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Water Framework Directive meets Common Agricultural Policy - Opportunities for the Future

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WFD and Agriculture – Analysis of the Pressures and Impacts Broaden the Problem's Scope

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RE	Restricted to a group specified by the consortium (including the Commission Services)	
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Please note: the data derived from the national WFD Article 5 reports and summarised in this report has not been reviewed by EU Member States.

The views expressed are purely those of the writer and may not in any circumstances be regarded as stating an official position of the European Commission or individual Member States.

The information compiled in this paper may contain gaps and uncertainties. It is subject to rapid change. The official Article 5 reports are available at the WFD CIRCA server: http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/implementation_documents_1/wfd_reports/member_states&vm=detailed&sb=Title

The information presented is the status as of **October 2005**.

Warsaw Agricultural University

WFD and Agriculture – Analysis of the pressures and impacts

Broaden the problem's scope

Wokinging Report

Version 3 – 12/10/2005

Prepared by:

Nadine Herbke (Ecologic)
Thomas Dworak (Ecologic)
Zbigniew M. Karaczun (Warsaw Agricultural University)

With contributions from:

Anne Gendebien and Helene Horth (Water Research Centre – WRc) and other consortium partners such as Vituki Consult, NIVA and NERI

Niels Thyssen and Beate Werner (European Environmental Agency – EEA) and partners from the National Environmental Research Institute Denmark

Giovanni Bidoglio and Faycal Bouraoui (Joint Research Centre – JRC)

Foreword

As a result of a process of more than five years of discussions and negotiations between a wide range of experts, stakeholders and policy makers, the Water Framework Directive (or the Directive 2000/60/EC) of the European Parliament and of the Council established a framework for Community action in the field of water policy. The Directive, which entered into force on the 22nd of December 2000, sets a framework for the protection of all waters with the aim of reaching a "good status" of all community waters by 2015.

The latest reform of the EU Common Agricultural Policy (CAP) in 2003 increased the opportunities for the implementation of the Water Framework Directive (WFD). A working document prepared by the Environment Directorate General of the European Commission highlighted a number of opportunities where the CAP can help achieve the WFD objectives (European Commission, DG Environment, 2003). However, achieving these objectives remains a challenge. Acknowledging this, the Water Directors, who are the representatives of the EU Member States administrations with overall responsibility on water policy, agreed in June 2004 to take action in the context of a Common Implementation Strategy (CIS)[1]. To this aim, they established an EU Strategic Steering Group (SSG) to address the issues of interrelations between CAP and WFD. The timeframe for the SSG work is short given the tight WFD timetable (developing draft River Basin Management Plans by 2008, achieving the ecological status objectives by 2015) and the timing of CAP developments, notably the development of the European Rural Development Policy (implementation by 2007).

The Strategic Steering Group (SSG) on WFD and Agriculture is led by the UK and the Environment Directorate-General of the European Commission with technical support from the Directorate-General for Agriculture and Rural Development. The aim of the group's work is to identify the issues which affect a Member State's ability to meet WFD objectives resulting from pressures of agricultural sources. The group will also put forward suggestions on how to best manage the risk of not meeting these objectives, taking into account the opportunities of the reformed CAP.

As one of its first steps, the SSG is preparing a report demonstrating the linkages (direct and indirect) between agricultural activities and water resources status. Ecologic and Warsaw Agricultural University (WAU) have been commissioned to prepare this report in the context of the 6th Framework Programme of Research Project "WFD meets CAP – Opportunities for the future"[2]. This background report is mainly based on:

- the analyses of the national synthesis of the Article 5 reports[3] for agricultural pressures by the WRc and consortium partners;
- the EEA activities on source apportionment of nitrogen and phosphorus inputs into the environment;
- the IRENA operation on agri-environmental indicators[4]; and
- the results from the FATE research project[5] by the JRC.

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[1] The main aim of this strategy is to allow a coherent and harmonious implementation of the WFD. The focus is on methodological questions related to a common understanding of the technical and scientific implications of the WFD.

[2] Contract no. SSP-CT-2005-006618 CAP&WFD.

[3] Article 5 of the WFD stipulates that each Member States shall ensure the submission of a report including the characteristics of the river basin district, the review of the environmental impact of human activity and the economic analysis of water use.

[4] The IRENA (Indicator Reporting on the Integration of Environmental Concerns into Agricultural policy) project has been launched in September 2002 in order to improve, develop and compile the agri-environment indicators identified by two Commission Communications (COM(2000) 20 final; COM(2001) 144 final) at the appropriate geographical level. The project is a collaborative research between DG Agriculture, DG Environment, Eurostat, JRC and EEA.

The paper establishes a foundation for future work on the linkage between the Common Agriculture Policy and the Water Framework Directive.

Ecologic and WAU would like to thank all co-authors of WRc, EEA and JRC as well as all experts of DG Environment, DG Agriculture and Rural Development, Defra and all national experts for supporting us and helping us prepare this document.

This document is a *living document* that will need continuous input and improvements as application and experience build up in all Member States of the European Union and beyond.

For further information on the detailed reports please contact:

Anne Gendebien, WRc, 29 rue des pierres, B-1000 Brussels, Belgium; Email: gendebien_a@wrcplc.co.uk

Niels Thyssen, European Environment Agency, Kongens Nytorv 6, DK-1050 Copenhagen K, Denmark; Email: niels.thyssen@eea.eu.int

Giovanni Bidoglio, Joint Research Centre, Institute for Environment and Sustainability, Soil and Waste Unit, Via Fermi, I-21020 Ispra (VA), Italy; Email: giovanni.bidoglio@jrc.it

For general remarks and comments please contact:

Thomas Dworak, Ecologic – Institute for International and European Environmental Policy, Pfalzburger Strasse 43-44, D-10717 Berlin, Germany, Email: dworak@ecologic.de or info@ecologic.de

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[5] The project on the Fate of Agrochemicals in Terrestrial Ecosystems (FATE) aims at developing a set of modelling tools putting in relation pressures from various sources and water quality.

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Executive summary

Across much of the EU, tackling the pressures on water caused by agricultural activities constitutes one of the main challenges to meet the WFD environmental objectives in 2015. To broaden the problem's scope, this background paper prepared as part of the 6th Framework Programme of Research Project "WFD meets CAP – Opportunities for the future" analyses the various pressures of agriculture on water bodies. The paper summarises data from various sources such as the analyses of the national synthesis of the Article 5 reports for agricultural pressures by the WRc and consortium partners, the EEA activities on source apportionment of nitrogen and phosphorus inputs into the environment, the IRENA operations on agri-environmental indicators and the results from the FATE research project by the JRC.

From an agricultural perspective, diffuse pollution with nutrients and hydro-morphological modifications seem to be the main pressures on water bodies leading to a potentially significant risk of failing to meet the WFD objectives. In terms of nutrients, *nitrogen* compounds are considered to have a greater impact on water than phosphorus compounds inputs. However, *phosphorus* can also induce pressures, particularly in case of soil erosion. Indeed, phosphorus is mainly linked to particles of soil and can be transferred to the aquatic environment in areas particularly concerned by risks of erosion. In many agricultural areas phosphorus is accumulating in soil and can eventually reach levels such that significant amounts will leach (or already have leached) from the soil towards the aquatic environment. This is causing eutrophication problems in surface waters. With regard to active ingredients of *pesticides*, the use of these substances is generally higher in western Europe than in Nordic or eastern Europe. According to the EEA, all countries that reported on the pesticide situation in their state of the environment reports but Sweden mention a danger of pesticide pollution of groundwater.

Agricultural activities such as irrigation, drainage and land reclamation can cause the disturbance of the natural water balance and thus represent important pressures on water bodies. *Irrigation* as part of intensive agriculture, including horticulture, has often led to an unsustainable use of water in some regions in Europe. Especially in the southern EU Member States, irrigation increases the risk of over-exploitation of the available water resources. *Land drainage* can have a variety of impacts on hydrology and water quality, depending, among others, on the techniques used and the type of soil. The Netherlands and Belgium, as can be expected, have made extensive use of artificial drainage.

Furthermore, land drainage, the intensification of farming practices and inappropriate grazing regimes have contributed to the loss of wetlands and floodplains, resulting in hydro-morphological modifications of surface waters. Due to the limited information on hydro-morphology available in the national synthesis of the Article 5 reports, it is not possible to derive general findings on the contribution of the agriculture to hydro-morphological changes.

The identified linkages between agricultural activities and water protection render the necessity to look for synergies in present agricultural and water policies obvious. They also show that addressing problems of deterioration of quality and quantity of water bodies related to agriculture requires multidirectional activities and close co-operation between different sectors. Accordingly, there is a need to further strengthen the dialog with all sectors, and especially between the agricultural and water sectors. Stressing the linkage between the two policy fields enables not only the development of appropriate measures for the reduction of agricultural pressures but also the achievement of win-win situations, where the desired level of agricultural production is attained (or maintained) in parallel to the desired level of water resources protection, both in terms of quantity and quality. In order to start this process, it is important to discuss how the Common Agricultural Policy can contribute to the WFD

objectives and provide guidance on how the authorities working on the WFD and the CAP can co-operate more closely.

1 Introduction

Water is a key resource for human needs and environmental quality. Renewable fresh water, a basic component of the water cycle, is a resource essential to life. The availability of fresh water has determined the emergence and development of living organisms on our planet and still determines the existence of human beings and their activities. Therefore, both the contamination of water resources and water balance disturbance through the overuse of water can have far-reaching negative consequences: (i) social (e.g. health problems), (ii) economic (e.g. reduced possibilities to develop economic activities), and (iii) ecological (e.g. decrease of biodiversity). Due to economic development, the consumption of water continually increases which can result in problems of water resources availability. These problems are widespread in Europe because of industrialisation and urbanisation, and the implementation of industrial agriculture methods. Consequently, in the last years, several European institutions have paid attention to the trends in the quality and quantity of European water resources.

The European Union has being dealing with the problem of water quality and resources for more than 30 years. Early European water legislation began, in a "first wave", with standards for those of our rivers and lakes used for drinking water abstraction in 1975, and culminated in 1980 in setting binding quality targets for our drinking water. It also included quality objective legislation on fish waters, shellfish waters, bathing waters and groundwaters. Its main emission control element was the Dangerous Substances Directive. The results of the second phase of water legislation were the adoption in 1991 of the Urban Wastewater Treatment Directive, providing for secondary (biological) wastewater treatment, and the Nitrates Directive, addressing water pollution by nitrates from agriculture. The culmination of all these activities is the Water Framework Directive (WFD) adopted in December 2000 and the current work of EU on the linkage between policies on matter of agriculture and water in the enlarged Community.

Agriculture has always had a close relation to water, the latter being an indispensable input for both crop cultivation and animal rearing before being filtered by soils on its way back into ground and surface waters. This relationship remained relatively balanced for millennia.

After the second world war when European societies had been damaged by years of war, agriculture had been crippled and food supplies could not be guaranteed, the Common Agricultural Policy (CAP) was established in western Europe, in most cases in replacement of pre-existing national policy measures. The emphasis of the early CAP was essentially on encouraging an increase in agricultural productivity, so that fair standards of living could be ensured for the agricultural population, and consumers could have a stable supply of affordable food. To meet these ends, the CAP offered production-linked subsidies and guaranteed prices to farmers, providing incentives for them to increase production. This mainly production-oriented policy lived on into the 1990s. While contributing to its primary objectives, it caused unfortunate side effects that progressively began to appear related to both agricultural intensification and land abandonment.

Indeed, the CAP contributed to a significant increase of the pressures on the environment and more particularly on water. These pressures include higher water abstraction, nutrient leaching and/or hydro-morphological modifications, and can have manifold effects, among which are (Strosser et al., 1999):

- increased pollution of ground water and rivers due to nitrate and pesticide leaching;
- reduction of ground water and river flow levels as a direct result of water abstractions;

- increased negative impacts on natural resources resulting from the construction of dams and the diversion of water-courses for irrigation purposes;
- secondary effects, which are much more difficult to measure, such as risks of erosion, the disappearance of wetlands (also related to the implementation of drainage systems), oxygen deficits in rivers leading to the possible extinction of species of flora or fauna or the gradual salinisation of groundwater in coastal areas.

Other important problems related to water management and agriculture are (Karaczun and Indeka, 1999):

- risks of adverse effects on human health and problems related to water treatment (for consumption purposes) due to water pollution;
- epidemiological hazard due to an improper management of liquid manure;
- increased risks of river flooding due to deforestation (as an effect of agriculture land extension) and installation of polders for agriculture purposes.

However, in addition to exerting pressures, agriculture can also play a positive role in respect to water resources and related ecosystems (European Commission, DG Environment, 2003), such as:

- The preservation of farming activities in mountain and hill zones can ensure the maintenance of a positive land management in these areas, which possibly contributes to the prevention of floods and landslides and, by decreasing the rapidity of peak run-off of waters, to a better regulation of the flow pattern and level of the surface water bodies downstream;
- Certain farming systems can contribute to the building-up of organic matter in the soil and, thus, to the maintenance or even the enhancement of the binding, storage and buffering capacity of these soils, which contribute to limit the diffusion of pollution from soil to water;
- In some cases, certain farming systems can contribute to the preservation of wetlands and other terrestrial ecosystems depending on water bodies.

These linkages between agricultural activities and water protection render the necessity to look for synergies in present agricultural and water policies obvious. Addressing problems of deterioration of quality and quantity of water bodies related to agriculture will require multidirectional activities. The general aim should be to achieve win-win situations, where the desired level of agricultural production is attained (or maintained) in parallel with the objectives of water resources protection, both in terms of quantity and quality. Against this background, there is a need to identify the current pressures on water bodies from agricultural sources, as well as the possible benefits to the status of water bodies and related ecosystems that can originate from agricultural activities, and the areas where they especially occur, before defining future actions in the fields of water management and agricultural practices in a coherent manner.

This background paper exclusively focuses on agricultural pressures and their impacts on water bodies and aims to summarise the available data on this matter. The evaluated data include *inter alia* the analyses of the national synthesis of the Article 5 reports from ten Member States (MS) and four roof reports of international River Basin Districts (RBD) for agricultural pressures by the WRc, the draft results from an ongoing research on agricultural pressures to water by the EEA[6] and the JRC[7] and additional information gathered from other EU reports and documents.

As the Commission has yet to receive the Article 5 reports on the analyses of pressures, impacts and uses of water from approximately 120 river basins districts in the EU-25 and the full assessment of all of the Article 5 reports is planned for the end of 2005 to 2007, this document has to be updated on a regular basis in order to get a full and detailed picture of the pressures resulting from agriculture. To provide an initial picture in a short timeframe (the first Article 5 reports were submitted at the end of March 2005), it was decided to exploit the national syntheses rather than the individual river basin district reports. The result is a geographically wide assessment (with the exception of the Mediterranean Countries which have not yet submitted their reports). However, the choice of this scale also leads in many cases to inadequate information. Clearly, the background paper will have to be improved later through the exploitation of more individual river basin district reports.

6 For more information, see the EEA website under the following link: [http://themes.eea.eu.int/Specific_media/water].

7 The JRC website provides further information [http://ies.jrc.cec.eu.int/Action_2153_-_AGRI-ENV.78.0.html].

2 Data uncertainties

The data on pressures and impacts of agricultural activities on water bodies given in this background paper are gathered from a wide range of different studies and investigations conducted at European level. Due to the different methodologies applied it is not feasible to draw a single comparison between the data and thus to deduce general conclusions from them. To clarify the data origin, the following paragraphs give a short overview of the methodological background and the related uncertainties and gaps, if applicable.

The project on the ***Fate of Agrochemicals in Terrestrial Ecosystems*** (FATE), carried out by the Soil and Waste Unit of the European Commission's Joint Research Centre (JRC), aims at developing a set of modelling tools relating nutrients pressures from various sources (e.g. agriculture, background losses) and water quality. The tools are developed to make best use of EU-wide available data taking into account the current environmental and socio-economic conditions. In a first step, the FATE project compiled a harmonised European wide database to estimate pressures from point and diffuse sources. However, data availability is up to now the main obstacle to the application of the modelling approach to the EU-15 (JRC, 2005).

In contrast, the project on s***ource apportionment of nitrogen and phosphorus inputs*** into the aquatic environment, commissioned by the European Environment Agency (EEA), aims at preparing a literature study by identifying investigations that had performed source apportionment for various catchments in Europe. In the source apportionment studies, there are differences in the number of sources covered (EEA, 2005a: 16). Some of these studies make a distinction between point sources and diffuse sources, while other studies address several different classes of sources such as background atmospheric deposition, urban wastewater treatment plants, industrial discharges and fish farms. The source apportionment approach generally includes the discharges and losses that reach surface waters. The agricultural contribution contains the losses into river systems and not the nutrient surplus at the topsoil level. Some approaches include estimates of the retention in the river system. Due to the focus on agricultural sources, this background paper has generally treated the agricultural contribution to the diffuse sources separately (when possible). In some cases, only the total diffuse loads as sum of background losses and agricultural contribution were available.

With regard to the review of the national synthesis of the ***Article 5 Reports for agricultural pressures***, the summary report prepared by the WRc (2005a) identifies some uncertainties and gaps in the data submitted by the Member States. Accordingly, the majority of the Member States have indicated a low level of confidence in their data. The fact that the Member States classified a significant proportion of surface water and groundwater bodies as potentially at risk can be seen as a sign for the potential uncertainties or gaps of the data. The reasons for these uncertainties are on the one hand the limited base of the review (analysis of national report and some roof reports) and the tight schedule for the analysis (first submission of the reports in March 2005). The national synthesis of the Article 5 review identified the following data uncertainties (WRc, 2005a: 21):

1. Lack of data for some key driving forces and pressures

- ***Point sources***: Some key data sets are not available, e.g. data from farmyard storage facility assessments.
- ***Diffuse sources***: Agricultural data are not available at the farm level. Prediction of nutrient loss from agriculture is being developed as well as a farm risk assessment procedure. Improved understanding of nutrient and silt losses from forestry on peat soil or

in acid sensitive catchments as well as an improved quantification of diffuse urban and road runoff is needed.

- ***Abstraction***: The number of unregulated water abstracting activities and their impacts is not known but might be significant in certain cases.
- ***Morphological pressures***: Data on morphological pressures are held in disparate organisations, some are incomplete or out of date and others had to be generated from base mapping or aerial photographs. The impacts of activities involving morphological changes including river drainage works is unknown.

2. Lack of data on impacts

- ***Monitoring data*** are not available for all water bodies, especially for some water categories such as coastal waters.
- Data on ***dangerous substances*** is lacking for some MS.

In addition, it should be mentioned that not all EU Member States submitted their Article 5 report to the European Commission (such as the Mediterranean countries)[8], and that the national review of the Article 5 reports does not include the data of those Member States which reported late. Therefore, the summary and conclusions that can derive from the national synthesis of the Article 5 reports concerning agricultural pressures on water bodies are limited in terms of general applicability. However, the further integration of the Article 5 reports (including those of the Mediterranean countries) at River Basin District level into the review report is likely to lead to a reduction of the uncertainties and the gaps. This is especially the case for the alterations of hydrologic regimes (e.g. abstraction for irrigation) and the hydro-morphological modifications caused by agricultural activities, and the resulting risk assessment for surface water bodies.

Furthermore, with regard to the ***IRENA project***, the EEA stated that the statistical information on irrigable area is generally more reliable than reported water abstraction rates for agriculture. Accordingly, the related indicator values need to be viewed with caution (EEA, 2005c).

In conclusion, regarding the data uncertainties, this synthesis gathers information from different sources to draw the clearest and the most consistent picture possible.

[8] The WFD Scoreboard of the Environment Directorate General provides an overview of the current status of Article 5 reporting (see http://europa.eu.int/comm/environment/water/water-framework/scoreboard.html). According to the scoreboard (status as of 22/08/2005), Greece, Italy, Portugal and Spain have not yet submitted their Article 5 reports.

3 Risk assessment according to the WFD

As part of a review of the impact of human activity on the status of surface and groundwaters (the pressures and impacts analysis), Article 5 and Annex II of the WFD require Member States to carry out an assessment of the risk that surface and groundwater bodies fail to meet the Directive's environmental objectives by 2015. The risk characterisation process defines the boundaries around 'good status' recognising the WFD's objective of protecting, enhancing and restoring all non-artificial surface and groundwater bodies with the aim of achieving good ecological status and good surface water chemical status by 22nd December 2015.

The following box summarises the general methodological framework for the pressures and impacts analysis including risk assessment, as provided in the Guidance Document developed under the CIS process (CIS Working Group 2, 2002).

Box 1: Risk assessment as part of the pressures & impacts analysis

Identifying driving forces and pressures: In addition to a general description of the water body, the information on driving forces that may be exerting pressures on water bodies has to be collected and maintained and must document on the type and magnitude of these pressures in terms of anthropogenic significance. These are categorised in broad sets of pressures: (i) point sources of pollution, (ii) diffuse sources of pollution, (iii) effects of modifying the flow regime through abstraction or regulation, and (iv) morphological alterations for surface water and (v) changes in water levels and flow caused by abstraction or recharge for groundwater. In addition, there is a requirement to consider land use patterns (e.g. urban, industrial, agricultural, forestry etc.) as these may be useful to indicate areas in which specific pressures may be located.

Assessing the impacts: Assessing the impacts on a water body requires some quantitative information to describe the state of the water body itself, and/or the pressures acting on it. The type of analysis depends on the data available. Regardless of the particular process to be adopted, and as with the identification of significant pressures described above, the assessment requires a conceptual understanding of what causes impacts.

Evaluating the likelihood of failing to meet the objectives (risk assessment): Evaluating the risk of failing to meet the WFD objectives in 2015 should be theoretically a straightforward comparison of the state of the water body with threshold values that define the objective. At present, the threshold values are defined for protected areas and dangerous substances (Council Directive 76/464/EEC). However, these values are not yet known for other aspects of the water body status.

Although the Guidance Document provides a general methodological framework for the risk assessment, the applied methodologies vary between the individual Member States. Therefore, the data of the WFD Article 5 reports need to be evaluated in the context of the methodological approaches used.

The following sections summarise the results of the risk assessment related to agricultural pressures on surface and groundwater bodies derived from the review of the national synthesis of the submitted WFD Article 5 reports.

3.1 Surface water bodies

According to the national synthesis of the Article 5 reports submitted by the EU Member States, ***morphology*** seems to be a key factor for failing to achieve the WFD environmental objectives, due to dams for flood protection and shipping. In some cases, flood protection measures related to gaining and protecting agricultural land (not quantified) are the main reason (WRc, 2005a: 11).

A secondary impeding factor is ***nutrient inputs*** where ***diffuse sources*** are predominant. Agriculture (and in some regions forestry) is generally reported as the predominant source of such inputs. For lakes and coastal waters, nutrient inputs from diffuse sources is the predominant pressure and reason for being at risk (see Table 1).

Table 1: Surface water bodies at risk from agriculture

MS level	Quantity	Quality	Morphology [b)]
Austria	None [a)]	No information [a)], but nutrient input an important factor, with nitrogen compounds more significant than phosphorus compounds, and 35 % nitrogen (N) and 30 % phosphorus (P) of total input derived from agriculture.	Predominant factor: 62 % Definitely at risk: 42 % Uncertain: 20%
Denmark	None [a)]	***For lakes***: Diffuse P-losses from agriculture is a major reason for non compliance of almost all lakes. ***For coastal waters***: Diffuse N and P losses from agriculture is a major reason for non compliance for almost all coastal waters.	***For rivers:*** 50 % are impacted due to channelisation to improve agricultural drainage
France	Can be regionally important (Adour-Garonne RBD)	Pesticides and nutrients inputs are one of the main factors of risks.	Primary reason for failure the WFD objectives (except lakes and coastal waters)
Germany	None [a)]	No information [a)], but nutrient input is likely to be relatively high, since diffuse sources from agriculture were listed as the second major cause of failing to achieve 'good status'	
Hungary	No sectorial distinction	None [a)], since the use of fertilisers and chemicals and animal keeping has fallen to excessively low level, which means that there is no significant pressure from agricultural sector.	
Ireland	Not assessed	No information [a)], but eutrophication is the most important problem affecting the quality of surface waters. Diffuse agricultural sources are one of the main causes for eutrophication, together with population not connected to sewers.	At risk: 25-79 % *For transitional waters*: 31 %
Latvia	No information [a)]	No information [a)]	Definitively at risk: 21 % Potentially at risk: 30 %
Lithuania	No information [a)]	No information [a)]	At risk: 2 %
Sweden [c)]	No information [a)]	*For coastal waters:* At risk: 0-38 % Possibly at risk: 58-88 % Not at risk: 0-41 % Unclassified: 0-19 % Variation across RBDs with a very small proportion of coastal water bodies being at risk in the northern part of Sweden	No information [a)]

MS level	**Quantity**	**Quality**	**Morphology** b)
UK, England & Wales *)	At risk / probably at risk from abstraction and flow regulation pressures *For rivers*: 11 % *For lakes*: 2 % *For transitional waters*: 14 %	At risk / probably at risk from diffuse pollution *For rivers*: 82 % *For lakes*: 53 % *For transitional waters*: 25 % *For coastal waters*: 24 %	At risk / probably at risk *For rivers*: 48 % *For lakes*: 59 % *For transitional waters*: 89,7 % *For coastal waters*: 77,8 %
UK, Scotland **)	At risk / probably at risk from abstraction and flow regulation: *For rivers*: 24.6 % *For lakes*: 36.9 % *For transitional waters*: 2.5 %	At risk / probably at risk from diffuse pollution: *For river*: 24.3 % *For lakes*: 18.4 % *For transitional waters*: 45 % *For coastal waters*: 13.1 %	At risk / probably at risk: *For rivers*: 33.3 % *For lakes*: 38.3 % *For transitional waters*: 40 % *For coastal waters*: 9.6 %
UK, Northern Ireland	At risk / probably at risk from abstraction: *For rivers*: 13 % *For lakes*: 33 % *For transitional waters*: 14%	At risk / probably at risk from diffuse pollution: *For rivers*: 94.4 % *For lakes*: 83.4 % (mainly from agriculture and forestry) *For transitional waters*: 100 % *For coastal waters*: 55 %	At risk / probably at risk: *For rivers*: 69 % *For lakes*: 62 % *For transitional waters*: 100 % *For coastal waters*: 80 %
RBD level	**Quantity**	**Quality**	**Morphology** a)
Danube roof report	None a)	Lower Danube Region and the Danube delta are at risk from nutrient pollutions- Shared responsibilities of waste water and nutrient inputs from agricultural sources	No information a)
Loire basin	No information a)	Nutrient inputs, organic matter and pesticides belong to the main factors impeding the achievement of a 'good status'.	No information a)
Garonne basin	Abstraction constitutes one of the main pressures	Besides abstraction, pesticides and nitrates constitute the main pressures.	No information a)
Meuse roof report	None a)	For agriculture, no separate estimation was provided, but agriculture is one of the main driving forces: classical pollutants (CZV, N and P), specific pesticides, etc. are within the main determinants for 'at risk' classification for surface water.	No information a)
Mosel-Saar report	None a)	Nutrients inputs are one of the main factors of risk. 90 % of nitrogen pollution in Koblenz (where the Mosel meets the Rhine) are coming from diffuse pollutions.	No information a)
Odra basin	No information a)	***DE***: impacts of diffuse sources cause high nutrient load of surface waters, high agricultural land use in the river basin ***CZ***: agriculture (azote) has an important impact on surface waters ***PL***: agricultural use has a significant impact on surface waters.	No information a)

Notes: a) "No information" means that the Article 5 report does not specifically refer to agriculture as being the pressure behind the impact; "none" means that no significant pressure from the agricultural sector was reported in the Article 5 report.
b) The results of the risk assessment for morphology refer to the overall pressures on surface water bodies (and not only to the agriculture pressures).
c) The risk assessment only based on pressures from nutrients, while pesticide use is not included nor the other pressures from agriculture such as morphology or abstraction.

Source: WRc, 2005a: 16; WRc, 2005d; additional information from WRc; *) EA, 2005; **) SEPA, 2005.

Nitrogen compounds are considered more important than phosphorus compounds in terms of nutrient inputs. Hazardous substances (e.g. ***pesticides***) are also referred to as important diffuse pollutants, but measuring their impact still poses some difficulties due to lacks of tools and the diversity of substances that need to be followed. Diffuse inputs of sediments are also reported by some Member States as contributing to the risk of failing (WRc, 2005a:13).

For the countries studied, with some regional exceptions for France, abstraction in general and including ***abstraction*** for agriculture is not a significant factor contributing to the potential failure to achieve the WFD objectives. However, the representatively of this overview is limited, because districts with a traditional farming based on irrigation (such as in the Mediterranean countries) are not included. This picture will have to be completed when the data regarding the Mediterranean Countries is available (no analysis made at this stage due to late or absent submission).

3.2 Groundwater bodies

For groundwater bodies (GWB), the most frequently reported reason for anticipated failures is ***diffuse pollution*** (mainly ***nutrients***). These problems are attributed to diffuse sources, predominantly from agriculture (see Table 2). Minor local contributions include diffuse sources from urban areas or mines (WRc, 2005a: 18). The predominant cause of failure is high nitrate loads. In addition, problems with ***pesticides***[9], especially atrazine, and to a lesser extent chlorinated solvents, exist. Furthermore, due to the long-term nature of groundwater contamination, some water bodies still show an increasing trend in these substances, although some have been banned (WRc, 2005a: 18).

With regard to pesticides, it should be mentioned that atrazine forms part of the list of priority hazardous substance according to the Decision No 2455/2001 (established as Annex X of the WFD).[10] In addition, the future daughter directive on groundwater against pollution might refer to active substances in pesticides including their relevant metabolites, degradation and reaction products to define quality standard.

In general, diffuse pollution of groundwater is a difficult issue: The time period between a decrease of pressure and a decrease in groundwater contamination can be very long, and this increases the risk of failure to achieve good status of water bodies in 2015.

Abstraction puts only a very low percentage of GWB at risk in quantitative terms (see Table 2). The exceptions are the RBDs Meuse and Elbe where about 6% and 8% of GW bodies, respectively, are at risk from over-abstraction, but this is due to successive lowering of the water table as a result of open-cast brown coal mining (WRc, 2005a: 18). However, as for the surface water bodies, this quantitative picture may change when the Mediterranean Countries reports are assessed.

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[9] In some river basin districts, pesticide pressures have become one of the main agricultural issues that needs to be addressed.

[10] This priority substance is subject to a review for identification as possible "priority hazardous substance". The Commission plans to make a proposal to the European Parliament and Council for its final classification not later than 12 months after adoption of this list (cf. http://www.europa.eu.int/comm/environment/water/water-framework/priority_substances.htm).

Table 2: Groundwater bodies at risk especially from agriculture

MS level	Quantity	Quality
Austria	None a)	At risk: 5.9 % (predominantly due to agriculture)
Denmark	No information a)	16 % of the intakes above 50 mg NO_3/l 1 % of the water supply aquifers above 50 mg NO_3/l
France	Can be regionally important (Rhône and Adour-Garonne RBDs)	Pesticides and nitrates are the main risk factors
Germany	At risk: 5 % (no indication of contribution from agriculture)	At risk due to diffuse sources: ca. 85 % (mainly nutrients and pesticides from agricultural activities)
Hungary	No information a)	No information a)
Ireland b)	No information a)	Potentially at risk from diffuse pollution: 29 % (across RBD: 2% and 58%)
Sweden	At risk: 87 % (across RBD: at risk: 2-24 %, potentially at risk: 58-75 %)	No information a)
United Kingdom	At risk: 21 % (across RBD: 4-50 %) (no indication of contribution from agriculture)	At risk from diffuse pollution: 68 % (across RBD: 19-91 %) (no indication of contribution from agriculture)
UK, England & Wales	At risk from abstraction by the agricultural sector: 20 % (across RBD: 16-33%)	At risk from nitrogen diffuse pollution: 38 % (across RBD: 19-100 %) At risk from phosphorus diffuse pollution: 12 % (across RBD: 6-16 %) At risk from total pesticides diffuse pollution: 14 % (across RBD: 4-23 %)
UK, Scotland)**	At risk from abstraction: 0.4 %	At risk from diffuse pollution: 19.8 %
UK, Northern Ireland	None a)	At risk from diffuse pollution:19.4 %
RBD level	**Quantity**	**Quality**
Danube roof report	None a)	Intensive agriculture and inadequate waste and sewage treatment are quoted as a major threat to the quality of the groundwater
Meuse roof report	At risk: 6.4 % (no indication of contribution from agriculture)	At risk from diffuse pollutions: 61 % (mainly from nitrates and pesticides coming from agriculture).
Mosel-Saar report	No information a)	Pesticides and nitrates are the main risk factors
Odra basin	No information a)	*DE*: agricultural use covers 51 % of total land use of the area and has important impacts on groundwater (25 % of total impacts on groundwater from agriculture). *CZ*: agricultural use (azote, pesticides, atrazin) have a relevant impact on groundwater. *PL*: agriculture has an important impact on groundwater, as 50 % of total impacts of groundwater by nitrates come from agriculture.

Note: a) “No information” means that the Article 5 report does not specifically refer to agriculture as being the pressure behind the impact; “none” means that no significant pressure from the agricultural sector was reported in the Article 5 report.
b) Major pressure but no quantitative information. Deficiencies in livestock waste management and poor siting of on-site wastewater treatment systems such as septic tanks are the main sources for the unacceptable level of contamination of some groundwater bodies.

Source. WRc, 2005a: 20; WRC, 2005d; additional information from WRc; **) SEPA, 2005.

As already mentioned in chapter 2, several Member States reported a low level of confidence in their data and a need to improve data sets and develop better monitoring of groundwater bodies (WRc, 2005a: 18). Accordingly, the results of the risk assessment for groundwater bodies will need to be refined in the next implementation phase (2005-2007) when the WFD requires the full assessment of the data.

The programmes of measure should be based on the risk assessment (water bodies at risk to fail the WFD environmental objectives), but the individual measure have to target the pressures. Therefore detailed information on the driving forces and pressures are needed. As at the current state, no general picture on the individual pressures from the national synthesis of the Article 5 reports can be drawn, since the data on agricultural pressures are limited in terms of quality and quantity. However, the data reviewed so far show that agriculture significantly contributes to the risk of failing to meet the WFD environmental objectives (for the methodological relationship between pressures and risk assessment, cf. Box 1). The risk assessed varies between different Member States (and across River Basin Districts). From an agricultural perspective, diffuse pollution with nutrients and hydro-morphological modifications seems to be the main driving forces and pressures on water bodies leading to a potentially significant risk of failing to meet the WFD objectives. Pesticides pollution, alterations of the hydraulic regimes and soil erosion are further important pressures caused by agriculture. The following chapter gives an overview of the intensity of these pressures and the related impact by summarising data from various sources.

4 Challenges to WFD objectives specifically from an agricultural perspective

For centuries, agriculture has played a central role in Europe's environment, shaping and influencing it in numerous ways. As European agriculture is extremely diverse, ranging from large, highly intensive and specialised commercial holdings to subsistence and semi-subsistence farming using mainly traditional practices, the impacts on the environment vary in scale and intensity and can be either positive or negative.

This chapter analyses the main negative impacts that can be exerted by agricultural activities on water bodies which this background paper identified and categorised the as follows:

- Pollution,
- Alterations of hydrologic regimes,
- Hydro-morphological modification, and
- Soil erosion[11].

In order to develop appropriate measures under the Common Agriculture Policy (CAP) and the Water Framework Directive (WFD), it is necessary to understand the main challenges resulting from agriculture as well as the main future developments.

4.1 Pollution

Pollution from different agricultural sources represents one of the key impacts on water bodies. However, the impacts of water pollutants on the environment clearly depend on the quantity of pollutants discharged and on their physiochemical characteristics. A distinction can be made between (i) ***point sources*** of pollution such as such as industrial discharges or spillage of the contents of a farm slurry store into a river, and (ii) ***diffuse (non-point) sources*** including background losses (natural land, e.g. forest), losses from agriculture and from scattered dwelling and atmospheric deposition on water bodies. Pollution from point sources is often easier to treat, while polluting emissions from diffuse sources are difficult to measure and to control. The following box gives an overview of the main diffuse pollutants from agricultural activities.

Box 2: The main diffuse pollutants from agriculture

Fertilisers (mainly nitrate and phosphate, in mineral or organic form) escape from agricultural fields through runoff, drainage, or attachment to eroded soil particles. In many countries, ***nitrate*** pollution is caused mainly by agriculture. Unless fertilisers and manure are absorbed by crops or are removed during harvesting, excess nitrate can be washed into groundwater and surface water bodies. The amounts lost depend on the soil type and organic matter content, the climate, slope of the land and depth to groundwater, as well as on the amount and type of fertiliser in regard to previous yield and contribution period, and irrigation used.[12] Thus, it is difficult to establish a link between nitrogen supply and water pollution. Nitrates damage the environment, contributing to eutrophication in coastal and marine waters and pollution of drinking water, especially where groundwater has become contaminated.

[11] Soil erosion is mainly a pressure that results in negative soil quality, but it also has a strong linkage to water resources. Soil erosion contributes to the discharge of both nutrients and sediments into waters.

[12] The use of fertilisers varies between countries, depending on the economic situation and predominant agricultural practices.

Phosphorus as an essential element for plant growth is supplied to agricultural land by broadcasting mineral fertilisers and organic fertilisers (mostly animal manure and, to a lesser extent, compost and sludge). Since phosphorus is not very mobile in the soil solution, most soils contain too small quantities that are readily available for plants. Soluble phosphorus can move off-site with run-off water during heavy rainfall, particularly from livestock confinement areas and grazing lands. It can be transported into surface waters together with soil particles and organic matter during erosion processes. Phosphorus is the main cause of eutrophication and of water quality deterioration for closed water resources and in a lesser extent for running waters and coastal waters. Even a minimal phosphorus content (some tens of µg/l) can pose environmental and health problems because of eutrophication and micro-algae development respectively.[13]

Pesticides: Agriculture is a major user of pesticides. Pesticides contain one or more biologically active substance with a controlling effect on crop pests, diseases or weeds. Pesticide use by farmers depends on a multitude of factors, such as climatic conditions, the succession and variety of crops, pest and disease pressures, farm incomes, pesticide cost/crop price ratios, pesticide policies and management practices (OECD, 2005: 17). Agricultural pressures due to pesticides are less well-known than nitrate pressures because of insufficient follow-up tools and data on the multiple types of pesticides.[14] Pesticides are often also harmful to non-target organisms, and their presence in food can have a negative influence on both human and animal health. Therefore, in many countries, pesticides have been subjected to strict authorisation procedures for placing on the market, stringent use requirements and severe control measures for a long time already.[15] Nevertheless, pesticides cause surface as well as groundwater quality problems in many European countries.

Organic pollutants and pathogens: There is increasing concern related to the release of microbiological pathogens and organic pollutants from agricultural activities (e.g. from animal manure, residues of veterinary preparations) into waters, as they could pose a serious threat and represent an unknown long-term risk to human health. In many countries (especially in the new Member States, cf. Karaczun et al., 2003), the improper management of liquid manure causes serious risk for human health through the increasing number of *microbiological pathogens* (e.g. Giardia, Cryptosporidium) in soil and water (Karaczun and Indeka, 1999: 221). Furthermore, *organic pollutants* such as endocrine-disrupting compounds (EDCs) found in many pesticides still in use are capable of modulating or disrupting the endocrine system, which could result in adverse effects to growth, development, or reproduction. The exact concentrations of endocrine disrupting compounds in drinking water and thus the quantities consumed are currently unknown for all the European countries on the basis of the available information (European Commission, 2004).

Heavy metals: Some heavy metals (cadmium, copper, lead etc.) are essential trace elements for plants and animals. However, high concentrations can be toxic to plants, animals and humans. Agriculture and the related chemistry sector are a source of heavy metals: These (mostly Cd) are generally present in the ores used for P-fertiliser production, animal food (leading to their presence in manure), biocides (for instance for wood protection), and

13 According to the United Nations Economic Commission for Europe (UN-ECE) classification of surface water, water is considered fairly eutrophic as of 25 µg phosphorus per litre (UNEP, 2004: 23).

14 In Europe around 50,000 to 70,000 products with approximately 800 active ingredients are registered for use (EEA and UNEP, 1999). In terms of active ingredients, the overall amount of pesticides used in agriculture in the EU has decreased since the early 1990s (European Commission, DG Agriculture, n.y.).

15 In the EU, the placing on the market and use of plant protection products is ruled by Council Directive 91/414/EEC. Moreover, the EC Drinking Water Directive (98/83/EC) requires pesticide concentration in drinking water not to exceed 0.1 µg/l for a single pesticide and 0.5 µg/l for total pesticides.

pesticides. Their use increases the concentration of heavy metals in soils. Some minerals move easily from soil complex to underground water, and thus heavy metal pollution can travel over long distances.

Pursuant to Article 5 of the WFD, these pollutants are part of the review of the impact of human activity on the status of surface and groundwaters (cf. chapter 3). In the national synthesis of the submitted Article 5 Reports of the EU Member States, nutrients inputs and eutrophication in all categories of surface water are listed as the second most important pressure (WRc, 2005a: 8). The following table gives an overview of the nitrogen, phosphorus and pesticides loads to surface water from agricultural diffuse sources, as indicated by the Member States in their national synthesis of the Article 5 reports. The reports submitted so far include only a few data on pesticide loads (see also section 4.1.3), which makes it difficult to have a clear idea on the level of the pesticide pressure. They should be completed by the Member States within the next phase of the WFD implementation process. In addition, the new groundwater quality standards that are likely to be introduced by the future daughter directive on the protection of groundwater against pollution will have to be taken into account. The table does not include data on heavy metals, organic pollutants microbiological and pathogens due to the lack of information in the national syntheses of the Article 5 Reports.

Table 3: Share of nutrients and pesticide loads in surface water from agriculture

MS level	**Share of loads to surface water from agriculture (diffuse)**		
	Nitrogen	**Phosphate**	**Pesticides**
Austria (only Danube RBD)	35 %	30 %	Local problem
Denmark	76 %	27 %	No information *)
France	Some data are available at the RBD level (see below).	Some data are available at the RBD level (see below).	Some data are available at the RBD level (see below).
Germany	80 % (mainly agriculture)	70 %	Diffuse sources significant
Hungary	N_{tot}: 20,000 t/year	3000 t/year	No information *)
Ireland	75 %	36 %	No information *)
Latvia	74 %	72 %	No information *)
Lithuania	Across RBD: 1013-8117 t/year	Across RBD: 36-93 t/year	No information *)
Sweden	33 % (across RBD: 4.3-65.6 %)	25 % (across RBD: 4.5-52 %)	No information *)
United Kingdom	No information *)	No information *)	No information *)
RBD level	**Nitrogen**	**Phosphate**	**Pesticides**
Meuse roof report	70 %	37 % (phosphorus)	No information *)
Guadeloupe basin	No information *)	No information *)	More than 50 %
Loire basin	No information *)	No information *)	1-5 %
Rhine basin, Mosel-Saar part	Important pressures	Important pressures	60 %
Seine basin	No information *)	23 %	70 % of pesticides present in water are suspected to be from agriculture.

Note: *) “No information” means that the Article 5 report does not specifically refer to agriculture as being the pressure behind the impact; “none” means that no significant pressure from the agricultural sector was reported in the Article 5 report.

Source: WRc, 2005a: 9-11; additional information from the WRc.

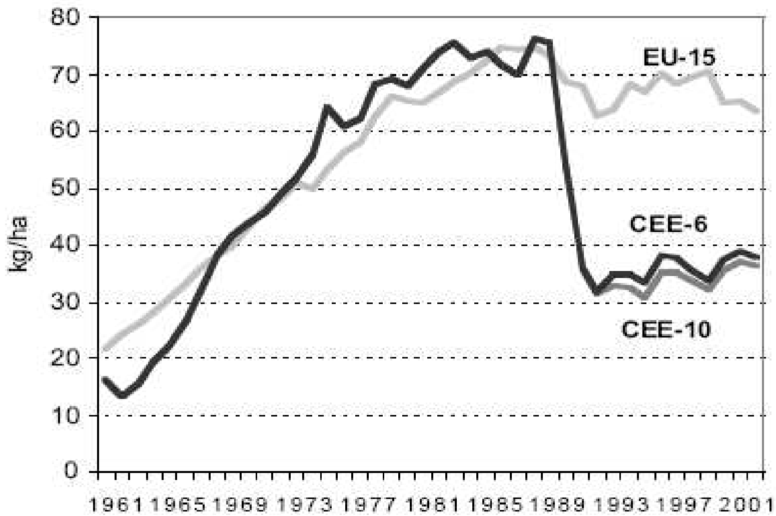
Although the data listed in Table 3 are of different quality, they show that many Member States reported significantly high share of nutrient loads in surface waters from agriculture. In addition, nitrogen compounds are considered more important than phosphorus compounds in terms of nutrients inputs from agriculture. However, phosphorus can also induce pressures from soil erosion. Indeed, phosphorus is mainly linked to particles of soil and can be transferred to aquatic environment in areas particularly concerned by risks of erosion. This phosphorus can accumulate in some stretches and causes their eutrophication (cf. section 4.4).

The following sections give a more detailed overview of the current available data of source apportionment of nitrogen, phosphorus and pesticides inputs into water in the EU.

4.1.1 Nitrogen pollution

Nitrates and ammonia are the most common forms of nitrogen in rivers, with nitrates alone accounting for more than 80 % of total nitrogen (Strosser et al., 1999).This section first provides data on the consumption of mineral nitrogen fertiliser in the EU-15 and Central and Eastern European (CEE) countries as well as in individual countries. It then analyses the relationship between fertilisers applied and the fraction of nitrogen emitted to the stream. Finally, it describes the nitrogen and specifically nitrate pressures caused by agricultural activities.

Until the 1980s, Central and Eastern Europe broadly followed the same trend of increasing chemical inputs as Western Europe. After the collapse of the communist regimes and a drastic reduction of agricultural subsidies, the use of agro-chemicals dropped sharply by more than 50% (see Figure 1 and Figure 9). In 2001-2002, the EU-15 applied on average 63 kg of nitrogenous fertiliser per hectare of farmland, whereas in the CEE countries the figure was 36 kg/ha (FAOSTAT database, 2004, in: FoE, 2004: 22).



Note: The CEE-6 countries include Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia. From 1992 onwards, data for all CEE-10 countries are available.

Figure 1: Nitrogenous fertiliser consumption in EU-15 and CEE countries (1961-2001)

Source: FAOSTAT database, 2004, in: FoE, 2004.

In 1980-2001, the trend of ***nitrogenous fertiliser*** consumption decreased in a number of countries such as Hungary, Italy, Poland and the Netherlands (Figure 15 in the Annex illustrates the estimated consumption in OECD member countries). In the EU, the highest amounts of fertilisers are consumed in France, Germany and Spain (OECD, 2005: 17). For example, in France, the consumption of nitrogenous fertilisers is stabilised around 2,300,000 tonnes. However, these data do not allow for any general statement concerning the likely pressure on water resources, since they are not expressed per hectare of land, and above all, since there is no automatic relationship between fertiliser consumption and the leaching of nutrient surpluses (as surpluses also depend on other parameters, such as the nature of the crops cultivated, their yields, the crop rotation system, the timing of fertiliser distribution, the type of mineral fertiliser used, the addition of nitrogen compounds from livestock manure, etc.).

Within the FATE research project[16], the JRC investigated the relation between nitrogen fertilisers applied (mineral and organic fertilisers) and the fraction emitted to the stream. The project results show that around 75 % to 97 % of the fertiliser is retained in the soil in the upland phase through crop uptake, soil storage, denitrification etc. Consequently, the predicted fraction of applied nitrogen fertiliser emitted to the streams range from 3 to more than 25 % (see Figure 2).

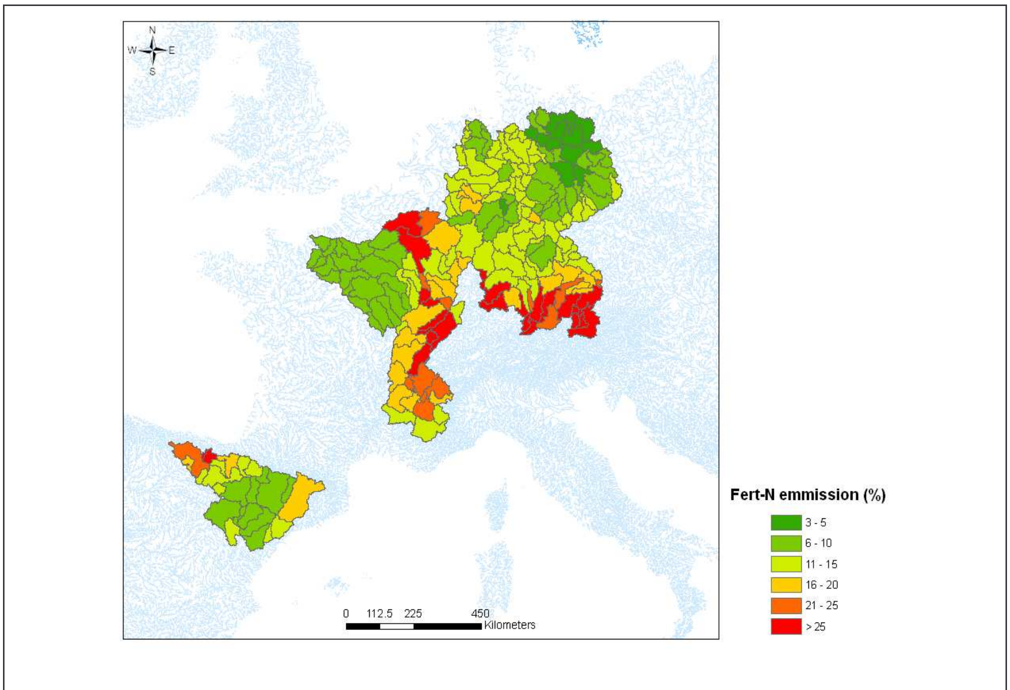


Figure 2: Fraction of applied nitrogenous fertilisers emitted to the stream

Source: JRC, 2005.

Although the nitrogen in water does not come only from agricultural sources, runoff from agricultural land is the main source of ***nitrogen*** pollution in most countries. Typically agriculture is responsible for 50 to 80 % of the total nitrogen load according to the EEA literature study on source apportionment (EEA, 2005a: 3). The nitrogen loading varies between different countries and catchments.[17] The total area-specific loading of nitrogen (kg N/ha per year), illustrated by the pie charts in Figure 3, increases generally in areas with high agricultural activities. For all countries and catchments examined in the EEA report, the

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[16] Aim of the project is to develop a set of modelling tools putting in relation nutrients pressures from various sources (e.g. agriculture, background losses) and water quality.

[17] It should be noted here that some data refer to country level, while others give the value for a whole river catchment.

losses from agricultural or diffuse sources (including agriculture and background losses) account for more than 60 % of the total area-specific load of nitrogen (EEA, 2005a: 4).

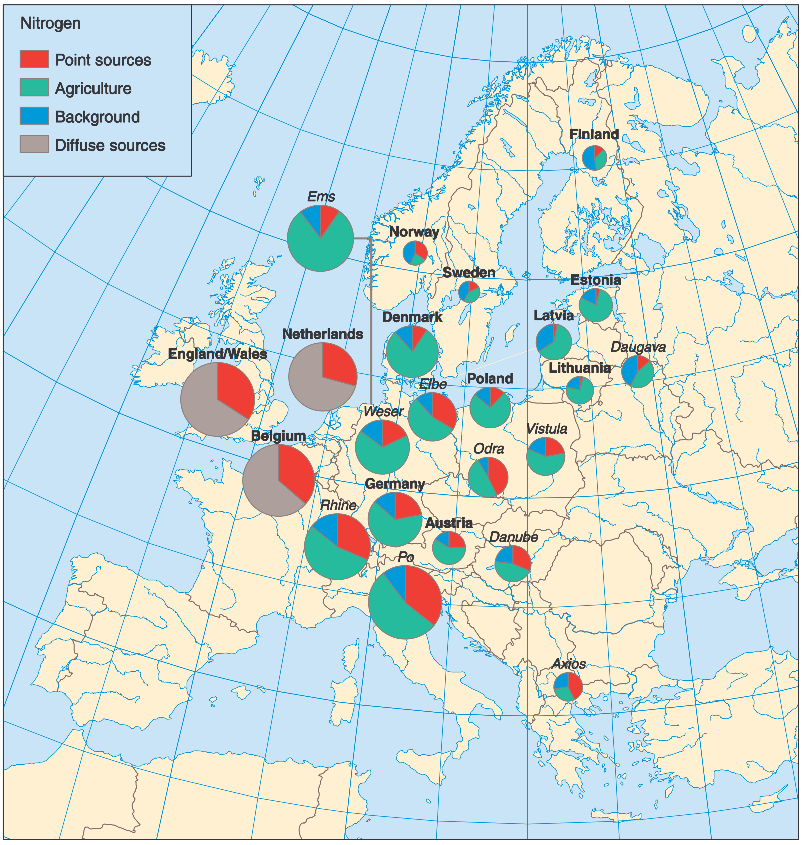

Figure 3: Source apportionment of nitrogen loading in selected regions and catchments

Note: The area of each pie indicates the total area-specific loading. The exact numbers of the area-specific load can be found in Table 5 in Annex.

Source: EEA, 2005a: 4.

The total area-specific load (kg N/ha per year) is higher in areas with increasing human activities and in particular with more intensive agriculture production (e.g. North Sea catchment), as illustrated in Figure 4.

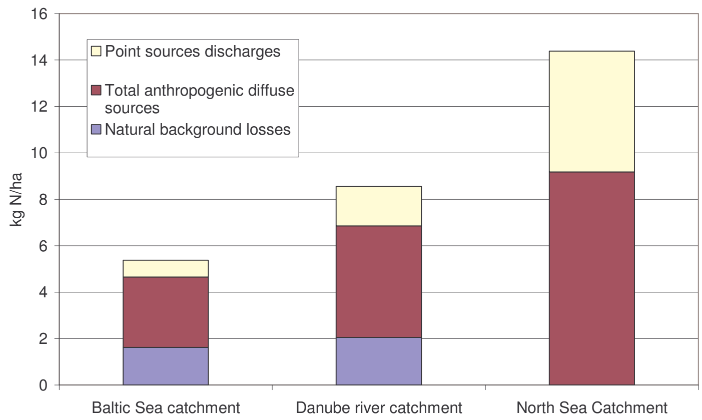

Figure 4: Source apportionment of nitrogen loading for the Baltic Sea, the Danube river and the North Sea catchment

Note: The catchments cover the following areas: 1.6 million km2 (Baltic Sea), 0.8 million km2 (North Sea), and 0.5 million km2 (Danube river). No separate information available on background losses for the North Sea.

Source: EEA, 2005a:3.

In addition, the FATE research project carried out source apportionment for various catchments in Europe for the year 1996 until 1999. The results of the project included the estimation that diffuse emission of ***nitrate*** ranged from less than 5 kg-N per hectare to close to 30 kg per hectare, with the lowest emission rates calculated for the Ebro and the Elbe and the highest calculated for the northern part of the Meuse and the Danube (German part, which forms 7.5 % of total watershed area). Concerning source apportionment, it was estimated that agriculture contributes close to 60 % of the total nitrate load in the Danube to about 65 % in the Elbe. For France, the agriculture contribution was calculated to be around 65 % for the Meuse to about 50 % for the Seine. In Spain it was estimated that agriculture contributes about 70% to the total measure nitrate load (JRC, 2005).

4.1.2 Phosphorus pollution

Besides discharges from urban wastewater and industry, agricultural activities contribute also to the phosphorus pollution of water bodies. This section summarises the results of an assessment of phosphorous pressures through a phosphorous balance. It then provides data on the application of phosphorus fertiliser and the related fraction emitted to the stream. Finally, it describes the phosphorous pressures caused by agricultural activities.

A study on phosphorus related problems in farm practices, commissioned by the Environment Directorate General of the European Commission, assessed phosphorous pressures through a ***phosphorous balance*** (Soil Service of Belgium, 2005). This balance considers the land, a farm or an entire region as a system characterised by an inflow (e.g. mineral fertiliser, livestock manure) and outflow of nutrients (crop production, forage production). The surplus in the balance for this nutrient (here: phosphorous) is a measure of the potential loss of this particular nutrient to the environment, or, in the case of a deficit, for the degree of 'nutrient mining'. The results of the assessment include data on the average total phosphorous input per hectare of agricultural land, the ratio between phosphorus input as manure and as mineral fertiliser as well as the resulting phosphorous surplus in the individual Member States of the EU-25 (for more detailed information, see Table 7 in the Annex). The efficiency of P-use and P-uptake seems to be very important. For instance Belgium and Italy have a similar balance surplus, while the average P-load in Belgium is twice as high as in Italy. In other words; P-uptake per hectare is much higher in Belgium than in Italy. This phenomenon can be explained by soil type, climate and level of intensification (Soil Service of Belgium, 2005).

The following figure shows the amount of ***phosphorus*** used per hectare in selected European MS in 2003. With the exception of Belgium, the Netherlands, Denmark and the United Kingdom, all countries consume less than 30 kg phosphorus per hectare arable land. With regard to the CEE countries, there are different levels of phosphorus applied per hectare of agricultural land: Lithuania and Latvia consume only around 5-10 kg P per hectare, while Poland and the Czech Republic still use about 20 and 15 kg P per hectare respectively (see Figure 5).

It should be noted that, as with statistics on total nitrogen fertiliser consumption, data on phosphate used per hectare of agricultural land do not allow for any general statement concerning the likely pressure on water resources, since there is not necessarily a relationship between fertiliser consumption, the amount of nutrient surpluses (which also depend on other parameters, such as the nature of the crops cultivated, their yields, the crop rotation system, the timing of fertiliser distribution, the addition of nitrogen compounds from livestock manure, etc.) and the final fraction leaching into water (which also depends on the nature of the soil).

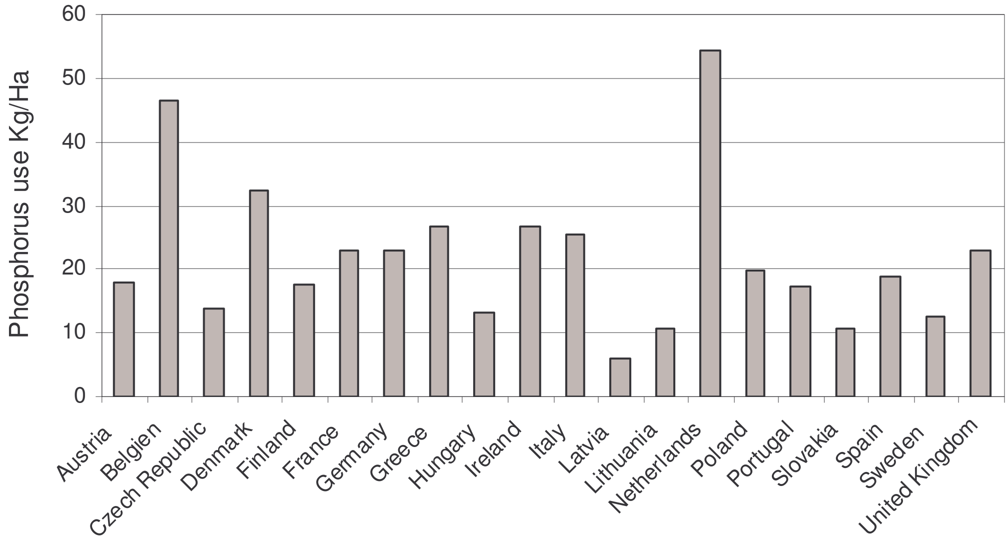

Figure 5: Phosphorus use in selected European countries (2003)

Source: Eurostat, IFA database, in : Soil Service of Belgium, 2005.

Within the FATE research project, the JRC investigated the relation between phosphorous fertilisers applied and the fraction emitted to the stream (JRC, 2005). The predicted fraction of applied ***phosphorus*** fertiliser emitted to the streams showed a high variability ranging from 0 to more than 6 % (see Figure 6) while 94 to 100 % are either stored in the soil in the upland phase or removed through crop uptake. (see P-balance above).

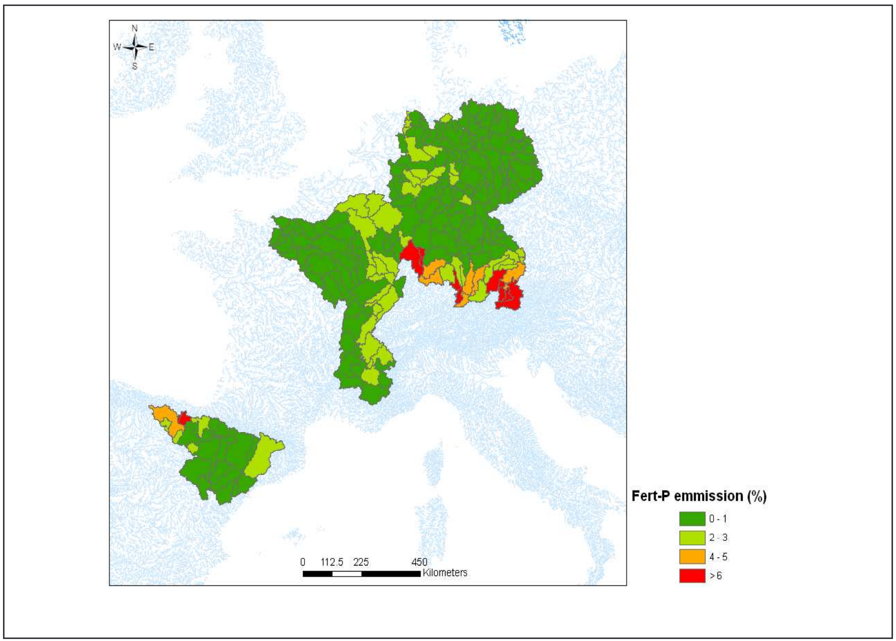

Figure 6: Fraction of applied phosphorous fertilisers emitted to the stream

Source: JRC, 2005.

Point sources such as domestic and industrial waste water still tend to be the most significant source of phosphorus. Nevertheless, agriculture is considered to have become in some cases the main source of (diffuse) ***phosphorus pollution***. The reason behind this development is the progressive, marked reduction in phosphorus emissions from other sources during the last 15 years due to increased wastewater treatment and the reduction of industrial discharges.

Similarly to nitrogen, the phosphorus loading differs between European countries and catchments.[18] According to the EEA literature study on source apportionment (EEA, 2005), the total area-specific loading of phosphorus (kg P/ha per year), illustrated by the pie charts in Figure 7, is highest in countries and catchments with high population density and high proportion of agricultural land.

However, the reason for high phosphorus loading from agriculture differs from region to region: In highly populated countries and catchments which have installed nutrient removal stages at the majority of their wastewater treatment plants such as Germany and the Ems and Weser catchments, runoff from agricultural sources generally accounts for more than 50 % of the total loading, resulting from the reduced percentage of phosphorus loading from point sources. In Poland and the Baltic states, however, the high phosphorus loading from agricultural sources (more than 63 % of total loading) may be due to excessive contribution in regard to crop needs, especially in intensive farming regions.

[18] It should be noted here that some data refer to country level, while others give the value for a whole river catchment.

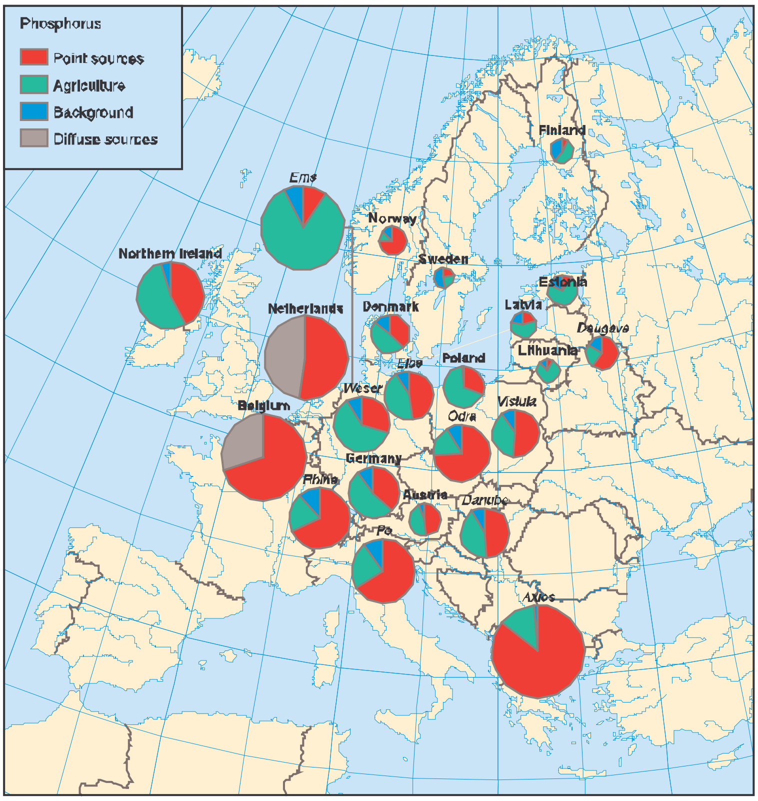

Figure 7: Source apportionment of phosphorus loading in selected regions and catchments

Note: The area of each pie indicates the total area-specific loading. The exact numbers of the area-specific load can be found in Table 6 in Annex.

Source: EEA, 2005a: 5.

In regions with a low population density and with a low percentage of agricultural land such as the Baltic Sea catchment, the phosphorus load amounts to only one third of the area-specific load of regions with a high population density such as the Danube and North Sea catchments (see Figure 8).

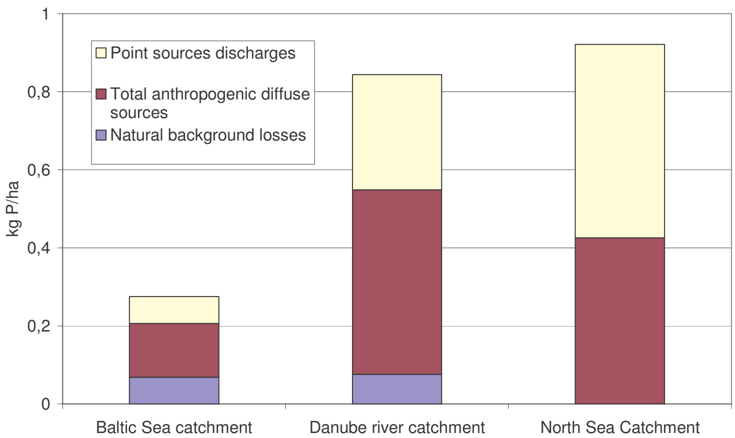

Figure 8: Source apportionment of annual phosphorus loading for the Baltic Sea, the Danube river and the North Sea catchment

Note: The catchments cover the following areas: 1.6 million km^2 (Baltic Sea), 0.8 million km^2 (North Sea), and 0.5 million km^2 (Danube river). No separate information available on background losses for the North Sea.

Source: EEA, 2005a:3.

In addition, the FATE research project performed source apportionment for various catchments in Europe for the year 1996 until 1999. One outcome of the project was the calculation that diffuse emissions from ***phosphorus*** ranged from less than 0.05 kg-P per hectare for the Elbe to close to 1.90 kg-P per hectare for the Danube (German part).

4.1.3 Pesticides

Agriculture is a major user of pesticides. Pesticides are present in surface waters and groundwaters at concentrations that, in certain cases, are of potential concern for drinking water and aquatic organisms. This is reflected in the fact that many countries reported pesticides (and metals) as being a problem for their supply of drinking water (EEA, 2003). Overall for Europe, there is limited information available on pesticides in both surface and groundwaters. The following section summarises the data available. The section provides first an overview of the consumption of active ingredients of pesticides in the EU-15 and the CEE countries as well as in individual countries. It then addresses the issue of risks of groundwater pollution by pesticides.

Generally, the use of ***active ingredients of pesticides*** is higher in western Europe than in Nordic or eastern Europe (see Figure 9). Between 2001 and 2002, in the EU-15 on average 2.3 kg of active ingredients of pesticides were applied per hectare of agricultural land, whereas in the CEE countries the figure was 0.6 kg per hectare (FAOSTAT database, 2004. in: FoE, 2004). It is important to note that the total consumption figures are dominated by sulphur and copper products as used in vineyards, orchards and on organic farms (European Commission, 2000).

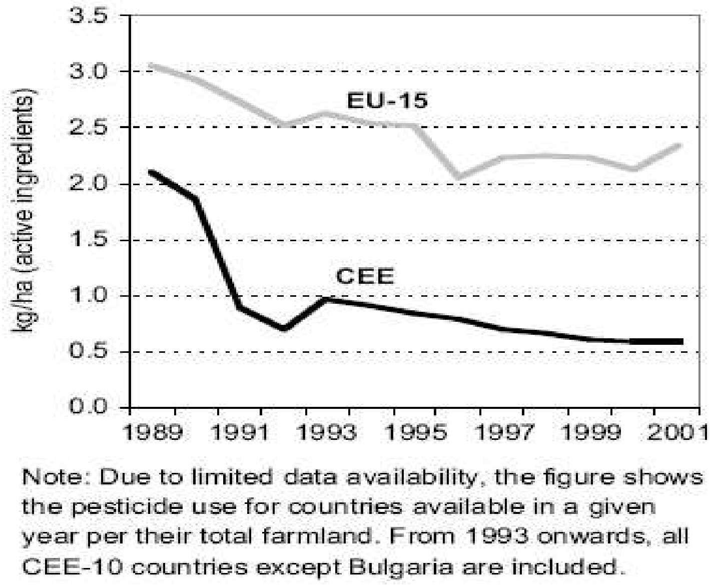

Figure 9: Pesticide consumption in EU-15 and CEE countries (1989-2001)

Source: FAOSTAT database, 2004, in: FoE, 2004.

Figure 9 shows that, in the CEE countries, the pesticide consumption dropped sharply by close to 70 % after the collapse of the communist regimes and a drastic reduction of agricultural subsidies. However, some CEE countries have recently seen a slight rise in the use of pesticides, but levels are still much lower than pre-economic transition. For example, in the *Czech Republic*, 4.302 tonnes of pesticide active ingredients were used in 2000, compared to 8.920 tonnes of active ingredients in 1990 (EEA, 2003).

A more detailed picture of the differences between the EU-15 Member States can be derived from Figure 10. The total amount of tonne of plant protection products sold per hectare of agricultural land is highest in the western European countries such as the *Netherlands*, *Belgium*, *France*, the *United Kingdom* and *Germany*.

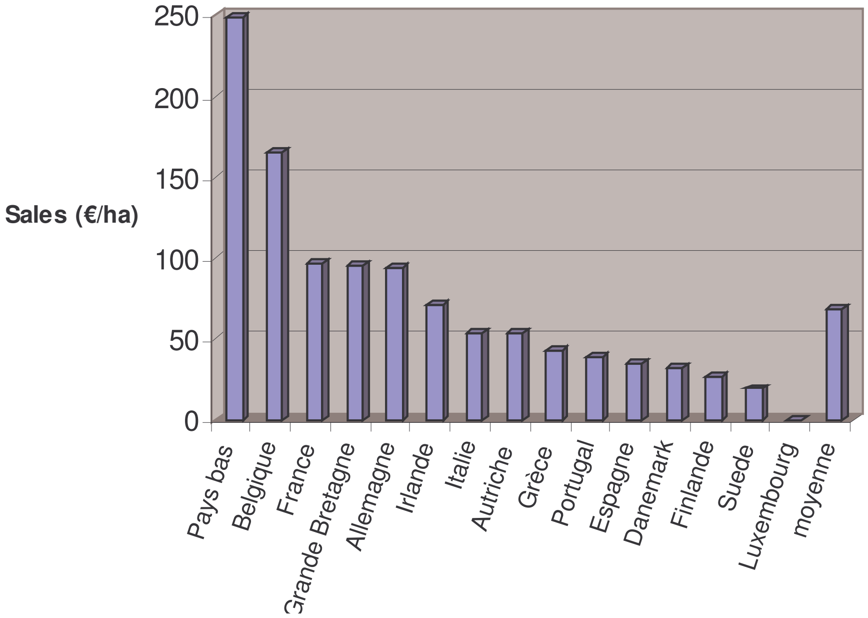

Figure 10: Sales of plant protection products per ha arable land / permanent crop (1999)

Source: Eurostat database, in: UIPP, 2002.

There are very large differences in the developments in different countries over this period. Figure 16 in the Annex illustrates percentage changes in the total number of tonnes of pesticides used (not weighed per hectare arable land) in different OECD member countries between 1990-92 and 2000-02. As can be seen, pesticide use in Portugal almost doubled, while the number of tonnes of active ingredients applied was reduced by at least 40 % in *Denmark*, the *Netherlands* and *Hungary*. These differences could reflect differences in the development level of agriculture in terms of productivity (gain of productivity in *Greece*, *Spain*, *Turkey*, *Poland* during this period, difficulties of Hungarian agriculture) and in the use of pesticides, as well as an important policy to reduce the use of pesticides (e.g. *Denmark*). On average across all OECD countries, there was a small reduction (-1.1 %) in the amount of active ingredients of pesticides being used.

When evaluating these developments, one should take into consideration that the toxicity of different active ingredients varies greatly, and that a number of low-dose pesticides have come on the market over the last decade. Greater use of low-dose pesticides tends to reduce the number of tonnes of active ingredients, without necessarily reducing the related environmental risks (OECD, 2005: 17). In general, it should be born in mind that statistics concerning the total volume of pesticides sold or used are to be interpreted with caution, to the extent that they say little about the nature of the active substances concerned and, consequently, about the risks of negative impacts associated with their use. Indeed, an increase (or a reduction) in the total volumes of pesticides sold/used is not necessarily equivalent to an increase (or a reduction) in the risks associated with their use (European Commission, 2002: 10).

As regards ***pesticides***, the submitted national synthesis of the Article 5 reports of the Member States contained no detailed information other than that diffuse sources are more significant than point sources (WRc, 2005: 8). This makes it difficult to derive a clear idea on the level of the pesticide pressure from the national syntheses of the reports. Consequently, Article 5 reports reveal that further investigation is needed in order to harmonise the characterisation methods and better understand agricultural pressures due to pesticides.[19]

In general, there is limited information available and a lack of reliable data on pesticides in groundwater overall for Europe. However, the European Environmental Agency (2004) summarises data from national state of the environment (SoE) reports in the indicator fact sheet on pesticides in groundwater. From the data provided in Figure 11, it appears that Member States reported a risk of pesticide pollution in groundwater.

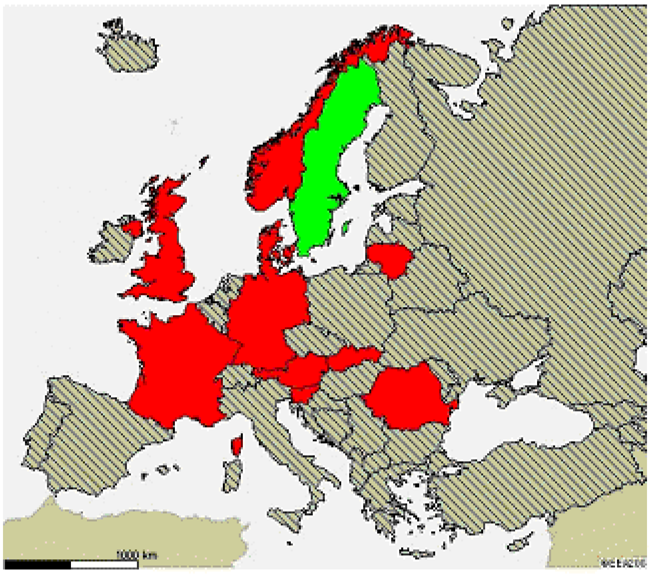

Figure 11: Risk of Groundwater pollution by pesticides

Legend: *red*: danger of pesticide pollution in GW reported by countries; *green*: no danger of pesticide pollution in GW reported by countries; *other*: no statements.

Source: WATERBASE data collected through EUROWATERNET, EEA, 2000; in EEA, 2004.

According to the EEA (2004), all countries that reported on the pesticide situation in their SoE reports but Sweden mention a danger of pesticide pollution of groundwater. In *Austria* between mid 1997 and mid 1999 about 15 % of sampling sites exceed 0.1 µg/l for desethylatrazine and 10 % for atrazine. Atrazine was banned in 1995 and the ban seems to be effective (EEA, 2004). In *France* over half of all monitoring sites (52 %) are considered to be unaffected. Excessive contamination is suspected at 35 % of sites and definitely present at 13 % of sites. However the available data covers only 75 % of France (EEA, 2004). In *Denmark*, in 2001, pesticides were found to be present in 27 % of the well screens and concentrations of pesticides in 8.5 % of the screens exceeded the limit value for drinking water (EEA, 2004). In the *UK* in 2000 about 9 % of the freshwater sites failed to meet the Environmental Quality Standards at least once (EEA, 2004). Even Sweden, which stated that pesticides do not cause problems in groundwater, reports on sometimes low but not insignificant concentrations of pesticides in groundwater (EEA, 2004).

[19] For instance, a first estimation of pesticide pressures in French river basins has been done by coupling crop localisation and frequency of phyto-sanitary treatments on each type of crop per year.

4.2 Alterations of hydrologic regimes

Agricultural activities such as irrigation, drainage and land reclamation can cause the disturbance of the natural water balance. The following box summarises the main alterations of hydrologic regimes caused by the agriculture.

Box 3: The main alterations of hydrologic regimes

Irrigation as part of intensive agriculture, including horticulture has often led to unsustainable use of water in some Member States. The agri-environmental impact of increasing water allocation rates result in a higher demand for water that can lead to declining groundwater levels or the need to build more and larger water reservoirs. In some instances major water diversion structures are necessary to supply water to irrigation schemes. The diversion or retention of water for irrigation can have serious downstream effects on the environment, especially the drying up of wetland areas. Furthermore, inappropriate irrigation results in an increase of the salinification of agricultural land. Problems arising from irrigation mainly occur in Southern Member States, and are often linked to specific crops, such as maize, fruit, and vegetables. Nevertheless, irrigation in agriculture also has some positive effects on the environment. Reservoirs created for irrigation can provide fresh water for birds and other fauna; terraces for growing wine can help slow-down run-off and reduce erosion; water-management for agricultural purposes can replenish the water-table and stabilise river levels. Finally, irrigation generally increases competition with other sectors for water resources, which leads to diverse effects. On the one hand, there is a risk that the water resources are overused, but on the other hand water becomes an important (and potentially expensive) resource resulting in an improved understanding of the need to protect it.

Agricultural drainage uses surface ditches or underground pipes to remove standing or excess water from poorly drained areas. Thus, agricultural drainage systems generally increase crop yields on poorly drained soils by providing a better environment for plants to grow, especially in wet years. Drainage can have a variety of impacts on hydrology and water quality, depending, among others, on the techniques used and the type of soil. The drained water can be carried to adjacent streams or rivers. Furthermore, the destruction of wetlands due to drainage can result in the loss of important water retention areas. Drainage can also have direct impacts on biodiversity, as it can cause floodplain disruptions and break the connection between water bodies, thus endangering the survival of, among other, certain fish species. Because of the removal of water from drained areas, runoff and high-flow peaks will increase as well as the risk of downstream floods which may lead to river channelisation. The groundwater table and renewal rate will then further decrease in the drained area/catchment (EEA, 1999). However, the actual impact of this phenomenon on water and solute transport has not yet been fully assessed or, especially, quantified. As regards water quality, subsurface drainage can reduce the loss of phosphorus and organic nitrogen but increase the loss of nitrates and other soluble constituents. Surface drainage however will usually increase phosphorus loss but reduce nitrate runoff.

Wetlands are also an important habitat for protected species and considered as an important habitat type under the EU Flora Fauna Habitats (FFH) Directive[20] as well as under the international Ramsar Convention. This Convention considers wetlands to be "*a resource of great economic, cultural, scientific, and recreational value, the loss of which would be irreparable*" (preamble). Contracting Parties must endeavour to promote the conservation of

[20] Annex I of the FFH Directive lists the "natural habitat types of community interest whose conservation requires the designation of special areas of conservation" and includes such types of wetlands as bogs, sandbanks and salt marshes.

wetlands and waterfowl by establishing nature reserves on wetlands (Art. 4). Originally meant to protect wetlands as a habitat for waterbirds, the convention broadened its scope over the years, to include "*the conservation and wise use of all wetlands through local, regional and national actions and international co-operation, as a contribution towards achieving sustainable development throughout the world*" (Ramsar Convention Secretariat, 2004).

The following sections provides more detailed data concerning water abstraction for irrigation and land drainage.

4.2.1 Water abstraction for irrigation

This section gives first an overview of the relative water consumption for agricultural activities, as reported by the Member States in the national syntheses of the Article 5 reports. It then summarises the results from the IRENA project on the regional water abstraction rates and the water use intensity.

The following table gives an overview of agricultural activities, the volume of water they use and the percentage of the total extracted water volume this represents, as indicated by the Member States in the national syntheses of the Article 5 reports submitted to the European Commission. However, the representativity of this overview is limited, as river basin districts from the Mediterranean region with a traditional farming based on irrigation are not included. In addition, it would be useful to link the relative water consumption for agricultural activities to the availability of the resource.

Table 4: Relative water consumption for agricultural activities

MS	List of agricultural activities	Volume of water used	Percentage of volume
Austria	Small proportion of agriculture land is irrigated (South and Southeast, only).	100 M m^3 per year	6 %
Denmark	Drainage and irrigation (especially in Jutland)	141 M m^3 per year (mainly groundwater)	22 %
France	Some data are available at the RBD level (see below).	Some data are available at the RBD level (see below).	Some data are available at the RBD level (see below).
Germany	No information	No information	No information
Hungary	Small proportion of agriculture land is irrigated (about 2%) Aquaculture: 68% of water used by agriculture Irrigation: 27% of water used by agriculture Animal husbandry and others: 5% of water used by agriculture	No information	Surface water: 11 % Groundwater: 9 %
Ireland	The key water using subsectors for agriculture in Ireland are: potatoes, cattle and cattle products, and sheep and sheep products.		
Latvia	No information	No information	No information
Lithuania	-	7 M m^3 per year	2 %
Sweden	Need for irrigation is low.	No information	1-4 % total 0.4-12.3 relative % of total volume extracted
UK, England & Wales	Need for irrigation vary across RBD	Across RBD: 6-50 M m^3 per year	
UK, Scotland	Need for irrigation is low. Need for high quality water for fish farming is high.	56.5 M m^3 per year 1582 M m^3 per year	
UK, Northern Ireland	No information	No information	No information

RBD	**List of agricultural activities**	**Volume of water used**	**Percentage of volume**
Garonne basin	645,000 ha are irrigated, especially for maize (70 %)	1 B m^3 per year	85 %
Loire basin	No information	473 M m³ per year	
Rhine basin, High Rhine part	No information	62-100 M m³ per year	1-3 %
Rhone basin	375,000 ha of land irrigated, especially for orchards and maize	No information	At least 10 % of groundwater abstracted
Schelde basin	No information	No information	4 %
Seine basin	140.00 ha are irrigated, mainly from groundwater sources Large cultivated surface areas, spring crops	95 M m³ per year (minimal estimation)	0,5 %

Note: *) "No information" means that the Article 5 report does not specifically refer to agriculture as being the pressure behind the impact; "none" means that no significant pressure from the agricultural sector was reported in the Article 5 report.

Source: WRc, 2005a: 6-7, WRc, 2005d, additional information from the WRc.

As already mentioned in chapter 2 on data uncertainties, there are significant gaps regarding the data of water consumption for agricultural purposes, especially due to the absence of the Article 5 reports from the Mediterranean Countries. In addition, with regard to the national syntheses of the Article 5 reports submitted so far, a number of unregulated activities of water abstraction and their impacts are not known but might be significant in certain cases (WRc, 2005: 21).

The role of irrigation differs between countries and regions because of climatic conditions. In Southern European countries, it is an essential element of agricultural production and irrigable area is irrigated the whole growing season and every year; in Central and Northern European countries, irrigation is generally used to improve production in dry summers.

The ***regional water abstraction rates*** for agriculture were estimated by weighing national reported water abstraction rates by regional irrigable area values. They provide an insight into which regions of a Member State have a high agricultural demand for water. The estimations are based on the assumption that water requirements for irrigation are abstracted from local water supplies, and thus resulting in regional pressures on water resources. In some cases however, large-scale water works include the transfer of water across large distances.[21] This means that the impacts are felt in other regions, which is not shown by this indicator (EEA, 2005c: 4).

[21] This was for example proposed in the Spanish National Hydrological Plan (SNPH), for further information, see, [http://www.mma.es/rec_hid/plan_hidro/plan_hidro_nacional_boe.pdf].

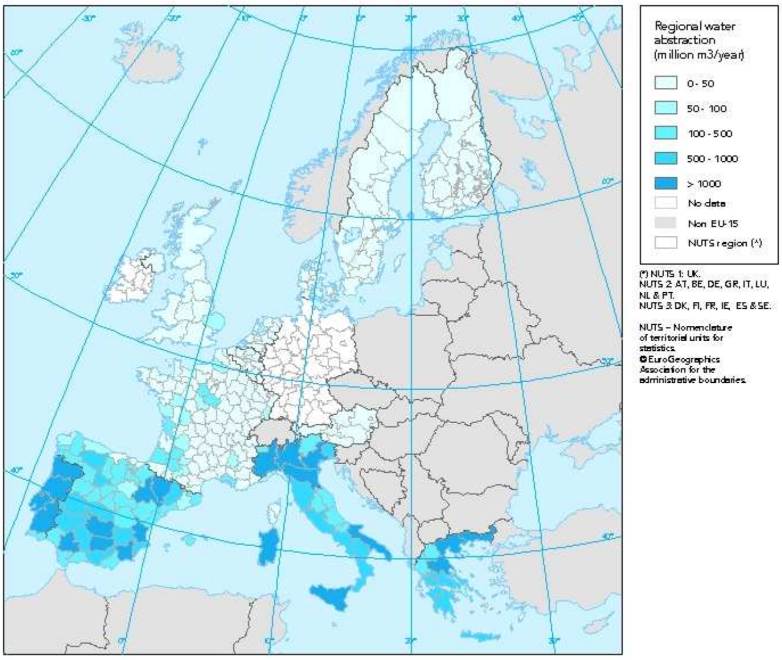

Figure 12: Regional water abstraction rates for agriculture (million m^3/year)

Source: Community Survey on the Structure of Agricultural Holdings (FSS), DG Eurostat combined with information from OECD/Eurostat questionnaire, in: EEA, 2005c: 4.

In northern Member States, 90 % of the regions are estimated to have abstraction rates between 0 and 50 m^3 per year, while in southern Member States the annual abstraction rates amount to 100 to 500 m^3/year in 40 % of the regions and to 0 to 50 m^3/year in 36 % (EEA, 2005c: 4; for more detailed information, see Table 8 in the Annex). Furthermore, the region of East Anglia appears as the highest consumer of water for agriculture in northern Member States, although the region has less than 35 % of the UK's irrigable area. The irrigation requirements should not be expected to exceed those of other irrigation regions in Northern France, Western France or Western Denmark. This suggests that the reported national water abstraction rates are underestimated in some Member States. Such an assessment can only be made if the demands for irrigation are close to exhausting the existing water resource capacity. However, the indicator of water abstraction does enable regions to be flagged up as being at potential risk for over-exploitation of water resources. In East Anglia, for example, there are problems reported for wetlands which could be attributed to water abstraction for agriculture (EEA, 2005c: 4).

With regard to the total area equipped for irrigation (***total irrigable area***) per utilised agricultural area (UAA), some areas may be facing unsustainable trends, especially in southern Europe where much improved efficiency of water use, especially in agriculture, is needed to prevent seasonal water shortages (EEA, 2005b: 5).

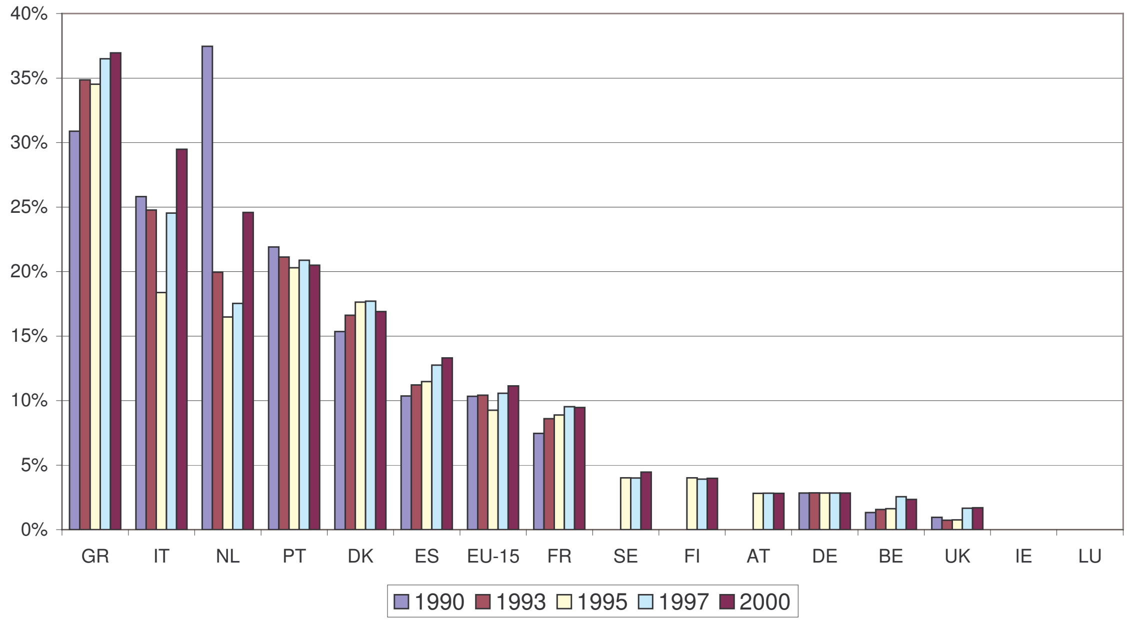

Figure 13: Total irrigable area per utilised agricultural area in % (1990-2000)

Note: All Member States regularly report farm structure survey (FSS) results to Eurostat in accordance with EU legislation. However, no FSS data are available concerning Germany. FAOSTAT data are used instead. For Austria, Finland and Sweden the change presented is not 1990-2000 but 1995-2000

Source: Community Survey on the Structure of Agricultural Holdings (FSS), DG Eurostat: 1990-2000 as reported by Member States (categories: I/03 (a), in: EEA, 2005b: 6.

As illustrated in Figure 13, the percentage of total irrigable area per UAA increased or remained stable between 1990-2000 in most Member States, except in the Netherlands and Portugal. The largest increase in irrigable area per UAA is observed in southern European countries such as *Greece*, *Italy* and *Spain*. In 2000, the utilised agricultural area that is irrigable varied from 1.7 % in the *United Kingdom* to 37.0 % in *Greece*.

4.2.2 Land drainage

For the European Union, data on land drainage for agricultural purposes are rather limited. According to the EEA (1999), in Austria and Denmark, land drainage, either for flood control or land reclamation, is probably the single most important measure which has adversely affected the landscape (loss of wetlands, small scale structures in the landscape), the biodiversity and the hydrological cycle.

Between 1980 and 1990 more than 37 % of wetlands of *Austria* have been destroyed. In *Denmark* it is estimated that about 49 % of the agricultural land has been drained, mainly in the 19th century. The main benefits of this intervention are reclaimed land for cultivation, increase agricultural production (economical benefits) and a reduction in the risk of floods (EEA, 1999). Nowadays in Austria the drainage of land is no longer supported by government and programmes to recover drained land and restore rivers, including riparian wetlands, have been started to re-establish their natural hydrological features. Thus it is expected, that land drainage will decrease (EEA, 1999).

4.3 Hydro-morphological modification

In the past, land drainage (cf. section 4.2.2), intensification of farming practices and inappropriate grazing regimes have contributed to the loss of wetlands and floodplains, resulting in hydro-morphological modification of surface waters. Such modifications aggravated major floods, such as the Rhine flood in January/February 1995, the Odra flood in summer 1997, in Southern Germany in spring 1999 and on the Elbe and its tributary rivers in August 2002. These floods also demonstrate that technical solutions alone, such as dykes, have a limited effect if they are not completed by alternative strategies such as "living with rivers" or "giving space to rivers" (Dworak and Hansen, 2003) .Such strategies have been applied in several European Member States. The future measures must recognise the role of agriculture in sustainable flood management, especially in terms of "non-structural measures" (Dworak and Hansen, 2003).

Across the EU Member States studied by the WRc in the review of national synthesis of the Article 5 reports for agricultural pressures, artificial morphological changes lead to significant pressure on surface water bodies (WRc, 2005: 8). In some cases, flood protection measures related to gaining and protecting agricultural land (not quantified) is the main reason (WRc, 2005: 11).

4.4 Soil erosion

In the Report of Working Group on Soil Erosion Task 5 under the European Union Soil Thematic Strategy it is clearly stated that soil erosion by water has implications for the quality of soils and their ability to perform important soil functions, in particular the ability to sustain agricultural and forestry production (European Commission, DG Environment, 2004). In addition, soil erosion and the delivery of contaminants to water (and air) influence the quality of surface waters, groundwaters (and air), and, in turn, freshwater ecosystems and human health. In this respect, soil erosion on land and the erosion of river banks have important implications for the ability of Member Countries to implement and comply with the Water Framework Directive.

Inappropriate agricultural practices are only one factor among many, though an important one, contributing to soil erosion by water in Europe. The Mediterranean regions, especially *Portugal*, *Greece* and *Spain*, are particularly affected by the problem, with 66 % of the rural area presenting at least a moderate potential risk of soil erosion by water. Western Europe enjoys bio-climatic conditions suited to help avoid major soil erosion. The removal of protective vegetative cover resulting from cultivation can however increase the potential erosion risk. In Belgium for instance, some 10 % of the agricultural land area is estimated to be susceptible to water erosion (Montanarella, n.d.). The following map shows which regions are mostly at risk from erosion.

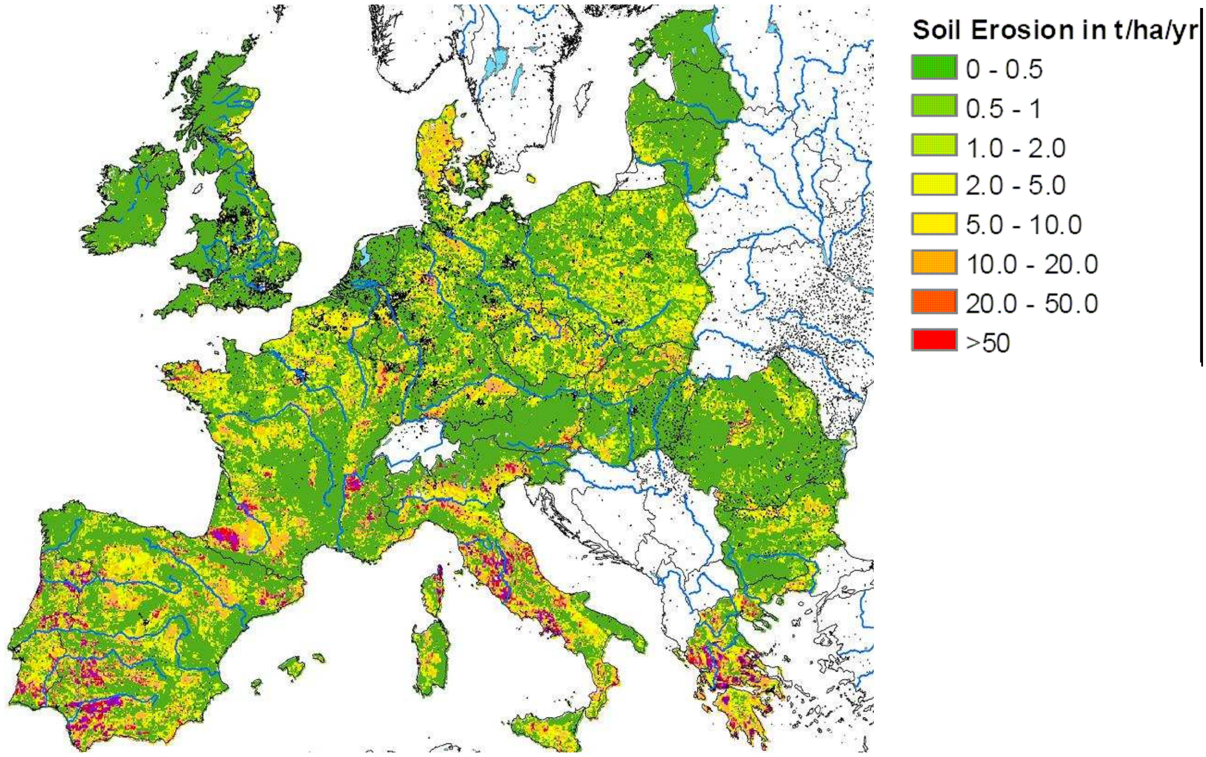

Figure 14: Soil erosion risk assessment in the EU-25

Source: JRC, 2003.

The national syntheses of the Article 5 reports submitted by Austria and Denmark give an exemplary relation between soil erosion and phosphorus input. In *Austria*, 52 % of total P inputs are derived through erosion (data for the Danube RBD of Austria, which comprises 96 % of Austria's surface area) (WRc, 2005b). In *Denmark*, erosion of farmland gives important loads of phosphorus contributing to the eutrophication of lakes and coastal waters and leads to depositions of sand and silt in rivers decreasing the possibilities for the natural fauna, including spawning possibilities for salmonides (WRc, 2005c: 5).

5 Lessons learned and key messages

The deadline for the first Article 5 report submission expired at the end of March 2005. However, not all EU Member States submitted their Article 5 reports to the European Commission, such as the Mediterranean Countries. Furthermore, the methodology applied by the EU Member States to assess the pressures and impacts on water bodies is not completely consistent (see chapter 2). In general, the methodological approach used varies between the different studies. Therefore, the summary and conclusions that can derive from the data regarding agricultural pressures on water bodies provided in the different studies are limited in terms of generalisation, as already mentioned in chapter 2 on data uncertainties. However, key messages on a general level of pressures can be identified.

Besides the industrial and household sectors, the agricultural sectors poses a significant pressure on both surface and groundwaters in terms of quality and quantity. For example, extensive abstraction of water for agricultural purposes, especially in the southern EU Member States, increases the risk of over-exploitation of the available water resources. In addition, hydro-morphological changes due to agricultural activities such as drainage and land reclamation pose significant pressures on surface water bodies. The possible negative impacts of some agricultural practices on water include not only environmental problems but also potential risks for both human health and life (floods, water and food contamination, etc.). The structure and scope of all these problems vary widely between the different regions in Europe but appear in many places. The long-term protection of water resources makes sense not only environmentally but also economically.

The agricultural sector has an additional strong incentive to reduce the pressures on water bodies, since clean water is essential for agricultural production.

Across much of the EU, tackling the pressures on water caused by agriculture constitutes one of the main challenges to achieve the WFD objectives, as shown in the data provided by a wide range of studies. Up to now however, most of the emphasis has been placed on reducing point source pollution, and the review of the national syntheses of the Article 5 Reports as well as the EEA and JRC investigations show that implementation measures are needed to address agricultural pressures, in particular for the reduction of diffuse pollution. With regard to quantity aspects, impacts of water abstraction by agriculture on WFD achievement can be also very important regionally.

These pressures need to be addressed by future measures for protecting the water quality and resources in order to meet the environmental objectives of the WFD. The CAP contains several tools, under both the 1st and 2nd pillar, which can contribute to the WFD objectives. Further tools have been introduced through the 2003 CAP reform, that makes an important step towards the integration of environmental concerns by including, *inter alia*, the following elements: (i) decoupling direct payments for EU farmers from the production, which is expected to further reduce incentives for intensive production and also make land-use change easier, (ii) making the full payment of the direct payments conditional on the respect of statutory environmental requirements and minimum standards of good agricultural and environmental condition (cross-compliance), (iii) introducing an obligatory modulation, with the progressive reduction of direct payments for all producers in receipt of more than € 5000 annually and the corresponding funding made available for financing rural development measures, and (vi) strengthening the rural development policy with new measures to promote the environment, and in particular with the new “meeting standard” measure.[22]

With the establishment of WFD, economic instruments play an increasing role in the field of sustainable water management. Indeed, the WFD contains several economic instruments to tackle pressures on water bodies, including the application of the polluter-pays-principle, the implementation of the cost recovery principle including environmental and resources costs as well as the selection of the most cost-efficient measures.

Since the precise impacts from agriculture vary widely according to the type of agriculture and territory, and are often very specific to the existing local conditions, the measures need to be tailored to these conditions. Climate change is likely to strengthen some agricultural pressures (increased risks of run-off and erosion, greater needs for water abstraction).

To reach the WFD objectives is not only a problem linked to agriculture itself but demands multidirectional activities and close co-operation between different sectors. Accordingly, there is a need to further strengthen the dialog with all sectors, and especially the exchange between the agricultural and water sectors. Stressing the linkage between the two policy area enables not only the development of appropriate measures for the reduction of agricultural pressures but also the achievement of win-win situations, where the desired level of agricultural production is attained (or maintained) in parallel to the desired level of water resources protection, both in terms of quantity and quality.

In order to start this process, it is important to discuss how the Common Agricultural Policy can contribute to the WFD objectives and provide guidance on how the authorities working on the WFD and the CAP can co-operate more closely. In addition, recommendations should be made on how work in co-operation with the farming community can achieve the desired results.

[22] Further tools are provided for by the Commission proposals concerning the next programming period (2007-2013) for Rural Development, which are currently under discussion at the Council. These include the new possibility, under Axis 2 (Improving the environment and the countryside), of granting specific annual payments to farmers in order to compensate for cost incurred and income foregone resulting from disadvantages in the areas concerned related to the implementation of the WFD.

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Annex

Table 5: Source apportionment of nitrogen in selected regions and catchments

Country / catchment	Area-specific nitrogen loading (kg N/ha per year)					Source
	Total diffuse	Background losses	Agriculture	Point sources	Sum	
Austria	-	1.14	4.29	1.72	7	Umweltbundesamt (AT) 2001
Belgium	21.75	-	-	12.38	34	OSPAR 2003
Denmark	-	2.05	14.02	1.65	18	Bøgestrand 2004
England/Wales	23.74	-	-	12.32	36	WRc 2004
Estonia	-	1.28	5.76	0.27	7	HELCOM 2004
Finland	-	2.07	1.36	0.53	4	Finlands miljöcentral 2005
Germany	-	2.61	12.43	4.24	19	Umweltbundesamt (DE) 2004
Latvia	-	2.84	5.27	0.24	8	HELCOM 2004
Lithuania	-	1.06	3.80	0.18	5	HELCOM 2004
Netherlands	21.75	-	-	9.02	31	OSPAR 2003
Norway	-	1.68	0.87	1.33	4	Selvik et al. 2004
Poland	-	1.51	8.04	1.33	11	HELCOM 2004
Sweden	-	1.25	1.22	0.54	3	SLU and SMHI
Axios	-	1.50	1.60	2.30	5	Behrendt, 2004
Danube	-	2.00	3.90	2.70	9	Behrendt, 2004
Daugava	-	2.90	3.00	0.90	7	Behrendt, 2004
Elbe	-	1.80	8.50	5.20	16	Behrendt, 2004
Ems	-	3.00	23.10	2.80	29	Behrendt, 2004
Odra	-	0.90	5.10	4.50	11	Behrendt, 2004
Po	-	3.70	19.20	12.70	36	Behrendt, 2004
Rhine	-	4.10	15.60	9.00	29	Behrendt, 2004
Vistula	-	1.80	5.70	2.10	10	Behrendt, 2004
Weser	-	2.90	13.00	3.50	19	Behrendt, 2004

Source: EEA, 2005a.

Table 6: Source apportionment of phosphorus in selected regions and catchments

Country / catchment	Area-specific phosphorus loading (kg P/ha per year)					
	Total Diffuse	Background losses	Agriculture	Point sources	Sum	Source
Austria	-	0.025	0.161	0.172	0.4	Umweltbundesamt (AT) 2001
Belgium	0.760	-	-	1.750	2.5	OSPAR 2003
Denmark	-	0.077	0.252	0.194	0.5	Bøgestrand 2004
Estonia	-	0.057	0.215	0.031	0.3	HELCOM 2004
Finland	-	0.080	0.098	0.018	0.2	Finlands miljöcentral 2005
Germany	-	0.101	0.480	0.348	0.9	Umweltbundesamt (DE) 2004
Latvia	-	0.052	0.131	0.043	0.2	HELCOM 2004
Lithuania	-	0.026	0.152	0.013	0.2	HELCOM 2004
Netherlands	1.130	-	-	1.250	2.4	OSPAR 2003
Northern Ireland	-	0.062	0.831	0.647	1.5	Smith et al. 2004
Norway	-	0.039	0.026	0.203	0.3	Selvik et al. 2004
Poland	-	0.010	0.380	0.175	0.6	HELCOM 2004
Sweden	-	0.080	0.036	0.034	0.1	SLU and SMHI
Axios	-	0.048	0.373	2.484	2.9	Behrendt, 2004
Danube	-	0.073	0.359	0.412	0.8	Behrendt, 2004
Daugave	-	0.061	0.088	0.221	0.4	Behrendt, 2004
Elbe	-	0.068	0.360	0.381	0.8	Behrendt, 2004
Ems	-	0.177	1.981	0.231	2.4	Behrendt, 2004
Odra	-	0.100	0.189	0.798	1.1	Behrendt, 2004
Po	-	0.144	0.339	0.925	1.4	Behrendt, 2004
Rhine	-	0.143	0.271	0.865	1.3	Behrendt, 2004
Vistula	-	0.071	0.296	0.393	0.8	Behrendt, 2004
Weser	-	0.100	0.633	0.312	1.0	Behrendt, 2004

Source: EEA, 2005a.

Table 7: Average P-use, ratio P-manure/p-fertiliser and balance result (2003)

Member State	Average P-use kg P/ha	P-consumption ratio manure/fertiliser	P-Balance kg P/ha
Austria	18.0	1.89	1.5
Belgium	46.4	2.27	7.5
Czech Republic	13.7	1.31	1.2
Cyprus			
Denmark	32.4	4.70	11.6
Estonia	7.3	4.16	- 1.7
Finland	17.6	0.72	10.9
France	22.9	0.98	2.6
Germany	23.0	1.71	1.5
Greece	26.7	1.04	11.0
Hungary	13.1	0.90	2.4
Ireland	26.7	1.74	7.9
Italy	25.3	0.68	6.6
Latvia	6.0	0.90	- 3.3
Lithuania	10.8	1.55	- 14.3
Luxembourg			
Malta	62.3		
Netherlands	54.4	3.77	13.8
Poland	19.9	1.41	10.1
Portugal	17.4	1.68	0.0
Slovakia	10.6	1.57	1.2
Slovenia	35.2	0.88	19.4
Spain	18.7	0.78	1.1
Sweden	12.7	1.44	0.1
UK	22.8	1.95	- 1.4

Source: Eurostat, IFA, in : Soil Service of Belgium, 2005.

Table 8: **Frequency table of the number of regions according to water abstraction classes (million m^3/year)**

Region	Number of regions according to water abstraction class [million m^3/year]						Total number
	0	0-50	50-100	100-500	500-1000	> 1000	
Southern Member States	1	86	16	41	20	21	
Northern Member States	51	95	1	0	0	0	

Source: EEA, 2005c.

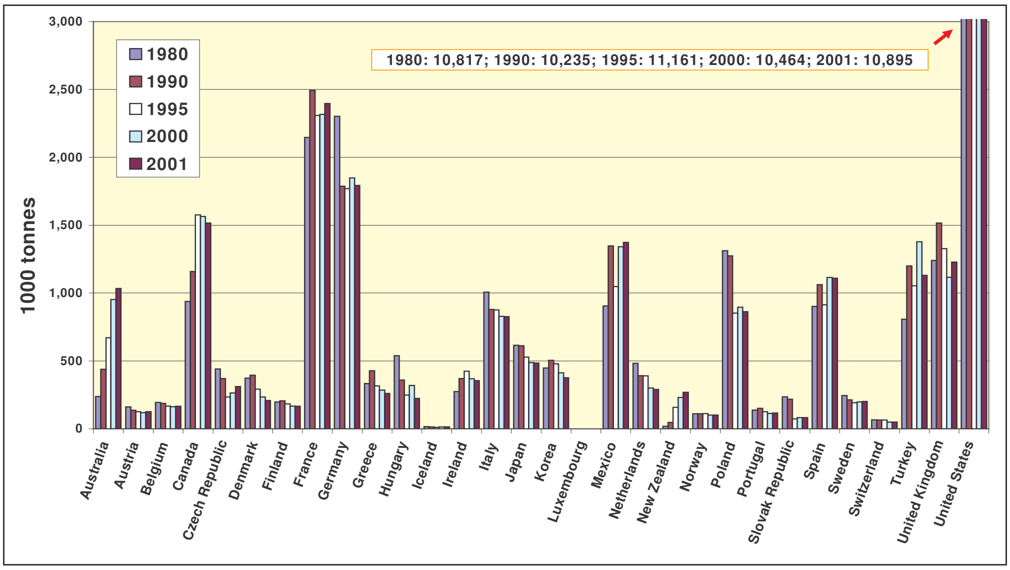

Figure 15: Apparent consumption of nitrogenous fertilisers in OECD member countries

Source: OECD Environmental Data Compendium, 2004. Based on data from FAO, in: OECD 2005: 17.

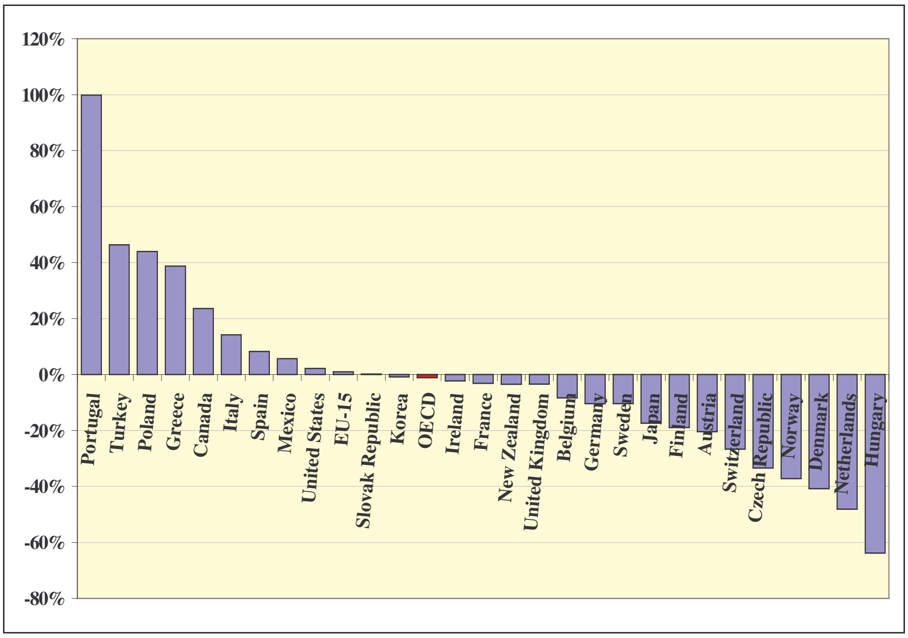

Figure 16: Percentage change in the number of tonnes active ingredients of pesticides used in OECD member countries between 1990-92 and 2000-02

Source: OECD Environmental Data Compendium, 2004; based on data from FAO, in: OECD, 2005: Figure 4.