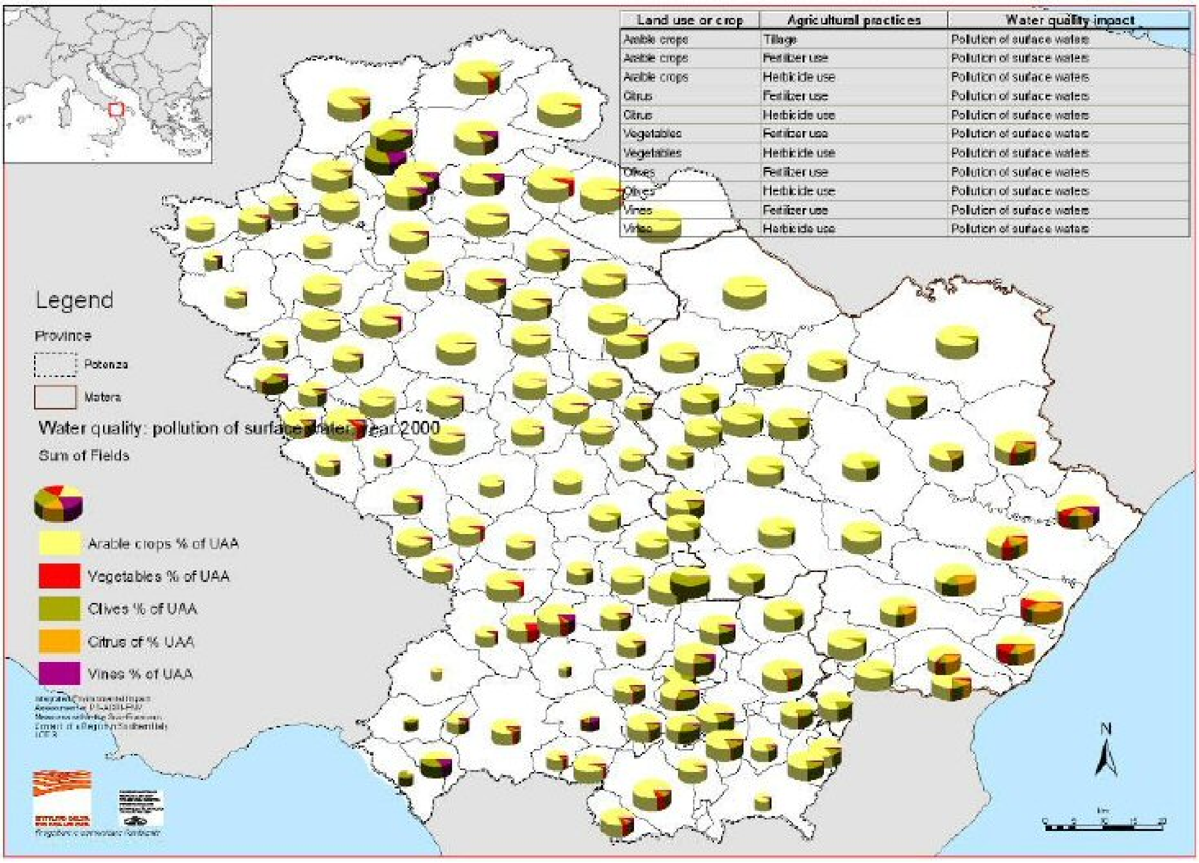


Figure 5.: potential impact of farming practices on water quality (pollution of surface water) expressed as percentage per crop and related farming practices (year 2000)

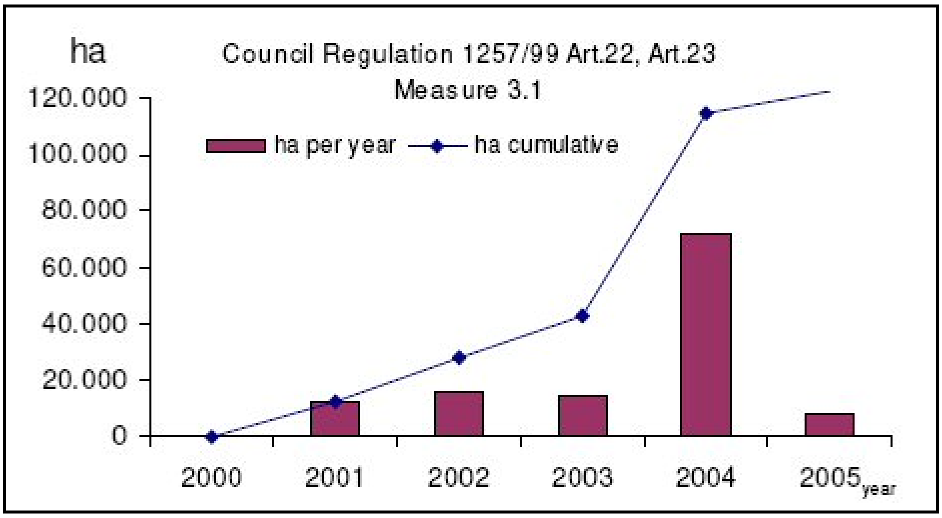


Figure 6.: Uptake of Organic Farming AEM in Basilicata, Italy

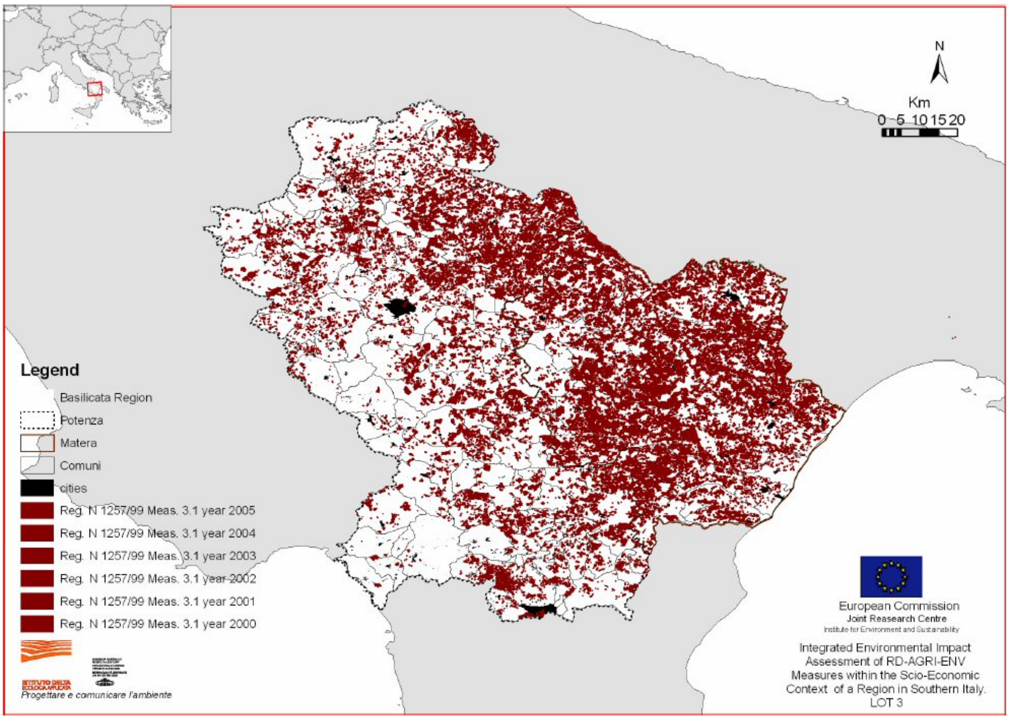


Figure 7.: Spatial distribution of implementation of the AEM

Water quality data was obtained through regional monitoring points of which however only ten had time series data. Times series data is required for assessing changes over time and to link them to periods when measures were implemented. Figure 9 shows a spatial overview of measure implementation and available water point data. Figure 10 illustrates the long-term trends of N concentrations in the water. Further inquiry is now needed to quantify the implementation of the measure specifically aiming at reducing use of fertilizer. A spatial model is needed that allows calculating the exact area that drains into the water point[7]. Within that area, the surface where the measure was applied can then be calculated. From this data an expected reduction in N use, as suggested by the measure, can be deducted which can be compared to the observed rates in the water points.

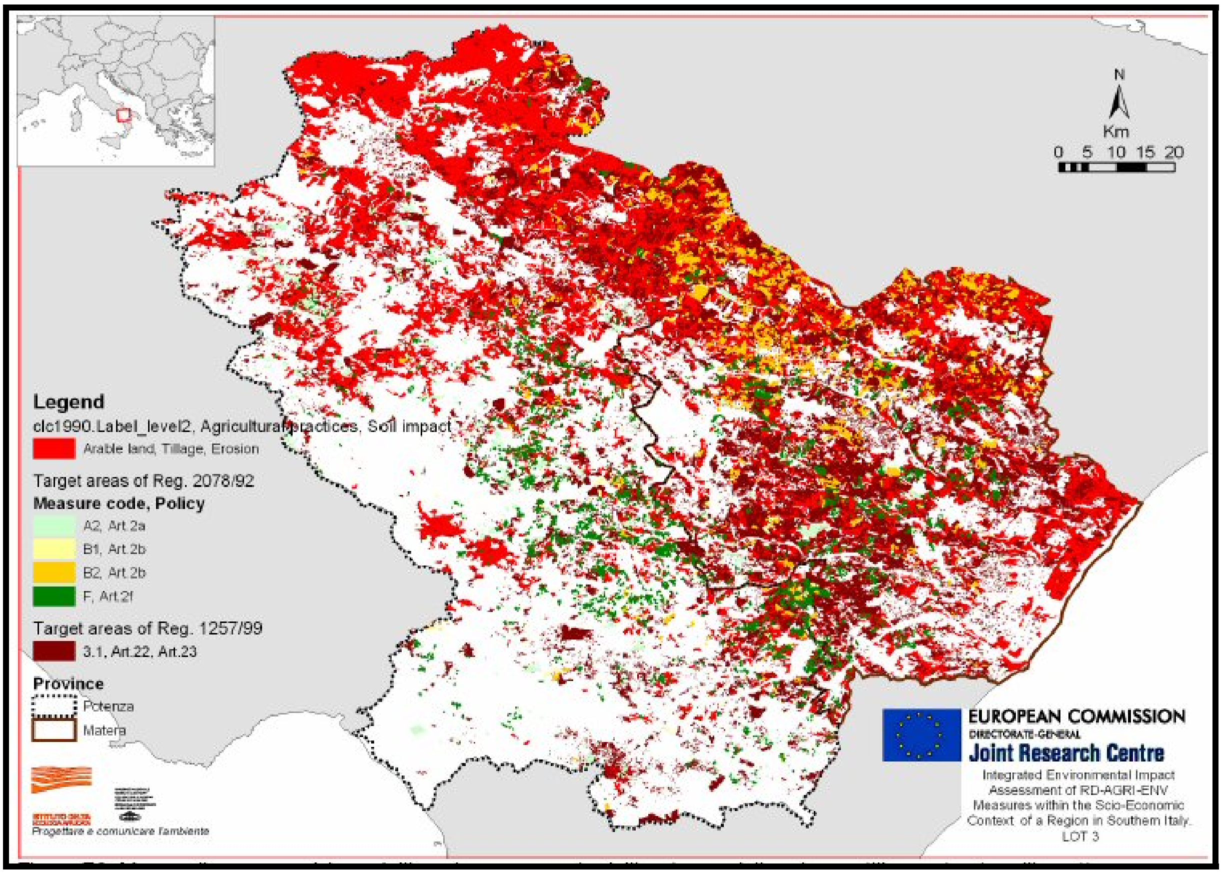


Figure 8.: map showing overlay of measure implementation and farm practice stress for erosion (in red)

Figure 10 could suggest that for certain areas the measure of Organic Farming could have a positive impact on the N rates corresponding to the uptake of the measure which increased over the years to a maximum in 2004, see Figure 6. However, at this stage this is preliminary and further study is required.

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[7] The Catchment Characteristic Model (CCM) developed within the JRC is an available GIS modelled catchment mapping and coding system, that allows calculation of draining and outflow involved areas. Information can be found on: http://agrienv.jrc.it/activities/catchments/

Similar data and scenarios are made and available for fertilizer and agro-chemical use within the Basilicata area.

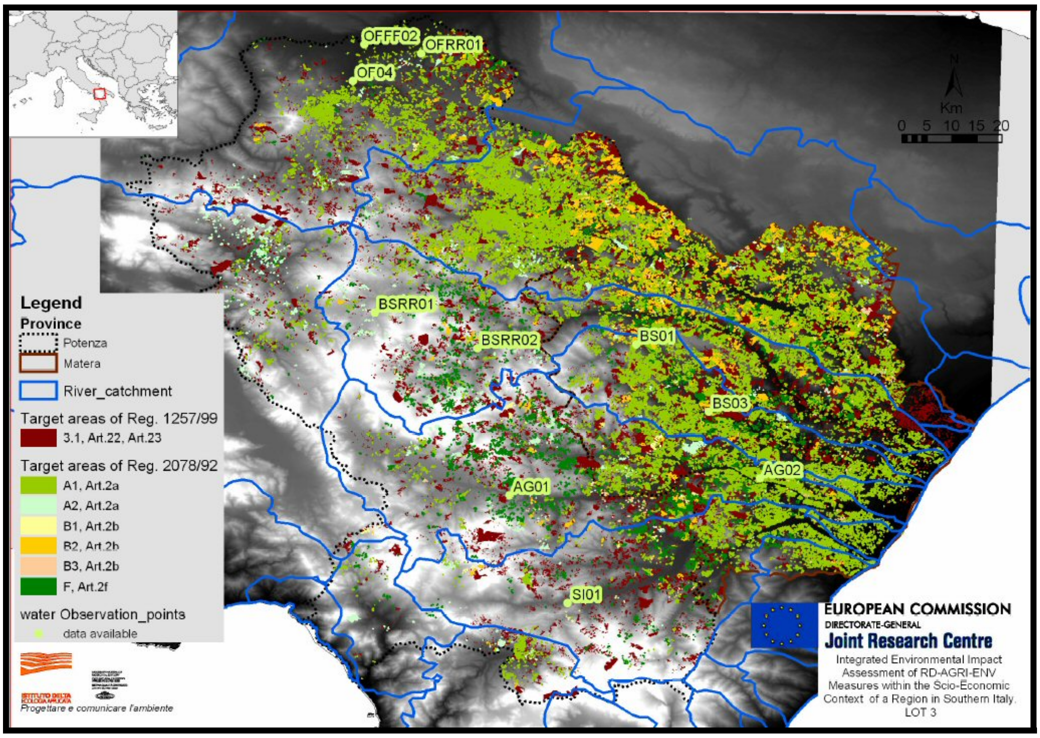


Figure 9.: water quality observation points and Measures of Regulation 2078/92 and 1257/99 on DTM

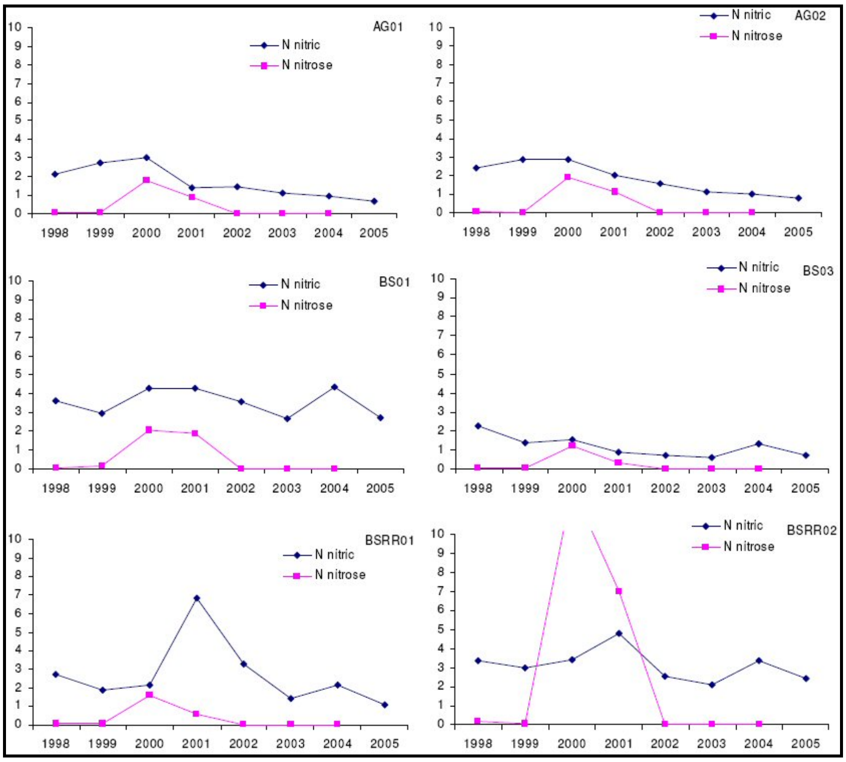


Figure 10.: annual average trends of N in water observation points (for only three stations)

NOTE on Basilicata Case Study

Apart from the preliminary results, this case study already provides a good insight in a complete approach for analysis of impact of agriculture on water resources.

The study also will be able to emphasize where the weak gears are in terms of data availability. A lot of effort has been required to compile the above structured and harmonized data layers, based on a variety of data sources and formats. This is an aspect that cannot be neglected and common efforts from all stakeholders will be required to solve this in view of optimizing similar analyses.

Seyhan River Basin Case study (Adana, Turkey)

(Based on contribution from S. Kapur, E. Akca et al. from the University of Cukurova, Adana, Turkey)

This case study similarly looks at identifying, assessing and mapping environmental impacts and will try to relate this to changing agricultural land management. The basin has an extended area north of Adana that is mostly extensively used and the Seyhan delta south of Adana where intensive and irrigated agriculture is practised.

Main problems are related to population migration to cities, causing excess cultivation around the city areas and specifically in the Seyhan delta, and intensive agriculture practices with recently increased farm inputs in terms of agro-chemicals and water use. These are the major causes for stresses on environmental and water resources.

Since 1991, the Ministry of Environmental implements policies for the protection and conservation of the environment, as follow-up to earlier policies started in the 1970s. The water authority, State Hydraulics, is mainly responsible for the water quantity management in the basin and specifically in the Delta.

The study introduced a new concept for inventorying and analyzing relations between spatial geo-physical and socio-economic data. Resource management planning can be optimized based on this concept. The 'Anthroscape' concept considers physical land shaping activities, geomorphological processes 'combined ' to anthropomorphic aspects. The Anthroscape is developed based on information on soil resources, climatic conditions, land cover and land use. This inherently includes all water uses. This spatial human-nature integrated concept is an ideal basis when moving from selective and individual resource management towards promoting holistic or basin wide approaches for resources management that consider human-natural systems with all processes and interrelations that sustain life. Anthroscape-based assistance plans for harmony between the needs of people and the needs of the environment by taking into account the interaction among biological communities, the environment and human society, particularly its historical dimensions. The latter is an important aspect in the policy planning stage as it tries to promote sound management and proper use of resources based on historical practices that have proved sustainable. These can be adapted with and to modern technologies without losing their sustainable effectiveness. An important linkage thereto in support of anthroscape use inventories can be made to a UNESCO initiative on traditional knowledge, the Traditional Knowledge Word Bank (TKBW[8]). Especially within the Mediterranean areas a lot of useful traditional knowledge is still available that can be applied in a modern way to help sustain resource use.

An example of the Seyhan Anthroscape (SA) is illustrated in figure 11. This anthroscape is used to inventory land use and water resources use in both the upstream and the downstream sections.

[8] www.tkwb.org

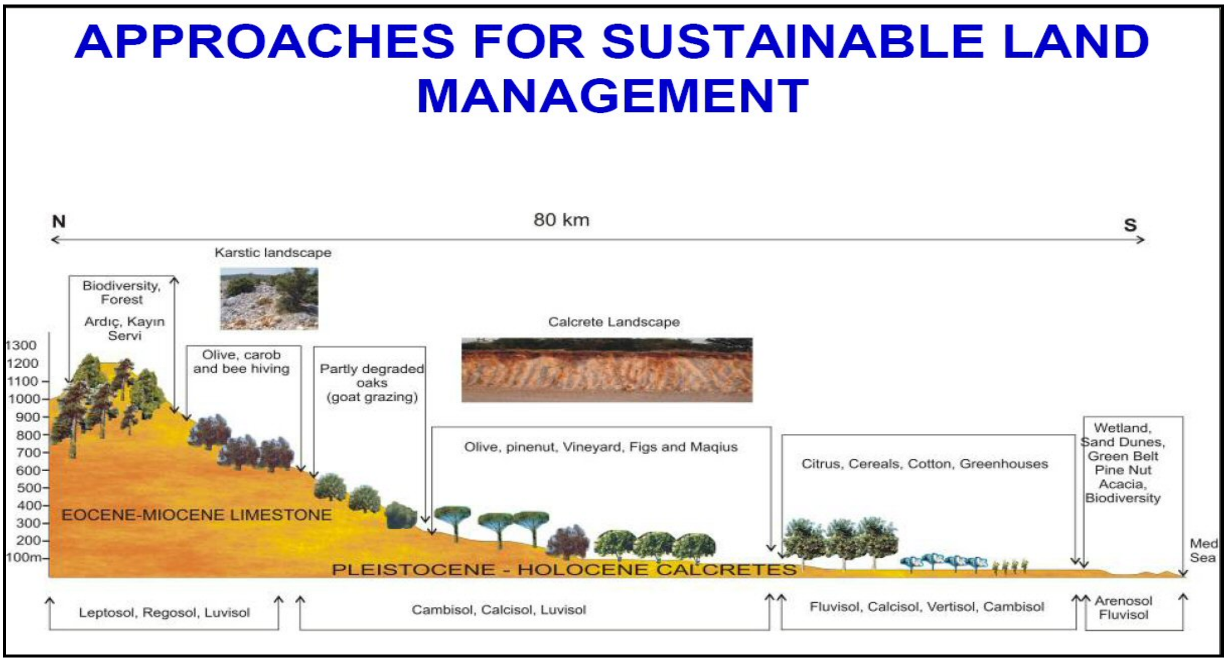


Figure 11.: The Seyhan Anthroscape

The major changes in the agricultural pattern of the SA, which is based on an indigenous and renovated wheat/cotton cultivation system, are:

In the highlands:

In the highlands a shift can be observed from cereals to orchards, vineyards and stone fruits in response to market demands. Being tree crops and not area extended crop such as cereals, use of irrigation tends to increase in these areas as well. This might affect in the long term the water supply from up- to down stream.

In the lowland basin:

The major change in agricultural land use is from cotton and or wheat as first crop to maize as a first crop. This is due to the agricultural policy followed by the government aiming at increased production of edible oil to meet the ca. 40% oil deficit of the country. This of course has large repercussions on the water use and the application of agro-chemical, especially in the intensive used irrigated delta.

Conventional furrow irrigation has always been practices in the basin since the early 1950s following the construction of the Seyhan dam, and even earlier by water obtained from wells in the downstream part. However sprinkle and drip irrigation systems are being introduced, farmers are not inclined to take on the extra investment, as they perceive that enough water is available through the dam regulation. They keep on applying the more labour intensive and higher consumptive furrow irrigation. Photo 1 shows furrow irrigation management in the delta area.

Photo 1.: furrow irrigation in the Seyhan river delta

The traditional cotton crop requires less water than maize and seems to be more convenient for the region in sustaining the regional climate avoiding excess water use and higher evaporation rates.

Furthermore fertilizer use and rate per crop has been increasing progressively with the increasing demand for food by the ever-increasing population.

NO_3 and NH_4 bearing fertilizers are used as well as potassium and phosphorus. It is noted that application rates indicted in the study are of 300-350 kg/ha of NPK for wheat and ca. 450 kg for cotton and maize.

Considering a 2-1-1 combination this implies a high application of resp. +-175kg/ha N for wheat and +-225kg/ha for cotton and maize. These numbers are still well above EU norms. Eutrification and desertification of coastal lagoons and coastal waters seems inevitable due to increasingly polluted drainage discharge, despite the high flow rates and the good quality (low EC and Na) of the Seyhan river water used for irrigation.

Organic N and organic P and N and NO_3-N are lower the hazardous limits, but NH_4-N is already slightly higher than threshold values. Influence of untreated human and farm waste waters has to be considered as well.

In between the delta agricultural area and the sea, a buffer zone of Pinus Pinea and dune fixation has been created some 25 years ago. This might well show effects on limiting nutrient leaching to coastal waters. Only an estimation of the buffer capacity can be made as no long term adapted monitoring data on coastal water quality is available in this spot.

For the final results of this study farming practices will be linked with their expected impacts and based on the anthroscape stratification, impact will be assessed.

NOTE on the Seyhan Case Study

This study introduced a new concept, Anthroscapes, for spatial mapping of resources use and to perform analysis on the cause-effect relation of agricultural stress on water resources.

The difficult step is to spatialize the anthroscape concept itself. Work is still being performed to offer a structured approach and guidelines to do this in other areas, which will be a major contribution from this study.

Mainland uses and related farming practices have been inventoried and are being linked to the spatial anthroscape for further analysis.

Lessons from the Pilot River Basins (PRB)

(contribution based on the input from all Pilot River Basins in the PRB Agriculture Group (see figure 3) and specifically from the Guadalquivir River Basin (A. Arguelles, V. Cifuentes, J. L. Serrano, E. Mellado et al.))

The PRB-AG network was established to provide practical information to the following key issues:

- Gathering evidence and information in relation to agricultural pressures and impacts on the environment, including the identification of information gaps.
- Identifying the opportunities to use the existing (and potential future) CAP measures for delivering WFD objectives, including further improvements of the implementation of CAP and WFD.
- Identifying what other mechanisms (apart from CAP) are available to MS to meet WFD objectives.
- Information sharing on best approaches for engaging and educating farmers and the public about agricultural pressures.
- Providing links between EU water, agriculture and rural agendas and authorities

The Strategic Steering Group on Agriculture of the Common Implementation Strategy (CIS) of the WFD already identified the need for better and harmonized data in order to fulfill these tasks. PRBs have started to compile a common set of indicators to be used for analysis of pressures and impacts, but during the exercise came to the conclusion that common indicators are not feasible in view of the many site-specific characteristics and objectives. In fact, some 45 indicators of interest were identified of which a mere 2 were common. However, detailed technical templates were prepared for the 45 indicators/data layers, precisely in view of contribution to data harmonization for Article 5 compilation and further monitoring.

Through their analysis the PRBs also confirmed the main pressures from agriculture on water resources in general:

- Nutrient pollution
- Pesticide pollution
- Water quantity
- Sediments (erosion and P)

- Habitat loss and physical modifications

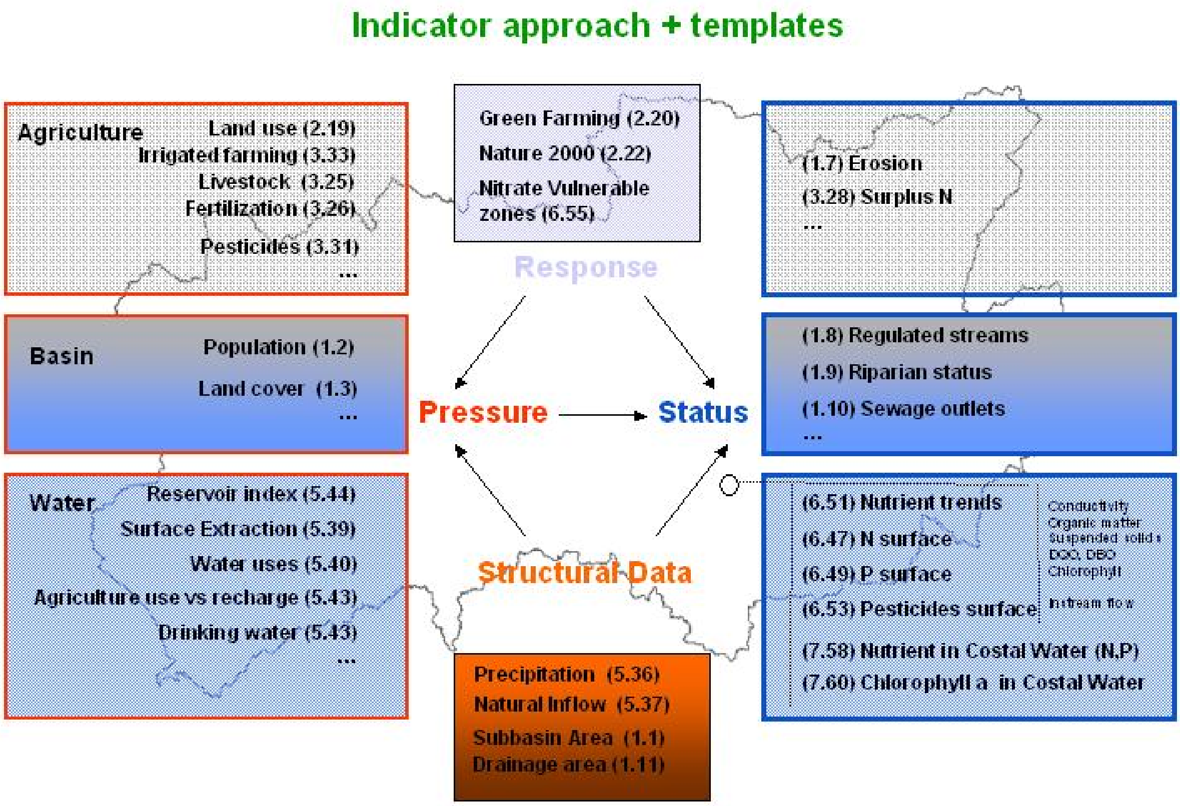


Figure 12.: Overview of PRB indicator/data layer approach

The Guadalquivir Pilot River Basin worked out a digital GIS based inventory and mapping system for the various indicator layers. It will be possible to share this experience. The system is expected to be a valuable basis for basin inventory in conformity to WFD Article 5 requirements. Application of such system can be envisaged in view of testing WFD guidelines in Southern Mediterranean basins. Figure 13 gives a schematic overview of the GIS system. The Guadalquivir is testing various methods for the analysis on pressures and impacts based on these data layers. Through descriptive statistics, in univariate and multivariate dimensions, and inferential approaches, considering different hypothesis formulation and testing, the impact of agri-environmental programmes on the water quantity and quality are being assessed. Single measures, such as organic farming, are considered and the spatial extend of implementation is mapped. Potential agricultural pressures are then mapped based on area statistics, which are aggregated or disaggregated, to match the spatial working unit that is the sub-basin level. Having time series data over a number of years, trends of these pressures are mapped and related to measures or hypothesis to assess the actual impact on water quantity or quality.

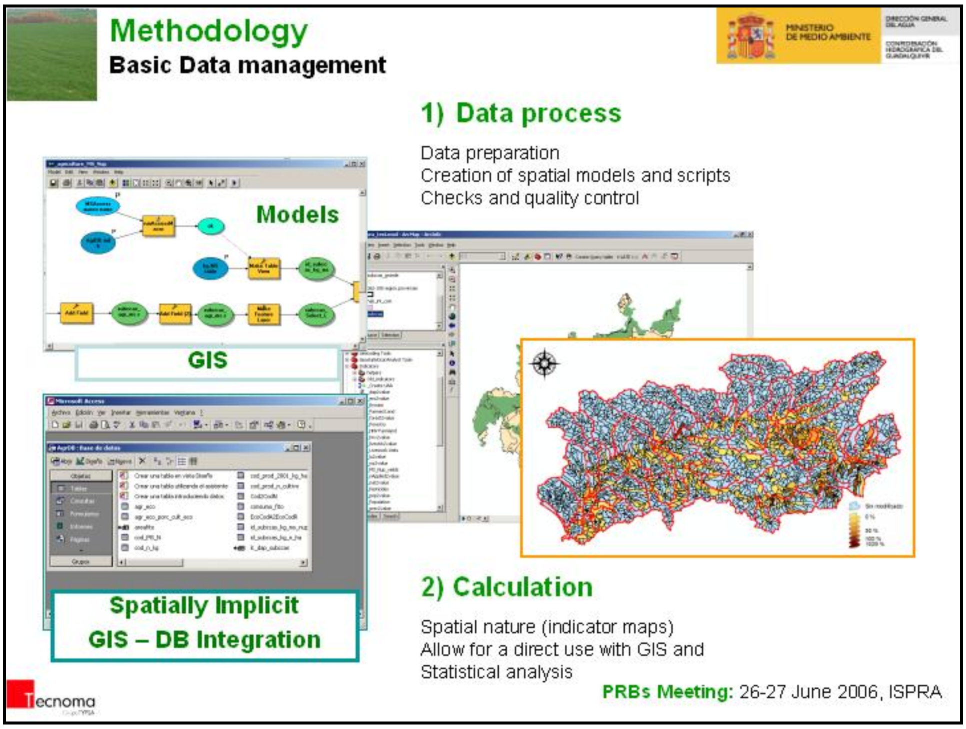


Figure 13.: schematic overview of the GIS based PRB indicator inventory and mapping system developed by the Guadalquivir River Basin

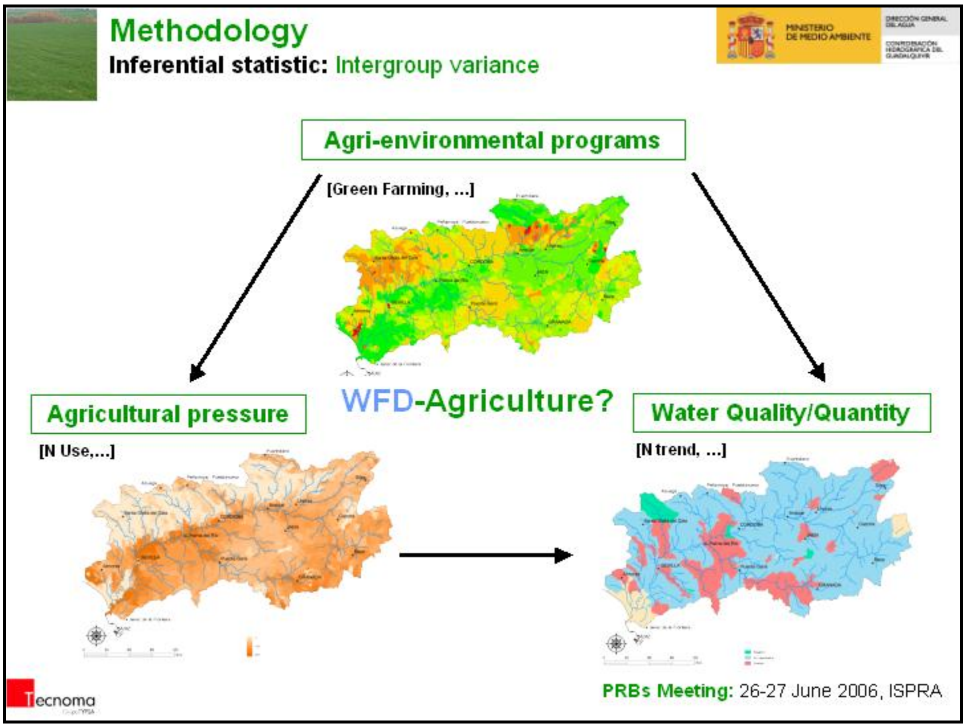
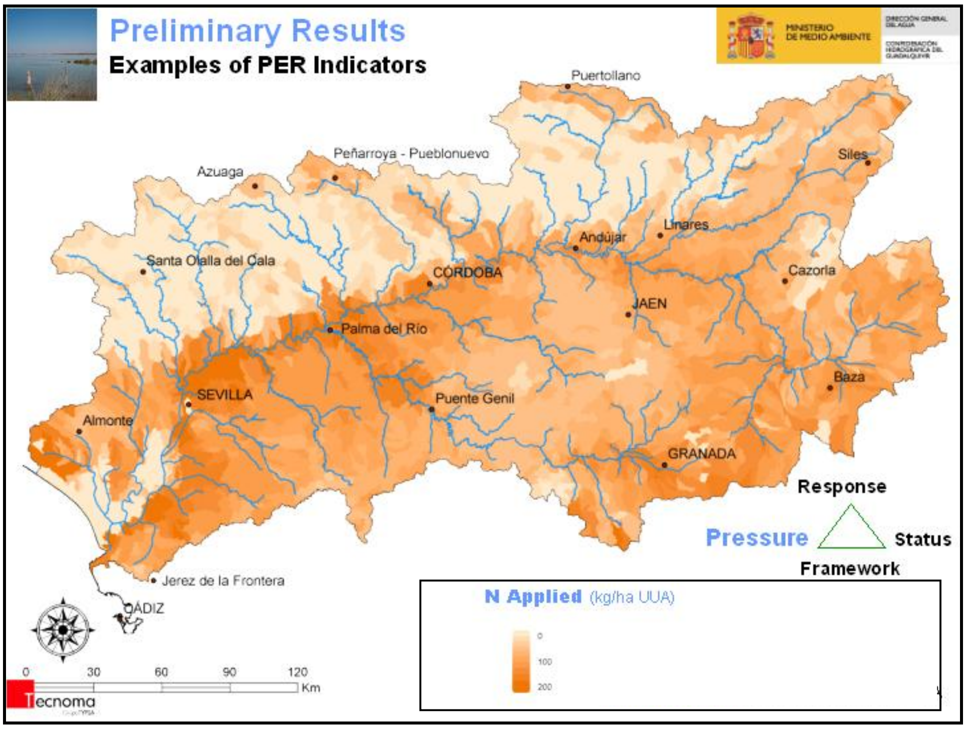


Figure 14.: schematic overview of the data processing for analysis of pressures and impact from agriculture as developed by the Guadalquivir River Basin



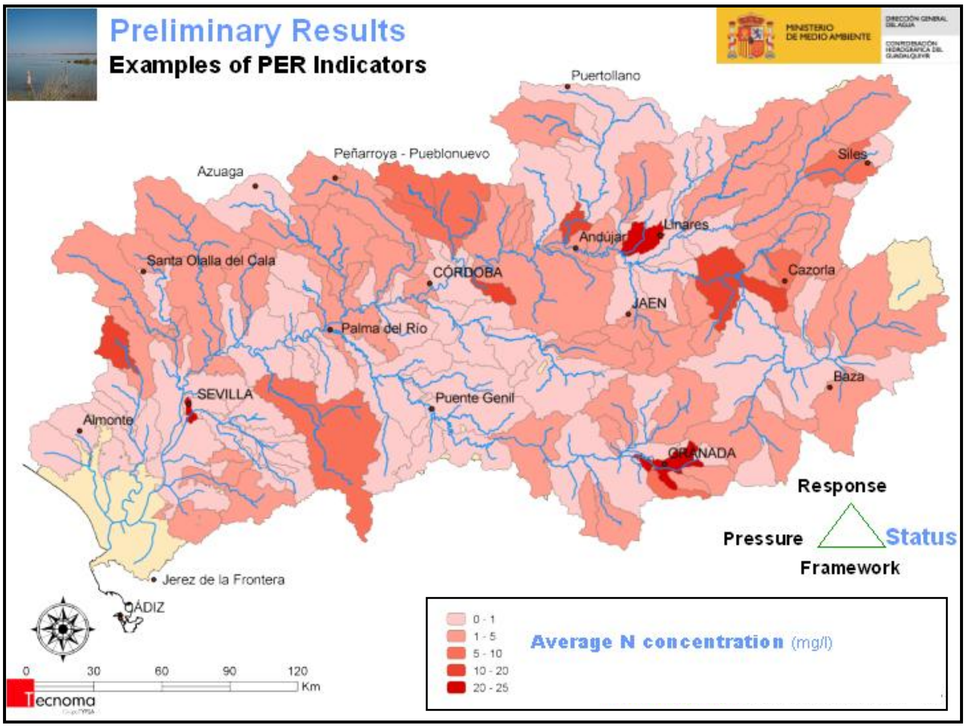


Figure 15.: example of mapped (a) N pressure (i.e. field applied N levels) and (2) N status (average N concentrations measured) for the Guadalquivir River basin.

A final report from the various PRBs is in preparation and will be made available.

NOTE on PRBs

The PRB exercise, including two Mediterranean basins, developed strategies for

- Harmonizing required data layers
- Analysis on pressures and impact from agricultural practices on water resources
- Design of appropriate mitigation measures based on the analysis
-

It can be confirmed that the link between water and agriculture is complex, but that now there are possibilities to identify and predict pressures from agriculture properly and that there are certain communalities to do so.

The PRBs also stress that effective measures can be derived from sound analysis, however these remains very site specific. Further socio-economic analysis would be needed ensuring and assessing proper implementation.

Photo 2.: View on intensive olive cultivation in the Guadalquivir River Basin

Conclusions and recommendations

During the Phase I of the Joint Process, this Joint Process Working Group on Agriculture has been established and operational, albeit not at full throttle due to limited facilities.

However, the Working Group on Agriculture has been taken a number of initiatives to promote the development and testing of integrated impact assessment in various Mediterranean sites. During the Phase I of the Joint Process, the WG met to discuss possible approaches and specific needs to address when setting up such studies.

The case studies are designed to be taking into consideration the need for synergies between the field level, regional and EU policies and enlargement and neighbourhood policy initiatives.

At this stage of reporting, the cases studies are still operational and in their final phase of reporting, but a number of indications and lessons have been listed in the report, these are mainly:

- A number of approaches has been developed and tested for inventorying, mapping and assessing impact from agricultural management on the water resources. Existing and innovative spatial concepts and processing methods are proposed. These approaches will be made available through a common platform (that will be rebuild by the JRC)
- Having outlined clear analysis strategies based on existing data, the case studies also indicate where the existing gaps are in data availability and structure in order to further solicit efforts from all stakeholders in this field in view of optimizing and harmonizing similar analysis
- Based on their analysis, the case studies indicate that the effectiveness of existing measures can be assessed and vice versa, effective measures can be designed based on solid analysis
- Linkages between agriculture and water are complex and very site specific, but it is now possible to identify and predict pressures and impact. However site specific the problems are, there is scope in finding communalities in analyzing these.

The Working Group would propose the following main recommendations:

- To continue to develop knowledge on pressures and impacts from agriculture on water in Mediterranean areas, including identification and assessment of actual impact and efficiency of agri-environment policy measures focusing on water quality and quantity, through continuation and further organizing site specific case studies for testing and verifying developed analysis strategies and accumulated knowledge
- To enhance the development of exchange on best practices for rural development planning addressing water management issues, through a common electronic platform and workshops
- To actively promote coordination between water management, rural development planners and other stakeholders based on sharing practical examples and analysis results. Appropriate ways will need to be explored during the next phase
- To foster integration within the Mediterranean basin in finding and implementing synergies between EU and non-EU policies and for the realization of common goals and initiatives in the field of water resources management. Case studies will need to be closely linked with all stakeholders and be in line with on-going initiatives related to e.g. WFD, EU-MED WI and Horizon 2015

Annex 1: Members of the initial WG

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Annex 2: Minutes of the WG meeting Nov. 2005.

Short Minutes of the first meeting on
"Assessing Environmental Effectiveness of Rural Development Measures Across Europe and How to Bridge the Local Experience"

Held in Ispra, 28-29 November 2005

1. Rationale

This meeting was held in the framework of an initiative within the Agri-Env Action at the JRC that looks at setting up a network of pilot sites to collect circumstantial evidence on the environmental impact of Agri-Env measures under the CAP Rural Development policy implementation and to look at ways on how to link this to the implementation of the Water Framework Directive (WFD). The overall objective of this first meeting was to gain insight in the possibilities to set up such network and to decide on a technical orientation. It was a first step to identify gaps and needs as well as priorities for studies needed. The network of pilot groups would make available a number of relevant experiences testing methods for assessing environmental effectiveness of rural development agri-env measures. This is expected to support RD stakeholders in how to solve (similar) environmental impact assessments in their areas in view of validating measures.

A next step is to mobilize regional RD authorities to collaborate for implementing pilot studies for testing a number of technical options. This network of test regions, supported by the technical core, would have the potential for supporting the planned European Network of Rural Development on a number of technical issues.

2. Meeting

The meeting went through a number of presentations illustrating practical technical study approaches as well as general or country based experiences related to needs, hurdles encountered or foreseen, good practices and plans.
Most of the presentations are available on the following web site:
http://agrienv.jrc.it/activities/

a. Two main points of attention were raised related to RD policy making. Firstly, that environmental effectiveness should be ensured in addressing environmental problems related to agricultural land use, while increasing the economic efficiency, or reducing cost. Secondly, improving dissemination of lessons learned from existing projects, countries and regions.

b. The major fields to improve in order to achieve the above were identified. Firstly, more rationale could be introduced into schemes. Ex-ante and cause-effect analysis, measurable objectives, and increased understanding of the complexity of the rural development would contribute to this. Secondly, more systematic data is needed on measurable indicators for economic efficiency and environmental effectiveness assessment of the RD policy implementation at scheme and local level

c. This led to a number of technical questions that are to be solved:

- How to set measurable/quantifiable objectives?
- How to improve targeting of measures (spatial and thematic)?
- How to account for interaction or counteraction of the measures?
- How to gain more knowledge needed for impact assessment
- How to release political obstacles related to monitoring and how to set up structured monitoring?
- How to ensure proper stakeholder involvement?
- How to create synergies between management plans (Rural Development Plans, River Basin Management Plans, National Action Plans, etc.)

Within its scope, the meeting considered that solving the problems to reach operational impact assessment, inherently addresses most of the problems listed above. Furthermore proper impact assessment is needed to validate the measures and/or their alternatives and contributes to specifying and/or re-adjusting scheme or measure objectives.

d. Presentations illustrated that measure objectives can be set quite clear on the one hand (e.g. Farmland Bird Index) but key data is missing for quantitative impact assessment. On the other hand, more frequently, objectives could be better set if knowledge is gained on the quantification of impacts. Within the potential frameworks, quantification is related to the possibility to:

- Establish effective indicators
- Collect significant related data (baseline and monitoring)
- Establish functional relations between certain indicators.

e. This knowledge can be compiled through pilot studies. Such studies are to analyze the actual impact of a variety of similar measures that are each tailored to the specific conditions of certain areas. Resulting methods are then to be extrapolated so interested users can apply them over other areas. Finalized or on-going significant initiatives are already offering a wealth in local experience but key signals need to be extracted from these initiatives. Some issues that need more in-depth technical work were identified:

- Defining adapted environmental indicators.
- Developing definitions and methods for establishing both baseline situations and trends of indicators or groups of indicators.
- In situ testing of indicator performance and compatibility.
- Defining key-combinations of indicators and their rules.
- Feeding indicators schemes into multi objective or other integrated analysis approaches
- Setting up practical realistic schemes for collecting monitoring data.

f. Work at local scale produces ‘deep and narrow’ methods and contributes to farm-scale knowledge on environmental effectiveness (including both on-site and off-site effects). But local studies need to be scaled up to make them not only comparable but also compatible for assessing the effectiveness of the RD policy objectives at smaller scales.

g. The meeting proposed to set up a forum to network all this current and future experience by providing further input to - identify relevant initiatives and to indicate potential pilot sites and partners. JRC will look into ways to make existing reporting more compatible and to make all these experiences available. This discussion consolidated the idea for looking at designing Best Practice Guidelines as a longer-term objective.

3. Outcome

To start off the above process, the meeting members decided and agreed to provide input for immediate follow-up on the following issues. JRC will draft a short questionnaire to facilitate this information collection and further coordinate this activity. A meeting to group Region Authorities and technical core would be envisaged for mid 2006.

4. List of Participants

"Assessing Environmental Efficiency of Rural Development Measures Across Europe: Bridging the locale experience"

JRC - Ispra (Italy) - meeting room nr. 6, bldg 6

28/11/2005 - 29/11/2005

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