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The Nitrate Pollution Problem and the Agri-environmental Policy in the European Union.[1]

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Abstract

In the European Union, during the 1980s the nitrate debate gained in public significance and political relevance. The spread of nitrate pollution is responsible for its growing political importance. However, the definitive factor making political action necessary was the enactment of the EC Drinking Water Directive in 1980. This Directive introduced a stringent new definition of nitrate pollution. Drinking water, which would have been previously defined as "safe", was to be redefined as "polluted". As a result, nitrate pollution control and regulation became part of the policy agendas of northern European countries in the latter half of the 1980s. Finally, in 1991, member states unanimously adopted the Nitrates Directive, aimed at reducing and preventing water pollution caused by nitrate runoff from agricultural sources. This article analyzes the issue of nitrate pollution in Europe, examines nitrate pollution policies, and finally reviews the shortcomings in the implementation of the 1991 Nitrates Directive.

Introduction.

In Europe, agricultural pollution has only recently come to be regarded as a significant problem. Previously, farming practices seemed to pose no possible threat to the rural environment, and agriculture's role as the keeper of the countryside was considered self-evident. Agriculture was placed in a reciprocal relationship with nature, and farmers were regarded as being in harmony with the natural environment. As a result, for a long time, agricultural pollution was precluded from public recognition, and farming was given special exemptions within planning, environmental and safety legislation. Since the mid-1980s, however, farm pollution has become one of the most prominent environmental issues at the European Union level and public opinion in northern European countries[2] now regards agriculture as one of the most environmentally disruptive social activities. Consequently, the pressures on farmers to curtail pollution and achieve higher environmental standards have been building up.

The transformation in the public image of agriculture and in the regulatory law governing farm pollution is in part the result of the implementation of European Union water quality policy in member states. In 1980, was enacted the EC Drinking Water Directive, setting absolute legal standards for a range of water quality parameters. Soon and unexpectedly, all over Europe, complying with these parameters became very problematic. As a result, farming appeared as the most damaging single activity in relation to drinking water quality. The violation of the legal standard set for nitrates, in particular, increased dramatically the political salience of the problem of farm pollution. Therefore, nitrate pollution control and regulation was set

up on the policy agendas of northern European countries during the second half of the 1980s. Finally, in 1991, member states unanimously adopted the Nitrates Directive, aimed at reducing and preventing water pollution caused by nitrates from agricultural sources.

This paper, analyses the problem of nitrate pollution in Europe. We have focused on certain member states, because the experience of these countries is typical of others. It first examines the europeanization of water quality policy and the appearance of the problem of drinking water pollution by nitrates. The paper goes on to examine the enactment of regulatory laws governing nitrate pollution in Europe in the mid-to late-1980s. Finally, we have analyzed the shortcomings on in implementing the Nitrates Directive, the most outstanding example at the European Union level of the pressures set on farmers to redirect agriculture a little closer to sustainability.

EU water quality policy and the politics of the precautionary principle.

Nutrient concentrations in ground and surface waters throughout Europe have reached levels which are causing concern. The increasing level of nitrates in water causes two main problems as far as human health and the natural environment are concerned. On the one hand, nitrate that enters ground and surface waters contributes to eutrophication, or excess nutrient levels in the water. This increases the occurrence of algae blooms, reducing the oxygen content of the water that destroys the aquatic life. On the other hand, nitrate concentrations in drinking water are of concern because of their implications for human health. The most important sanitary risk associated with high nitrate concentrations in drinking water is the development of methaemoglobinaemia in infants. The second human health concern with nitrate is its possible linkage to stomach cancer.

Nitrate is a common component of food, vegetables being the principal source of nitrates in the human diet. However, concerns about nitrates concentration in drinking water stem from the fact that water can contribute significantly to the intake of nitrate in our daily diet. As Gray [27, p. 21] has pointed out, when drinking water contains more than 50mg/l, consumers' daily nitrate intake increases disproportionately.

Infantile methaemoglobinaemia has become almost non-existent in developed countries and the linkage of nitrate intake to stomach cancer is doubtful (Hill [29], Gray [27]). However, in1970 the World Health Organization established that the scientific evidence about the sanitary risks associated to the consumption of nitrates was sufficient to justify the imposition of a legal limit to nitrate concentrations in drinking water. World Health Organization recommended that nitrate content in water were not higher than 50 mg/l ; although, considered admissible for human consumption water with a nitrate content comprised between 50 and 100 mg/l. World Health Organization guidelines soon were adopted by developed countries.

In 1980 European Community member states adopted the Drinking Water Directive (80／778／EEC, revised as 98／83／EC) and by the mid-1980s member states' drinking water quality laws had to be revised to conform with the Drinking Water Directive. Under the terms of the directive guide values and mandatory values for different parameters for water quality were fixed. In relation to the nitrates parameter, a guide limit (GL) of 25 mg/l, and a mandatory value or maximum admissible concentration (MAC) of 50 mg/l were established. Therefore, a maximum nitrate limit of 50 mg/l in any sample of drinking water, was to be implemented within five years (i.e., by 1985) in member states. Prior to the directive, in line with World Health Organization's recommenda-

tions, water supplies in European countries worked generally to an upper limit than the level set by the directive. Moreover, member states' standards for nitrates, as well as World Health Organization's guidelines, were advisory but not compulsory. Therefore, water containing higher nitrate concentrations than the upper limit set up by national regulations was not necessarily labeled as" polluted". The directive not only lowered the maximum admissible concentration of nitrate in drinking water in the majority of member states, halving the limit set for nitrates in countries like Britain, the Netherlands or France, but also introduced a stringent definition of nitrate pollution. Drinking water supplies, which would have been defined previously as "safe", were to be redefined as " polluted" (Izcara Palacios [33]).

Therefore, as it was asserted by an EC Commissioner (Haigh [28, p. 237]), the Drinking Water Directive could be seen as an early example of the precautionary principle[3]. Usually, in the area of environmental decision-making the lack of full scientific certainty has been used as a reason for postponing measures to prevent environmental degradation. On the contrary, the precautionary principle, raises the need to act in an environment of scientific indeterminacy, against risks which are not yet proved. Precaution is essentially forward looking and applies to the problematic area of uncertainty. This regulatory approach is underpinned in the recognition that scientific knowledge cannot adequately predict the potential environmental consequences of human activities, minimizing the need for information about the causal relations between human activities and environmental harm, and dictating that action to eliminate possible damaging impacts on the environment should be taken before a causal link has been established by absolutely clear scientific evidence (Hunt [32], De Sadeleer [19]). The precautionary principle, intending to provide protection against hazards which research has not yet identified, responds to scientific uncertainty, overregulating potential environmental or health hazards (Izcara Palacios [35].

Accordingly, the EC Drinking Water Directive reflects growing attention to the identification and management of scientific uncertainty (Izcara Palacios [33]). In relation to nitrate pollution, the stringent EC Drinking Water Directive maximum nitrate limit of 50mg/l, aims for anticipating and preventing a health hazard, requiring less than scientific certainty. At present it is questionable whether doses of 200 or 300 milligrams of nitrates per day really are a relevant health hazard (Conrad [18, p. 8]), and it appears unlikely that infantile methaemoglobinaemia is caused by bacteriologically pure water supplies containing nitrate concentrations up to 100 mg/l (Gray [27, p. 122]). Therefore, in this case, the lack of full scientific certainty is not an excuse for failing to take action to protect human health.

The implementation of the Drinking Water Directive and the nitrate problem.

The nitrate problem in Europe largely remained a topic for a small number of experts until the last two decades. However, in the 1980s the nitrate debate gained public significance and political relevance, and escalated rapidly on the political agenda, evolving from a primarily scientific topic into an issue with a high political profile. The broadening in the geography of nitrate pollution, as a result of agricultural intensification[4], helps to explain the growing importance of the nitrate problem. Nevertheless, the definitive factor making political action necessary was the europeanization of water quality policy (i.e., the transposition of the Dinking Water Directive into national legislations, domestic laws being overhauled).[5]

All over Europe, complying with the EC

Drinking Water Directive maximum nitrate limit of 50 mg/l has been very problematic. The monitoring under the Drinking Water Directive has led to a dramatic increase in the number of drinking water supplies failing to meet the standard set for nitrates, pointing to farming as the major cause of the decline in drinking water quality. According to the Dobris Assessment " model computations indicate that over 85 per cent of the agricultural area in Europe has nitrate levels above the GL (25 mg/l), and also that the MAC (50 mg/l) is exceeded below approximately 20 per cent of the agricultural area" (EEA [23, p. 68])[6]. Moreover, it is estimated that 5 % to 6 % of the European population is now being supplied with drinking water, which contains more nitrate than the maximum admissible concentration of 50 mg/l, and 25%of the population is using water with a level greater than 25 mg/l (ECA [22, p. 24]). The areas where nitrate pollution is particularly problematic are: the Netherlands, Belgium, Denmark, Brittany (in France), North Rhine-Westphalia (in Germany), and Lombardy (in Italy) (ECA [22, p. 12]).

In Europe, prior to the implementation of the Drinking Water Directive, the dearth of information about nitrate pollution had helped close off the issue from public perception and debate. However, as a consequence of the europeanization of water policy, water pollution by nitrates from agricultural sources came to light, and escalated at the center of the agriculture-environment debate. In Britain and Germany, since the early 1980s, as a consequence of the introduction of the directive, the nitrate problem has received considerable attention (Bruckmeier & Teherani-Kronner [8], Hill et al. [30]). In France, the adoption of this directive has contributed to rise general public concern about water pollution from agriculture (Rogers [47]). In Denmark, the Netherlands and Belgium, amongst the range of agricultural pollution problems that came to light since the1980s the problems of groundwater pollution by nitrates and the eutrophication of surface water stand out (Bennett [4], Glasbergen [26]). In Finland, in the early 1990s, when national policies were harmonised in accordance with European standards, water pollution caused by chemical fertilizers, was recognized in official environmental policy as one of the most difficult environmental problems (Jokinen [41 and 42]).

On the contrary, in countries of the European periphery, like Spain or Portugal, agriculture continues being regarded by public opinion as an activity in harmony with the natural environment and does not exist a public debate on agriculture and environment (Izcara Palacios [37]).

The violation of the legal standard set for nitrates in the EC Drinking Water Directive increased dramatically the political salience of the problem of nitrate pollution. Because of this, in the mid-to late-1980s, nitrate control and regulation was put on the policy agendas of northern European countries in order to prevent the concentration of nitrate reaching a level at which it could interfere with human consumption uses of the water. Consequently, " water protection zones", were established throughout Europe, aimed at reduce nitrate leaching (Cartwright et al. [9]) by imposing restrictions on manure applications or excessive use of fertilizers.

Water protection zones: A strategy to reduce nitrate pollution.

During the second half of the 1980s in northern European countries, to varying degrees, "water protection zones" where established to protect from nitrate pollution existing sources of drinking water. In these zones, farming activities were restricted by lying down stricter environmental standards for them than

elsewhere. Two contrasting approaches were adopted to control diffuse inputs of nitrate : legislated restrictions and voluntary agreements between farmers and water companies (Cartwright et al. [9]), these policies being underpinned on the compensation paid to farmers for loss of yield due to decreased fertilizer usage. Therefore, these policies, by offering such economic compensation to farmers for abstaining from damaging the environment, recognized and assigned to polluters an implicit right to pollute.

In Denmark, in the mid-1980s, were developed the most comprehensive and most ambitious nitrate and nutrient pollution policies of Europe[7]. Nitrate contamination of drinking water, surface water eutrophication and degradation of the marine environment were the main areas of concern. Between 1985 and 1991 three action plans were launched in Denmark to combat the nitrate problem. In 1985, the Minister of the Environment presented an Action Plan to abate pollution of the aquatic environment by nitrogen, phosphorus and organic substances. This program was replaced in April 1987 by a more comprehensive Aquatic Environment Action Program. In relation to the farming sector, the paramount objectives were to eliminate pollution from storage of animal manure and reduce nitrate discharges to the aquatic environment by half. However, only slow improvements from agriculture were obtained. As a result, in April 1991 was established an Action Plan for a Sustainable Agriculture, and the deadline for reducing the leaching of nitrate into the aquatic environment was extended to the year 2000. Notwithstanding, this goal has not been achieved (May and Winter [43], Eckerberg[21]). Moreover, in the framework of the implementation of article19 of Council Regulation 797/85 on Improving the Efficiency of Agricultural Structures, a total of 915 "Environmentally Sensitive Areas" were designated, 286 having as objective the protection of surface waters and 45 the protection of groundwaters (Primdahl [45]).

In the Netherlands, the adverse environmental effects caused by the farming sector led to the enactment of a complex legislation intended to reduce nutrient leakages into the environment. In 1986 the Fertilizers Act and the Soil Protection Act were passed, the protection of ground water quality being the main area of concern. In particular, under the Soil Protection Act special arrangements for the application of nutrients were applied in drinking-water catchment areas. Although different restrictions were applied in different groundwater protection areas ; usually, the application of fertilizers in the zone immediately proximate to the abstraction point was banned (Bennett[4]). Likewise, the Dutch National Environmental Policy Plan, which was introduced in1989, established the objective to reduce fertilization with nitrogen in areas where the groundwater could be used to supply drinking water (Van der Straaten [49]).

In Germany, the 1986 Water Management Act established special protection measures for surface water at risk of eutrophication. In relation with water protection areas, drinking water sources had to be surrounded by three protection zones with differing degrees of restriction on farming activities (Glasbergen [26])[8]. The regions implement the Water Management Act in different ways. However, it can be generally said that while the places of extraction keep free of any use, in the other two zones an"orderly agriculture", from which compensation payments are received by farmers as a result of the inevitable loss of income arising from increasing environmental protection, must be practiced.[9].

In France, under the 1964 Water Law, drinking water protection perimeters were established. As in Germany, the establishment of

three concentric zones for the protection of drinking water abstraction points were stipulated. In the immediate perimeter no land use was permitted. In a close perimeter pesticide use was not permitted and the use of fertilizers was limited. Finally, in a distant perimeter constraints were very slight. However, the practical application of drinking water areas protection measures has been very poor because of the high cost of the procedure for rural communities[10]. Although, from the late 1980s protection measures for drinking water abstraction points have been tightened (Bodiguel et al. [5]). Moreover, in 1984 the CORPEN (the Commitee of Orientation for the reduction of water pollution by nitrates) was established with the objective of preventing water pollution caused by nitrates from agricultural sources (Baillon [1], Evain-Bousquet [25]).

In England, in 1990, a decision was made to establish "nitrate sensitive areas" to reduce leaching from inorganic and organic nitrogen fertilizers. A Pilot Nitrate Sensitive Areas Scheme, based in the principle that farmers should be encouraged to change their practices in return for compensatory payments, was set up in 1990. Nitrate Sensitive Areas (10 were initially designated) were defined as areas where nitrate concentrations on drinking water sources exceed or are at risk of exceeding the EC Drinking Water Directive MAC for nitrates. Under NSAs two types of schemes where introduced ; a basic scheme, restricting the application of nitrogenous fertilizers and animal manure ; and, a premium scheme for converting arable land to pasture, financial compensation being four-to seven-fold higher under this scheme than under the former[11]. Alongside the 10 NSAs the Ministry of Agriculture also designated a further 9 Nitrate Advisory Areas, where the emphasis was on intensive programs of advice for farmers to encourage them to voluntarily reduce fertilizer applications, without financial compensation[12].

In Spain, the 1985 Water Law introduced the figure of the "perimeter of protection" on drinking water catchment areas. In these areas the development of activities that could affect water quality, like farming, was to be authorized by Hydrographic Basins. However, this policy has never been applied in practice. This is because in Spain, where water quantity problems are very severe, water quality issues have received much less attention[13].

The adoption of a Directive aimed at preventing nitrate pollution.

By the mid-1980s the Commission of the European Communities emphasized the need to adapt agriculture to the requirements of protecting the environment, stressing the need for agricultural policy to take more account of environmental policy. Agriculture, an activity that had escaped most of the environmental controls that had been applied to other sectors of the economy, for the first time was considered as an activity which, like other sectors with potentially harmful activities, should be subject to public controls designed to avoid deterioration of the environment (Izcara Palacios [33]). As a result, the 4th Environmental Action Program of the European Community, stated that the European Commission was to present a proposal for a directive concerning the protection of fresh surface, ground water and coastal water against pollution from livestock manure and from overuse of nitrogenous compounds (OJEC, C 328 of 7/12/87, p. 24), tackling the pollution problems associated with intensive livestock units and with excessive use of chemical fertilizers in intensive crop production.

Accordingly, in January 1989 the European Commission (OJEC, C 54 of 3/3/89) presented a proposal of Directive aimed at reducing and preventing water pollution caused by nitrates. This proposal was modified in 1990 (OJ No C 51

Table 1 : The timetable for the implementation of the Nitrates Directive

Requirement	Relevant Directive Article	Stipulated Completion Date
Transposition into National Law	12	1993, December, 12
Monitoring	5 / 6	1993, December, 12
Designation of Vulnerable Zones	3	1993, December, 12
Establishment of Code of Good agricultural Practice	4	1993, December, 12
Establishment of the first four year Action Program.	5	1995, December, 12

Source : CCE [10].

of 2 / 3 /90). Finally, the Council of the European Communities, considering the fact that the nitrate concentration in groundwater in many intensive agricultural areas was higher than the limits set in the EC Drinking Water Directive, adopted a directive concerning the protection of water from pollution by nitrates from agricultural sources, at their meeting on 12 th December 1991 (OJ No L 375 of 31/12/91). Overall the directive took nearly three years to negotiate.

The objectives of the directive are to ensure that the nitrate concentration in freshwater and groundwater supplies does not exceed the limit of 50 mg/l, and to control the incidence of eutrophication. Having set the overall targets, the directive requires individual countries, within prescribed limits, to draw up their own plans for meeting them. In the European Union the practical application of environmental directives is the responsibility of member states themselves. EU directives are a binding instrument in terms of the results to be achieved, but the choice of methods enacted to ensure compliance are left to individual member states. The European Commission has no power or authority to intervene directly on the supervision of the implementation of the directives within the member states.

The Nitrates Directive contains five main elements : i./ the transposition of the Directive into National Law ; ii./ the monitoring of groundwater and surface water[14] ; iii./ the definition of nitrate vulnerable zones[15] ; iv./ the creation of voluntary codes of good agricultural practice ; and, v./ the establishment of compulsory action programs within the vulnerable zones. Member states were supposed to identify the zones likely to be subjected to nitrate pollution and to bring into force the laws, regulations and administrative provisions, necessary to comply with the directive before the end of 1993. Also, by December 1993 member states were supposed to have carried out the monitoring exercise, designated their vulnerable zones, and have drawn up a Code of Good Agricultural Practice to be implemented by farmers on a voluntary basis. Within two years of designating vulnerable zones, member states had to establish action programs designed to prevent or reduce pollution within those zones (see table 1). Notwithstanding, by this time, only Denmark had fulfilled all those obligations (CCE [10, p. 7]). The action programs had to be implemented within a further four years. Therefore, by December 1999 all the measures had to be fully operational.

The Nitrates Directive has essentially two elements : the creation of voluntary codes of good agricultural practice, and the establishment of compulsory action programs within the areas designated as "vulnerable zones". On the one hand, codes of good agricultural practice contain provisions covering the periods when the land application of fertilizer is inappropriate ; the land application of fertilizer to steeply

Table 2 : The framework of EU Agri-environmental Policy

Agri-environmental Agenda	Desertification	Agricultural intensification	
Objectives	-To ensure continued agricultural land-use and thereby contribute to the maintenance of a viable rural community. -Conservation of high nature-value farmed environments. -The upkeep of the landscape and historical features of agricultural land	The protection and improvement of the landscape, wildlife and natural resources.	Reducing water pollution caused or induced by nitrates from agricultural sources and preventing such pollution.
Agri-environmental commitments	Apply usual good farming practices compatible with the need to safeguard the environment.	Agri-environmental commitments involve more than the application of usual good farming practices	Agri-environmental commitments involve the application of usual good farming practices
Eligible area	-Mountain areas -High nature-value farmed environments which are under threat	Environmentally Sensitive Areas. Areas with environmental restrictions.	Areas of land which drain into the waters affected and/or waters which could be affected by nitrate pollution.
Financial support scheme	Compensatory allowances are fixed at a level which is sufficient in making an effective contribution to compensation for existing handicaps.	Payments to compensate for costs incurred and income foregone are made to farmers subject to restrictions on agricultural use.	Application of the Polluter Pays Principle.
Agri-environmental Measures	Less Favoured Areas Directive 75/268 -Regulation2078/92 (measures d,e,f and g) -Regulation1257/1999 (chapters V & VI)	Regulation797/1985 (art. 19) -Regulation2078/92 (measures a,b and c). Regulation 1257/1999 (chapter VI)	The Nitrates Directive (91/676/CEE)

Source : The authors.

sloping, water-saturated, flooded, frozen or snow-covered ground ; the conditions for land application of fertilizer near water courses ; the capacity and construction of storage vessels for livestock manures ; procedures for the land application of both chemical fertilizer and livestock manure, and so on. On the other hand, the Directive prescribes two types of measures for action programs : rules for farming practices and limits on livestock manures. Member states must impose rules relating to periods when the land application of certain types of fertilizer is prohibited, and limitation of the land application of fertilizers, taking into account soil and climatic conditions. Therefore, because manure must be stored when application is prohibited, the Directive also contemplates the capacity of storage vessels for livestock manure. Action programs also include a maximum limit for livestock manure applied to land each year, equivalent to 170 Kg nitrogen per hectare.

Voluntary codes of good agricultural practice are intended to be a long term investment to inform farmers about the impact of their activity on the environment and to encourage appropriate changes. Action programs, involving compulsory elements constitute the core of the directive.

The measures developed by the Nitrates Directive were not entirely new. On the contrary, this regulation was prompted by the earlier adoption by some member states of legislation on intensive agriculture, representing a move towards common action among EU countries. Accordingly, there is a clear similarity between "water protection zones" and "nitrate vul-

nerable zones".

The Nitrates Directive in the framework of EU Agri-environmental Policy: the politics of the Polluter Pays Principle.

Two environmental agendas can be discerned in the European Union (Izcara Palacios [39]). The first agenda, associated with France, the Alpine countries, Scandinavia and southern Europe[16] (Baldock and Lowe [2]), relates to the problem of" desertification" (i.e., the danger of abandonment of land-use in areas characterised by the presence of land of poor productivity and low population density, in which farming should be continued in order to conserve or improve the environment). The priority under this agenda is to maintain agriculture through appropriate subsidies. The second agenda, prompted by countries where public attitudes towards farming were less benevolent, Denmark, the Netherlands, Belgium, Germany and the UK, deals with the problem of agricultural intensification. The primary objective under this agenda is to reduce pollution caused by livestock wastes, inorganic fertilisers and pesticides. However, this objective is pursued by two contrasting approaches. The first approach, is underpinned on compensatory payments being paid to farmers for abstaining from pollute the environment. Under the second approach, in keeping with the Polluter Pays Principle, the cost of the measures necessary to change current practices to reduce nitrate pollution should be borne by the producers themselves. These schemes are separated by the concept "usual good agricultural practices"[17]. Accordingly, European Union Rural Development regulation makes clear that when society desires that farmers deliver an environmental service beyond the application of usual good farming practice, this service would be purchased through agri-environment measures. On the contrary, the application of usual good farming practices, for example compulsory measures under the nitrates Directive, does not deserve compensatory allowances. As it is stated in the article 22 (2) of Regulation 1257/1999 : " Agri-environmental commitments shall involve more than the application of usual good farming practice" (OJEC L 160, 26/6/99, p. 90). However, there is not a clear definition of the term " usual good agricultural practice".

The Nitrates Directive, by setting ambitious environmental targets, supposes the imposition on farming of the same kind of controls which limit activity in other industries, reformulating agricultural practices in order to align them with the ecological demands set by nature. The Directive not only is underpinned in the consideration of "economic development" and "environmental protection" as two concepts mutually supportive, also regards stringent environmental standards as a precondition for future sustainable growth. Moreover, by pursuing stringent environmental objectives, the Directive adheres to two key principles of EU Environmental law : the "precautionary" and the " polluter pays" principles. On the one hand, the Directive intends to provide protection against a hazard (surface freshwaters and groundwaters, whether for drinking or not, which contain more than 50 mg/l nitrates) not clearly scientifically proved. On the other hand, the Polluter Pays Principle implies that those who cause environmental damage should bear the costs of avoiding it. Accordingly, compulsory measures flowing from application of the Nitrates Directive are supposed to be respected by farmers without receiving additional remuneration.

The implementation of the EU Nitrates Directive.

The EU Nitrates Directive is the most outstanding example of the recent pressures on European farmers to curtail pollution and achieve higher environmental standards to redirect agriculture a little closer to sustainability.

The Directive is a clear example of EU approach to the integration of environmental protection requirements into farming with a view to securing sustainable agriculture.

Glasbergen [26] describes agri-environmental policy as trapped in an iron law that undergoes three phases. In his classification, the relationship between agricultural pollution and type of policy control is assumed to pass through three phases. In the first- and second-phases environmental quality objectives appear subordinated to economic competitiveness. Measures aimed at reducing the harmful effects of farming practices are developed without questioning the practices themselves, regulations remaining strictly within the context of what is considered technically and financially feasible. Therefore, to make possible for farmers to continue to produce competitively compensation payments are given to them for loss of yield when environmentally oriented production methods are followed. By contrast, third-phase policy controls reassess farming practices regarding their ecological foundations, economic objectives being dwarfed by the prominence of environmental protection.

Following Glasbergen's model, the EU Nitrates Directive represents a third-phase type of policy control of agricultural pollution. However, member states are trying to implement it towards first-or second-phase type of policy controls.

In the first place, the Nitrates Directive affects the most intensive and profitable farming areas of the European Union, and to satisfy the objectives of the directive is going to require wholesome changes in some of the most intensive and efficient agricultural areas of the European Community. Therefore, the correct implementation of the Nitrates Directive could affect seriously the competitive position of domestic agricultures (Bontoux et al. [6]). However, member states are more prone to develop technical solutions helping to deal with the nitrate pollution problem, maintaining high levels of productivity, than to move towards less intensive production methods. For example, in France, the CORPEN has operated from mid-1980s following a "consensus strategy" based on the principle to reconcile the protection of water quality by improving agriculture practice, without making any fundamental changes to its development model based on steady growth of productivity and intensification of production (Baillon [1]). In Spain it is assumed that existing activities would be changed to a certain extent, but not to the extent of affecting productivity or putting farmers out of business. Especially, in the most intensive and profitable agricultural zones, the abandonment of existing activities in favor of less damaging ones, or reducing the intensity of agricultural activity, is never seen as a real possibility (Izcara Palacios [34 and 37]). In the Netherlands, technical solutions for the manure problem have been subsidized. Newly developed techniques, such as emission-reducing equipment at farm level and the reduction of nutrient content in animal feed and industrial manure processing, have been introduced in order to reduce nutrient leakages into the environment without reducing the size of the herds and without substantially damaging international competitiveness (Dietz [20]). However, as Wier and Hasler [51] have pointed out, in order to reduce nitrogen loading policy measures should aim at controlling production.

In the second place, there is a marked tendency for farmers to regard conservation practices as a source of income loss for which they need to be compensated. Usually, European countries, in an effort to improve the quality of drinking water supplies have adopted incentive-based measures, mainly subsidies to farmers who agree to switch to less intensive practices. The implicit assumption seems to have been that farmers have a property right to use land

as they want, and if society demands environmentally friendly farming practices, it must pay compensation. By contrast, the Nitrates Directive oblige farmers to comply with compulsory measures, to reduce nitrate leaching, without compensation. This can be regarded as a direct consequence of the "polluter pays principle" which requires that minimum environmental standards as, reducing water pollution caused or induced by nitrates from agricultural sources and preventing further such pollution, are respected by farmers without receiving additional remuneration (CEC [14]). Therefore, the Directive confirms society's legitimate demands that agriculture should not pollute the environment.

However, member states are very reticent to introduce agri-environmental measures that could put farmers out of business. There is a tendency to consider that the needs of business security and family income have to be met first. In most European countries persists a strong commitment to compensate farmers for loss of yield due to restrictions on agriculture (Izcara Palacios [33]). In Finland, for example, the environmental regulation of agriculture has mainly been based on moral persuasion. Particularly, farming unions, who have permanently opposed statutory regulation, have accepted only compensatory economic regulation and moral persuasion as the desirable forms of agri-environmental policy (Jokinen [41]). In the case of the United Kingdom, in relation with Nitrate Vulnerable Zone designations, farming unions considered the nitrate limit to be over-rigorous and expected the government to compensate farmers for the "unjustified imposition" of the limit (Richarson [46]). In response to farmer's concerns, the Farm Waste Grant scheme was introduced in 1996 to assist farmers in areas designated within Nitrate Vulnerable Zones (Rosso Grossman [48]). In France, under the 1993 Program for Controlling Pollution of Agricultural Origin (PMPOA), a system of contracts between farmers and the state was instituted, farmers receiving financial assistance to bring their farms and farming practices into line with the Nitrates Directive (Rogers [47]).[18]

Moreover, most countries efforts to reduce nitrate pollution have been integrated into the CAP agri-environmental measures (i.e. Regulation 2078/92)[19]. In Denmark, the basis of the initial agri-environment program was a set of nationwide measures to reduce the use of nitrates (CEC [13, pp. 132, 133]). In Germany, the protection of waters from excessive nitrates is one of the measures implemented to date (pp. 133-137). In Greece, a regional program to reduce nitrate leaching has been implemented in Thessaly (p. 137). In Italy, constraints on quantity and timing of application of fertilizers to minimize the leaching of nitrate run-off into water were applied in each of the 21 regions (pp. 141-143). In Sweden and Portugal, several measures have been designed to reduce nutrient leaching (pp. 146-148). England, during 1994 and 1995, as part of its implementation of Regulation 2078/92, launched 32 Nitrate Sensitive Areas within zones later designated as Nitrate Vulnerable Zones (Rosso Grossman [48]). In Finland, measures to reduce nitrate leaching are substantially subsidized by the Finnish Agri-Environmental Program, which is mainly directed towards water pollution problems caused by arable cultivation (Jokinen [42]). In Austria, on the basis of EC Regulation 2078/92, numerous measures were taken to reduce water pollution by granting subsidies to farmers, within a program based on voluntary participation (OECD [44]). In Spain, the Royal Decree 261/1996, transposing the Nitrates Directive into national law, establishes a close relationship between the Directive and CAP agri-environmental measures. Notwithstanding, as it has been pointed out by the Commission of the European Communities "Some agri-

environment programmes exist to further reduce nitrate leaching into the aquatic environment and to reduce abstraction. However, compulsory measures, for example, flowing from the application of the Nitrates Directive are not the subject of agri-environment payments" (CEC [14]).

In the third place, the Nitrates Directive reflects the growing attention to the identification and management of scientific uncertainty, over-regulating a potential environmental and health hazard. The directive emphasis upon reducing and preventing surface and groundwaters from reaching a concentration of 50 mg nitrates per liter represents a sensible erring on the side of caution in the light of the inconclusive evidence about the implications of nitrate pollution on human health. Particularly, Nitrates Directive objective to protect groundwaters which contain more than 50 mg/l or could contain more than 50 mg/l if protective action is not taken, and not only those intended for the abstraction of drinking water, as it was stated in the Commission's first proposal of directive on nitrate pollution[20], responds to a stringent understanding of the "precautionary principle" (Izcara Palacios [35]). In countries like Spain, where aquifers are used principally for irrigation, to reduce and prevent groundwater that is not going to be used for human consumption from reaching a concentration of 50 milligrams nitrate, is seen as a "nonsense" (Izcara Palacios [37]). In the same way, the French position in Community negotiations on the EU Nitrates Directive was of disagreement with the imposition of a drinking water standard for all water, whether for drinking or not (Comolet & Pagnard [17]). Likewise, the British and Portuguese governments have designated as "vulnerable zones" only those where groundwater is used as a source of drinking water. Moreover, in Britain, Nitrate Vulnerable Zones were kept deliberately small instead of extending to cover whole watersheds (Bontoux et al. [6], CCE [11]).

In the fourth place, problems of coordination when various ministries participate in implementation, is causing the process of implementing the Directive being delayed. Conflicts within the administrations are common. Particularly, between agricultural ministries, which have been deeply concerned about the financial burden that the implementation of the Directive could impose on farmers, and week environmental ministries, which have pushed for stringent standards. In the case of Finland, the Ministry of Agriculture did not want to define any area as vulnerable, and was very reluctant of the environmental protection requirements the Ministry of Environment was proposing (Jokinen [42]). In France, from the early 1990s the Ministry of Environment wanted farmers be made to comply with the Polluter Pays Principle. On the contrary, the Ministry of Agriculture minimized the farmers' responsibility for pollution (Rogers [47]). In Denmark, the Ministry of Environment has struggled for stricter regulation concerning fertilizer standards, while the Ministry of Agriculture has been opposed to environmental regulations concerning the agricultural sector (Hofer [31]). This problem is most acute in member states which have quasi-federal structures : Belgium, Italy, Germany and Spain[21]. In these countries, in order to comply with the Directive, coordination between national and regional governments, and among the different departments involved in the process (in national and in each regional government), is required. In Spain, because of the lack of coordination between national and regional governments, and also between the different public departments within each regional government, the Nitrates Directive implementation process did not move (Izcara Palacios [34 and 37]). Belgium has registered the poorest record on implementing the

Table 3 : Level of satisfactory implementation 1 by Member States of the Nitrates Directive

	Transposition into National Law	Monitoring	Designation of Vulnerable Zones	Establishment of Code of Good Agricultural Practice	Establishment of the first four year Action Programme	Performance being sufficient to avoid formal infringement proceedings
Belgium	×	×	×	×	×	×
Denmark	○	○	○	○	○	○
Germany	○	○	○	○	×	×
Greece	○	×	×	○	×	×
Spain	○	○	×	×	×	×
France	○	○	×	○	○	×
Ireland	×	×	×	○	×	×
Italy	×	×	×	○	×	×
Luxembourg	○	×	○	×	×	×
Netherlands	○	○	○	○	×	×
Austria	×	○	○	○	×	×
Portugal	○	○	○	○	×	×
Finland	○	○	○	○	×	×
Sweden	○	×	○	○	×	○
United Kingdom	○	×	×	○	×	×

Source : Elaborated from ECA [22], CEC [16].

The European Commission is responsible for ensuring the satisfactory implementation of EU environmental policy. As a result, the European Commission decides if member states are implementing it satisfactorily. If member states fail to implement properly the EU enivironmental policy, the European Commission will take actions (see note 5).

Directive (see table 3). Its implementation deficit can be explained not only by structural problems, such as the excessive concentration of pig and poultry production on small land areas[22], but also as a result of the quasi-federal structure of the Belgian state, where powers to regulate the environment are devolved to the regional governments within the federation (Barnes and Barnes, [3])[23].

Finally, even presupposing a political commitment from member states authorities to implementing the Directive, regulatory officials must rely on the co-operation of the large majority of farmers to fulfill their tasks. However, if complying with the Directive imposes a significant financial burden on them, farmers co-operation will be poor. In the case of Spain, farmers are very reluctant to redirect farming practices taking ecological considerations into account[24]. In the United Kingdom farmers demanded annulment of 2 Nitrate Vulnerable Zones (Rosso Grossman [48]). In Brittany (France), even when the plans existed on paper, concrete progress towards implementing measures to meet the Nitrates Directive environmental standards was minimal, due to the lack of cooperation from the farmers (Rogers [47]).

Therefore, after ten years now from the adoption of this Directive, the status of its implementation is unsatisfactory (CCE [10 and 11], CEC [14]). For nearly every requirement under the directive, the majority of the fifteen member states have failed to meet deadlines, and not one member state[25], has a fully satisfactory transposition record. As a result, all but two member states are deemed by the European Commission to have infringed on the Nitrates Directive. Currently, 13 member states face proceedings in the European Court of Jus-

tice, because of non-transposition and/or the incorrect application of the Directive. Only Denmark and Sweden[26] performance on in implementing the Directive has been sufficient to avoid formal infringement proceedings (see table 3). Moreover, as it has been pointed out in a resolution adopted by the European Paliament on 17 January 2001 : "with the notable exception of Denmark and Sweden, the implementation of the Nitrates Directive has been extremely unsatisfactory" EP [24, p. 1]. In this resolution, the European Parliament calls on the European Commission to use the appropriate legal enforcement means within its powers to ensure the proper implementation of the Directive.

From table 3 it can be inferred that the level of satisfactory implementation by Member States of the Nitrates Directive is very low. However, there is a clear implementation gap between northern countries and the European periphery[27]. The application of the specific requirements of the Directive has been more satisfactory in northern countries. Especially, the designation of vulnerable zones, one of the most important requirements of the Nitrates Directive, and the element that shows more clearly the political commitment from national authorities to implementing the Directive, has been very problematic in the European periphery. Moreover, if we consider that the quantitative and qualitative importance of the responsibilities imposed on the member states by the Directive is much higher in northern countries, where the nitrate problem is very severe, than in southern states, where only small areas are affected, we can conclude that northern countries effort on implementing the directive is more marked.

The countries of the European periphery have been conspicuously slow to carry out the actions required under the nitrates directive, and for years have ignored the directive. In these states problems with implementation are related to a weak culture of environmental protection. Southern countries took the view that the Nitrates Directive was not a priority, because their agricultural systems use less fertilizer than their northern counterparts. Moreover, despite the fact that the Nitrates Directive is above all a statutory regulation in southern European countries it was seen principally as a voluntary-persuasive regulation. For example, in Spain, the directive tends to be seen as a broad statement of intent, rather than a binding law (Izcara Palacios [34]). Ireland did not designate any Nitrate Vulnerable Zone (CCE [10]). Italy established Action Programs without identifying Nitrate Vulnerable Zones (Rosso Grossman [48]). Portugal's correct implementation of specific requirements of the Nitrates Directive is higher than in other countries of the periphery (see table 3). This is because Portugal has minimized the problem designating only three small Vulnerable Zones. However, the European Commission has pointed out that 22 additional areas need designation in Portugal (CCE [11]).

Northern countries, where numerous water abstraction points where threatened with closure in the foreseeable future due to increasing nitrate concentrations, deeply concerned about the nitrate problem, were quicker to transpose the Directive into national legislation. By contrast with southern countries, in the Netherlands, Denmark, Germany, Austria, Luxembourg and also in Finland, the whole area has been put forward as a vulnerable zone under the EU Nitrates Directive (CCE [11])[28]. However, action on the ground has often been inadequate. Despite numerous nitrate policy initiatives focusing on manure production and limits on fertilizer use, northern member states still struggle to implement the directive. For example, in the Netherlands, differences on both instruments and standards for nitrate policy be-

Table 4 : Consumption of nitrogen fertilisers in the European Union, 1990−97 (Kg/ha of total agricultural land)

	1990	1997	Growth(%)		1990	1997	Growth(%)
Belgium/Luxembourg	122.1	125.4	2.7	Netherlands	194.3	156.1	−19.7
Denmark	141.6	104.5	−26.2	Austria	38.6	26.3	−31.9
Germany	151.0	91.5	−39.4	Portugal	38.0	29	−23.7
Greece	82.2	58.4	−29.0	Finland	80.8	62.7	−22.4
Spain	34.7	34.0	−2.0	Sweden	62.0	56.1	−9.5
France	82.0	82.6	0.7	United Kingdom	82.7	72.4	−12.5
Ireland	81.6	57.3	−29.8	EU−15	74.1	64.2	−13.4
Italy	51.1	48.2	−5.7				

Source : CEC [15, p. 206]

tween the European Commission, and the Dutch government have resulted in extended discussions. As a result, the implementation process of the directive has been delayed (Van der Bijl & Oosterveld [50]).

As can be seen from table 4, consumption of nitrogen fertilisers in the European Union has been reduced during the 1990s, as a result of the 1992 MacSharry reforms. However, only marginal improvements from agriculture have been achieved in the leaching of nitrates to watersheds (CEC [13 and 16]). Major nitrate pollution problems persist in many regions of Europe due to member states failure to implement the Nitrates Directive (ECA [22]). Implementation of the Directive has had very little effect in converting intensive practices to extensive farming. Until now, the implementation of specific requirements of the nitrates Directive has remained within the context of what is considered technically and financially feasible. However, in some areas compliance with the Directive will require more than that. Especially, in areas where nitrate pollution is particularly problematic, intensive practices would have to be converted to extensive farming. As a result, to comply with the Directive may have far-reaching economic consequences for the farming industry.

Agenda 2000 CAP Reform and the Nitrates Directive.

In the European Union the importance of environmental considerations within agricultural policy is set to increase further over time. One of the priorities of the European Commission when it drew up the proposals for the Agenda 2000 CAP Reform was to ensure that European agriculture would become more environmentally sensitive. Accordingly, the newly reformed Common Agricultural Policy is becoming a dynamic instrument for environmental integration (Izcara Palacios [39]). The main new element as so far as market support is concerned is the linkage of environmental protection requirements to direct support payments to farmers[29]. Article 3 of the Council regulation No 1259/1999 establishing common rules for direct support schemes under the CAP, the so-called " eco-conditionality rule", establishes that"Member States shall take the environmental measures they consider to be appropriate in view of the situation of the agricultural land used or the production concerned and which reflect the potential environmental effects. These measures may include : -support in return for agri-environmental commitments, -general mandatory environmental requirements, -specific environmental requirements constituting a condition for direct payments." (OJEC, L 160, 26. 6. 99, p. 114). This new regulation faculties member states to decide on the penalties that are appropriated to the seriousness of the ecological consequences of not observing certain environmental commitments. If specific envi-

ronmental requirements are not respected, the benefits accruing from the direct support schemes can be cancelled. This means that direct payments could be made conditional on the respect by farmers of European environmental protection legislation, such as the Nitrates Directive. This aspect could speed up the implementation process.

However, article 3 "eco-conditionality rule" is not mandatory throughout the European Union. Therefore, in countries where does not exist a public pressure to implement measures aimed at restraining environmentally harmful agricultural practices, like in southern European countries, direct support payments rarely are going to be linked to environmental protection requirements. On the contrary, in northern European countries, where agricultural practices and their implications for the rural environment have come under increasing scrutiny, there is a growing interest in the use of the new rule. Especially in Austria, environmentally friendly forms of agriculture are regarded as a potential niche for domestic agriculture in an international context (Hofer [31]). As a result, the Nitrates Directive implementation gap between northern and southern countries could be further widen[30]. Northern countries, where the image of farmers as the prime keepers and protectors of the environment has been wiped out, could be more willing to use the "eco-conditionality rule" to force farmers to implement the directive. Southern countries, where public attitudes towards agriculture have changed very little, and farmers are considered as an example of harmony and respect for the environment, will be very reticent to impose penalties on farmers, progressing much more slowly on implementing the directive (Izcara Palacios [36, 38 and 39]).

CONCLUSION.

In the European Union the overwhelming productivist rationale of farming has come under increasing scrutiny, agri-environmental regulations have become stricter, and farmers have been required to use environmentally sound production methods, involving a significant reduction of polluting inputs in crop production.

The Nitrates Directive, undoubtedly, is the most ambitious agri-environmental regulation at the EU level, and represents an important step towards integration of environment into agriculture. This measure, in keeping with the "precautionary" and "polluter pays" principles imposes on farming the same kind of controls which limit activity in other industries, reformulating agricultural practices in order to align them with the ecological demands set by nature. On the one hand, this regulation, in contrast with other agri-environmental measures, which have been based on the compensation paid to farmers for abstaining from damaging the environment, oblige farmers to follow certain rules to reduce nitrate leaching without economic compensation. On the other hand, to satisfy the objectives of the directive is going to require far-reaching changes in some of the most intensive and profitable farming systems of Europe. Especially, in areas where major nitrate pollution problems persist, intensive practices would have to be converted to extensive farming. This could result in the closure and restructuring of farms, with a resultant loss of employment. However, in member states there is a strong commitment to ensure the needs of business security and family income. Moreover, European countries are very reticent to move towards less intensive production methods in the areas were it has been developed a highly productive type of agriculture linked to international markets. As a result, after ten years now from the adoption of the Directive, the status of its implementation is unsatisfactory, and all member states have failed to meet deadlines.

In conclusion, European countries approach to nitrate pollution control continues being dominated by a productivist rationale, giving farming objectives priority over environmental considerations. However, in the framework of the reform process launched by the Commission's Agenda 2000 proposals, the growing interest manifested by some countries in the use of the new "eco-conditionality rule" will likely drive compliance with the Directive in member states.

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Notes

1. We would like to thank the anonymous referee and Dr. Yukio Hiromasa,associate professor at Meiji University, for their helpful and valuable comments.
2. With the term "northern European countries" we are referring to : Belgium, Denmark, Germany, France, Luxembourg, Netherlands, Austria, Finland, Sweden and the United Kingdom.
3. This principle, embedded in German environmental policy, entered the language of the European Union with the Dublin Declaration in 1990 and the Commission's 5 th Environmental Action Program of 1992 ; but, only by November 1993 it became a legal obligation, when the Treaty on European Union entered into force (Haigh [28] ; De Sadeleer [19]). In June 1995, when the Council and the Environment Committee of the European Parliament called for a fundamental review of Community water policy, the precautionary principle was outlined as one of the twelve principles of European Union water policy : "So much of the science underlying our understanding of water systems and, in particular, of the impacts of pollution on human health and the health of the environment is incomplete. The precautionary principle therefore requires that policy should always be based on recognized scientific knowledge, but that it should err on the side of caution whenever there are doubts or insufficient information" (CEC [12, p. 5]).
4. In the European Community, average application of nitrogen increased almost 400% between 1950 and 1981 (Rosso Grossman [48, p. 574]).
5. In the environmental field EU countries are not free to follow its own policy. EU environmental law is compulsory in member states. Three are the forms of legislation available to the EU : Decisions, Regulations and Directives. The first is the least important form of legislation for environmental policy. About 10 per cent of the EU's environmental legislation take the form of Regulations, which are directly applicable in member states. By contrast, directives, the most frequently used form of legislation for environmental measures, need to be transposed into national law. The primary responsibility for implementing EU environmental legislation lies with the member states. However, the European Commission is responsible for ensuring the proper development of EU environmental policy. The European Commission is able to perform its role through several procedures : sending a letter of complaint, issuing a reasoned opinion, or referring a case to the European Court of Justice (Barnes and Barners [3]).
6. These data are referred to nitrate concentrations at one metre below the soil surface where concentrations would be at their maximum.
7. Denmark, as well as Finland, Sweden, Norway, Estonia and Lituania have all ratified the 1987 North Sea and Baltic Sea Declarations, committing themselves to reduce by 50% the loading of nitrogen and phosphorus between 1987 and 1995. However, neither in the Northic countries nor in the Baltic states it is possible to suggest that this goal has been achieved in relation to the farming sector (Eckerberg [21]).
8. Water Protection Areas were divided into three concentric zones ; a wider protection zone, including the total catchment area, about 200 hectares ; an inner protection zone, extended to a line from which the groundwater requires 50 days for its arrival to the place of extraction ; and, the place of extraction.
9. Within the protection areas farmers have to accept considerable limitations on their activities, such as restrictions on nitrogen fertilizer use, prohibition to install or enlarge farms with intensive livestock, or limitations on those farms growing intensive crops (Bodiguel et al. [5]).
10. According with a survey realized in 1981 only in about 10 per cent of the 30.000 water catchment areas of France this regulation was implemented (Bodiguel [5]).
11. NSA's are located around groundwater sources affected by rising nitrate levels. Under these areas farmers have to obey several restrictions on farming practices (Rosso Grossman [48]).
12. In NAA farmers received advice for nitrogen fertilizer application, no restrictions being made on farming practices. Follow-up visits indicated that, although some farmers perceived an economic risk from reduced fertilizer applications, most farmers followed the recommendations, delaying the application of manure, for example (Rosso Grossman [48]).
13. In Spain, water resources are unevenly distributed, leading to acute shortages in some localities,

resulting both from rapid consumption growth and natural scarcity. For example, in the Mediterranean area, the South and islands, renewable resources lag behind water consumption. As a result, Spanish water policy's primary objective has been to enlarge the supply of water in order to meet a rising demand for water resources. On the contrary, the reduction and prevention of water pollution has received much less attention. Moreover, in Spain, the most serious water pollution problem is saline intrusion, nitrate pollution being a minor problem (Izcara Palacios [34]).

14. Member states were required to monitor the nitrate concentration in their fresh surface waters and groundwaters and to review the eutrophic state of their waters.
15. After identifying polluted waters, member states had to designate the lands that drain into these polluted waters as "vulnerable zones". Identification of polluted waters was based on three criteria: whether surface fresh waters (in particular those used for public supply), contained or could contain more than 50 mg/l nitrates; whether groundwaters contained or could contain more than 50 mg/l nitrates; and, whether bodies of water were eutrophic.
16. With the term southern Europe we are referring in this case to: Spain, Portugal, Italy and Greece.
17. Broadly speaking, the term "good agricultural practice" refers to farmland management and production methods able to prevent or to reduce environmental damage.
18. At the end of 1993, the Ministries of Agriculture and Environment, and farmers associations, reached and agreement to support a national plan of agricultural pollution control (PMPOA), aimed at reducing water pollution caused by nitrates from agricultural sources. The key element of this program was a system of voluntary contracts between the farmer and the state. On the one hand, based on the completion of an environmental diagnosis of the farm, the so-called DEXEL, the farmer had the obligation to carry out detailed measures to prevent water pollution by run-off into the groundwater and surface water of liquids containing livestock manures. On the other hand, the state, the local authorities and the Water Agencies, acquired the obligation to compensate the farmers for part of the cost incurred in bringing their farming practices into line with the Nitrates Directive. However, the implementation of the first phase of the PMPOA (1994－2000) has been very unsatisfactory, and only slow improvements have been achieved, as a result principally of farmers delaying tactics (Rogers [47]).
19. The agri-environment program (Regulation 2078/92) was agreed in May 1992. In the EU it is obligatory on Member States to implement a national agri-environment program (Baldock and Lowe [2]). Under Regulation 2078/92 incentive payments could be made to farmers who reduce substantially their use of fertilizers, for example (see: art. 2. 1. [a]). Moreover, this program, introduced through the 1992 MacSharry reform, has been expanded under the recently approved Agenda 2000 policy package (Jazra Bandarra [40]).
20. In the Commission's first proposal of directive on nitrate pollution the criteria for identifying polluted groundwaters was referred only to those groundwaters intended for the abstraction of drinking water; however, in the Council Directive of 12 December 1991 the criteria was extended to all groundwaters, whether for drinking or not.
21. In member states which have quasi-federal structures the powers to regulate the environment are devolved to the regional governments. In these countries, to transpose a single directive, several pieces of national legislation have to be introduced (16 in Germany, 17 in Spain or 21 in Italy, for example). Therefore, each of the regions must implement the EU legislation separately (Barnes and Barnes [3], Izcara Palacios [36]). In the case of Spain, central government keeps the prime responsibility for implementing EU directives. However, powers on environmental issues have been transferred to regional governments, which have the competence for implementing EU environmental directives (Izcara Palacios [37]).
22. However, intensive livestock production is not uniform in Belgium. While in Flanders manure surpluses are extremely high, there is not such a problem in other regions (the so-called shortage regions). In Belgium, the Manure Action Plan was enforced in1995. Accordingly, standards on the application of nitrogen should not exceed 450 and 275 kg/ha, for grassland and the other crops, respectively, by the year 2002; exceeding substantially the 170 kg/ha Nitrates Directive standard. There are strict rules regarding the disposal of excess amounts of livestock manure. Non-family livestock farms with

a livestock manure output which exceeds 10,000 Kg are obliged to transport manure to regions without manure surpluses (Brouwer et al, [7]).

23. In Belgium it is not possible to understand nitrate policies without digging into regional policies. Nitrate policies vary from region to region.
24. In Spain existing agricultural practices are not seen by farmers as environmentally disruptive. Fertilizers and particularly, nitrates, are regarded as innocuous substances. Moreover, in Spain the largest user of groundwater is the farming sector. Therefore, farmers do not understand a policy aimed at reducing nitrate leaching into water used for irrigation (Izcara Palacios [34 and 37]).
25. Denmark did not complete the establishment of first four year Action Programme on time.
26. Denmark is the country of the EU where environmental regulation imposes the most severe financial burden on farmers. Denmark also shows a low degree of utilization of EU subsidies for environmental protection in agriculture (Eckerberg [21]). Accordingly, as the European Parliament [24] has pointed out "farmers in Member States which comply with the Directive are at a competitive disadvantage to those who do not meet the exacting requirements and this is particularly true in the case of Denmark". In the case of Sweden, to meet the Nitrates Directive requirements imposes a lower burden on farmers, because the nitrate pollution problem is less severe than in Denmark, where the whole country has been declared "vulnerable zone".
27. With the term "the European periphery" we are referring to Greece, Spain, Portugal, Ireland and Italy. We will also refer to this group of countries with the term" Southern countries".
28. France designated 46% of agricultural land as Nitrate Vulnerable Zone, and in the United Kingdom and Sweden were designated 65 and 5 zones respectively (CCE [10]).
29. Agenda 2000 CAP reform deepens and extends the 1992 reform through further shifts from price support to direct payments. In particular, direct income support is expected to increasingly replace agricultural price supports.
30. Until now, northern countries have implemented more satisfactorily the Directive than southern states (see table 3). Moreover, southern countries failure to designate "vulnerable zones" (see table 3), while in many northern states the whole country has been put forward as a vulnerable zone, shows a lack of political commitment to implementing the Directive.