



# European Community Measures to Reduce Nitrate Pollution

## -Implementation Steps Taken in England

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## **Abstract**

Water protection proves to be a difficult task, whether it is dealt with through legislation or the implementation of a process to reduce further pollution. This study considers how the issue of water pollution from nitrates in agricultural practices has become better understood through the reforms of the common agriculture policy (CAP) and the enactment of various regulations and directives by EU. The implementation of the EC Nitrate Directive is a main focus of this study because it was a major movement towards protecting water against pollution from agriculture, and an important step in implementing the Water Framework Directive. The implementation process is analyzed from both a formal and practical perspective, along with a discussion of the difficulties that arose in the implementation phase. There is a focus on the implementation of the Nitrate Directive in UK, with an emphasis on England as a case study. The study finds that if the distribution of responsibilities (planning, regulating, implementing, and reporting) is shared between national, regional and local bodies, the compliance with political regulations becomes easier. It is also concluded that rearrangements of the existing institutions are necessary to reduce costs, exchange new ideas that could translate to regulative ideas, and create an atmosphere of trust between regulators and implementers. It can be concluded from this study that, despite the traditional centralization of governments, England has taken several steps towards integrating institutions and has tried to be open and responsive to the local communities. Finally, there are several lessons that can be learned from the UK's approach to control nitrate pollution, which are discussed and outlined in the conclusion of this study.

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# **1- Introduction**

## **1.1- Subject**

Water is a daily human and environmental need which makes it vital for human survival. Water influences both consumptive and non-consumptive activities through two strongly related dimensions- quality and quantity. Water quality influences many human activities and simultaneously, it is affected by these activities. Commonly, water quality is defined by its physical, chemical, biological, and aesthetic (appearance and smell) characteristics. Degraded water quality is indicated by outcomes such as eutrophication, toxic contamination, and acidification. Correspondingly, there are different indicators for measuring each outcome. For example, high levels of nitrogen and phosphorous are indicators of eutrophication. Eutrophication results from high levels of agricultural activity in which there is an increased use of fertilizers and pesticides on crops and livestock productions. Nitrates are the main water pollutants. An increased use of fertilizers in agricultural practices causes the concentration of nitrates to rise in surface waters. In turn, there is a reduction in water's ability to support human life.

Nitrogen is a nutrient needed for plant growth and it exists in three forms: nitrate, nitrite, and ammonium. Although it forms about 80% of the air, it is also found in sewage and fertilizers. Commonly, it is transmitted to crops through chemical fertilizers or animal manure. Although nitrogen is an essential nutrient for crop production, it has grave health and environmental consequences (FAO, 1996). Maintaining a healthy ecosystem and preserving

genetic diversity requires planning of political, institutional, financial and technical resources. It is a difficult task to gain effective control over agricultural pollution, which is the main reason why over 60% of nitrate is in surface water. For this reason, water pollution from agriculture sources continues and is still unresolved in many parts of the world.

The pollution problem in the European Union has only intensified with the introduction of a common agriculture policy (CAP). The current CAP promotes agricultural production, which indirectly increases nitrate pollution. In the last decades, EU has adopted more than 25 directives to address water issues in addition to regulations and amendments, such as the Nitrate Directive, Water Framework Directive, and Drinking Water Directive. The first step toward successful implementation is to translate EU directives and requirements into national regulations. The implementation of these national regulations depends on the administrative structure and patterns of administrative practice. A successful policy does not stop at the decision making phase, but continues during the implementation phase. Within this concept of implementation as a process, the EU member states have different styles of institutional arrangements that vary according to two dimensions: vertical (centralization versus decentralization) and horizontal (concentration versus fragmentation).

In this thesis, I studied the role of governmental responsibility in establishing, organizing, and launching specific programs to meet EU Nitrate Directive requirements. In order to analyze the compliance with the EC Nitrate Directive of the United Kingdom (UK), and England as a Case Study, I will address the following questions throughout the study:

- How is the UK controlling nitrate pollution and what kind of institutional arrangements exist?
- How much importance is placed on local level input and what opportunities do the local people have to participate in different policy phases?
- Finally, what kind of institutional arrangements, ambitions, and visions will move the EU towards achieving EU Directives requirements?

## **1.2- Structure**

My thesis analyzes agri-environmental institutional arrangements in the UK, with a focus on England. In addition, it explores the role of individuals at the local level (stakeholders) and their participation in both regulating and implementing processes of the EU Nitrate Directive. To begin, I will present a historical background on nitrate pollution from agriculture sources, and how the EU (at a supra-national level) currently deals with this pollution issue. I will also provide an overview of the EC Water Protection Directives and how they are relevant to the Nitrates Directive.

To build on the background information and to further emphasize the problem at hand, I will then outline my research results from a case study on the formal and practical compliance with EC Directives in England. With this information, I will then make an informed assessment the reality of Nitrate Directive implementation in England. To complete the picture of England's approach to water quality protection, I will briefly summarize several lessons that can be learned from this approach. I will finish with a final conclusion, where I summarize my findings, and then a bibliography.

### **1.3- Methodology**

Throughout my research I used a variety of literature resources such as research papers, newspaper articles, and books. I also found information on the websites of the respective environmental organizations. In order to determine the British approach to controlling nitrate pollution, I used books as well as research papers and reports by governmental agencies in the EU and other research institutes.

### **1.4- Limitations**

I began my research with the aim of analyzing the UK approach for controlling nitrate pollution. I found that there are many different legislations and institutions within United Kingdom (UK), and there is much variation between England, Wales, Scotland, and Northern Ireland. In order to analyze the control of nitrate pollution within this limited period, I primarily focused on England. I believe that England will have to pay a substantial cost for every day that they delay acting on nitrate pollution. For this reason, I made the decision to focus some of my research on the implementation of Nitrate Directive in England.

Due to time limitations, the picture may not be complete. However, I tried to point out the main reasons why there is such complexity involved with the implementation of national regulations that address nitrate pollution in England.

## 2- Nitrate Pollution: Causes and Treatment

### 2.1- Background of Nitrate Pollution

Nitrogen composes about 80% of the air in our atmosphere. Nitrogen can be found in a gaseous state as  $N_2$ ,  $N_2O$ ,  $NO$ ,  $NO_2$ , or  $NH_3$  (Gaillard, 1995). Both nitrate ( $NO_3^-$ , an anion) and ammonium ( $NH_4^+$ , a cation) results from lightning photochemical oxidation in the stratosphere. In soil, nitrate can be reduced through a de-nitrification process and become a gaseous form. Bacteria in the soil also convert part of nitrate into organic matter through an immobilization process. On the other hand, Ammonium is converted to nitrate through an oxidation reaction (nitrification process).

Plants consume simple forms of nitrogen (nitrate and ammonium) to provide the amino acids and nucleic acids that are needed for building essential components for animals (e.g., DNA, RNA, and Vitamins). Nitrate is the preferred form of nitrogen by most of plants, and is therefore an essential nutrient for life, so how could it possibly become a pollutant?

Nitrate is the most soluble anion and in turn, it is highly leached out of root zones. The leached nitrate represents the part that has not been taken up by crops, converted into gases by de-nitrification, or immobilized as a part of organic soil matter. As Bocher (1995) suggests, nitrate will face one of the following fates: "it is taken up by plants, stored in soil, lost to atmosphere, lost to groundwater, or lost to runoff". The last three processes listed are considered as the main contributors to pollution. The main source of nitrate pollution is the misinformed and poorly managed actions of farmers, such as over-fertilizing to

keep crop yields constant. The storage of manure in large holes in the ground is also considered as an additional source of nitrate pollution since it increases the leaching of pollutants from manure into the soil. As a result of these uncontrolled practices, the nitrate concentration will grow and exceed 50 mg/liter, which is the EU directive limit. The problems associated with such high levels of nitrate (above 50 mg/liter) are explained below.

- **How is Nitrate Harmful to Our Health?**

Despite the fact that the effects of nitrate pollution on human health are still unsure, many studies confirm a link between high levels of nitrate in drinking water and the production of N-Nitrose compounds in digestive tracts, which cause stomach cancer in adults. Two studies that were performed in the United Kingdom have shown an inverse relationship between nitrate levels and stomach cancer (Payne, 1993; Forman et al. 1985). As well, when there are high levels of nitrate in the body, the excess nitrate reduces to nitrite which leads to the oxidization of blood hemoglobin into ferric iron. Unfortunately, this oxidization process causes “blue baby,” which is a term used when there is a starvation of oxygen in infants (Comly, 1987; Johnson, 1987). Early in the 1990’s, the Center For Disease Control Investigation suggested of probable link between high level on nitrate in drinking water and spontaneous abortions in humans. In addition to human health, the health of our livestock is experiencing similar negative effects from the accumulation of nitrite, causing anemia and abortions (Carpenter et al. 1998).

- **How Is Nitrate Harmful to Our Environment?**

Environmentally, nitrate impacts are more certain. Eutrophication is one of the worst effects of high level of nitrate and phosphors. This is the increasing of

algae blooms which deplete oxygen and kill aquatic life. This is especially dangerous for fish since they require a high level of oxygen to live. In addition, the increase of algae decreases water transparency (Kapoor & Viraraghavan, 1997). Excess nitrogen also reduces the biodiversity of wildlife where the original flora is replaced by only a few dominant nitrophilic species. High loss of ammonia to the air increases the acid rain for more detail see (GEO report, 2000).

As outlined above, nitrate pollution has a very harmful impact on humans and the environment. It has been found that it is caused by intensive agricultural practices. Within the European Union (EU), the common agriculture policy (CAP) has contributed to increasing nitrate levels in both surface and groundwater. The following sections will take a deeper look at the role that CAP plays in the cause and control of nitrate pollution from agricultural practices.

## **2.2 – Nitrate Pollution’s Dependence on Common Agricultural Policy**

The establishment of a Common Agriculture Policy (CAP) transferred the responsibilities from national level to EU level. Under a “self-sufficient” slogan, CAP went into effect in 1963. Its initial objectives were set out in Article 39 of Treaty of Rome in 1957, and the objectives were:

- To increase agricultural productivity.
- To secure a reasonable standard of agricultural community life.
- To stabilize markets and secure the stability of supplies.

- To provide supplies to consumers at sensible prices.

The Common Agricultural Policy (CAP) was geared towards governing agricultural production and the marketing of these products. In fact, CAP has achieved its objective successfully and it forms a small part of EU economics where it is responsible for about 2% of the GDP and 5% of employment. However, CAP has had a significant negative impact on natural resources, accounting for 45% of total land use and 30% of total water use (Parris, 2001).

Unfortunately, while CAP has promoted a large expansion of agricultural production, it continues to allow farmers to use non-ecological substances, such as a surplus using of fertilizers and pesticides. In turn, these practices have serious detrimental effects on the environment. Poor water quality, a loss of bio-diversity, air pollution, destruction of landscape, and climate change are all negative side-effects of the recent increase in agricultural production. The awareness of the environmental side effects caused by the intensification of agricultural productivity first surfaced in the 1970's. Increased awareness of this has led to a series of reforms of the initial CAP which are outlined below.

- **Introduction of Milk Quota in 1984**

Dairy products became controlled when the Milk Quota was introduced in 1984, which was the first CAP reform. It was based on "Total Assured Quantity (a quota of each country), Reference Quantities (the producers' and/or purchasers' quotas), and the Milk Tax (**applicable** taxes if producers exceed their reference quota)". (Alliance environment report, 2008)

This Milk Quota was a sensible and effective way to limit milk production in the EU and the domestic consumption of dairy products in the EU was glutted (Delayen, 2007). Initially, the Milk Quota was established to continue for five years but this period has been extended four times from 1988 up to the last CAP reform in 2008. The first extension was made as a part of “Agricultural Stabilizers” which lasted until 1992. The 1992 Reform extended it again until 2000 and then the Agenda 2000 Reform further extended it all the way to 2008. The current extension was granted under the 2003 Mid-Term Review and it will now stretch until 2015. The “Health Check Reform” in 2008 proposed a flexible expected approach to phase out the Milk Quota system in order to give the dairy sector the right to demand clarity and alter successfully. Table 1 briefly outlines all of the extensions including the main measures involved in each extension period.

In summary, as the intensification of milk production became financial and environmental burden, the Milk Quota was introduced. It was an attempt from EU to curb the overproduction, maintain more stable milk prices, and maintain the supply at predictable level. These objectives led to the achievement of improved market stability and the assurance of sufficient farm profits.

**Table 1: Developments of the EU Milk Quota System**

Event	Measures and Outcomes
Emergence of the Milk Quota 1984	<p>The Milk Quota System was introduced in 1984, initially for 5 years and then extended to 1992;</p> <ul style="list-style-type: none"> <li>• Permanent transfer of Milk Quota with land introduced in 1985</li> <li>• Temporary transfer of Quota permitted at Member State level from 1986/87</li> <li>• 1988: 2% permanent cut in Milk Quota</li> <li>• 1989: 1% permanent cut in Milk Quota</li> </ul>
CAP Reform 1992	<p>Milk Quota extended until March 2000;</p> <ul style="list-style-type: none"> <li>• Permanent transfer of quota without land ('special transfers') permitted at Member State level</li> </ul>
Agenda 2000 Reform	<p>Milk Quota extended until 2008;</p> <ul style="list-style-type: none"> <li>• Increased milk quotas (IT, EL, ES, IE, NI for 2000/1 and 2001/2, other Member States by 1.5% from 2005/6 to 2007/8).</li> </ul>
2003 CAP Midterm Review	<p>Milk Quota extended until 2015;</p> <ul style="list-style-type: none"> <li>• Increases in milk quota scheduled for 2005 deferred to 2006.</li> <li>• Inactive producers no longer able to continue holding quota (Thomsen case)</li> <li>• Strict limits on temporary transfers</li> </ul>
Health Check Reform 2008	<p>Proposal to phase out the Milk Quota System.</p>

*Source:* Evaluation of the Environmental Impacts of Milk Quotas Final Deliverable Report – 30/07/2008

- **MacSharry Reform in 1992**

The MacSharry Reform represents the first environmental reform of CAP. This reform introduced new subsidies to farmers who carry out environmentally-friendly practices. The farmers had to set aside a certain amount of their land as well as limit the number of animals per hectare in order to be entitled for these subsidies. It was under the 1992 Reform that the level of support for cereals was reduced by 29 percent and for beef by 15 percent. There were also payments given to those who limited stocking levels and introduced measures to promote forestation and other environmental protection practices. The MacSharry Reform mostly focused on cereals, oil, protein crops, and beef, but it was a monumental turning point toward agri-environmental aid.

About 90% of the CAP budget accounted for the first pillar “market regulation and income support”, while the second pillar was more focused on agri-environmental aid such as “accompanying measures” in the 1992 reform and “rural development regulations” in 1999 (Jacquet, 2003). In order to support an input decrease, an alteration to organic farming, and biodiversity protection programs, the second pillar was financed equally by member states and the EU budget.

Evidently, environmental issues became a higher priority during CAP reforms that started in 1992 and it continued to be a priority under the Agenda 2000 Reform and other upcoming reforms. This reform represents the first step towards transforming intensive agricultural practices into environmentally friendly agricultural practices.

- **Agenda 2000 Reform**

In Berlin, 1999, the EU launched Agenda 2000 as an action program to encourage competitiveness, improve the safety and quality standards for food, and provide insurance for the agricultural community income within reasonable standards of living. In addition to this, there were two regulations that were connected to the improper use of nitrogen and phosphorous. The first regulation, 1259/99, called for indirect payments to farmers for agri-environmental commitments. The second regulation, 1257/99, was targeted towards enhancing rural development. The farmers who protected the environment and maintained the countryside could be compensated. Reducing livestock numbers and maintaining the original landscape was considered a good farming practice under Agenda 2000.

The funding of the second pillar of the CAP adopted a “Multi-functionality Approach” and this represented the CAP framework until 2005/2006. Based on this approach, the funds could be transferred between the first pillar (of the earlier CAP) and the second pillar. The first pillar of CAP tackled the support for agricultural product; however the second pillar tackled support for agri-environmental schemes and subsidy programs for long- term goals of development (Gallego-Ayala & Gómez-Limón, 2009).

- **The 2003 "Fischler" Reform**

The 2003 "Fischler" reform was essentially planned as a review of the 1999 policy reform's "Mid-Term Review". Concurrently, there was an increased engagement of 10 new countries into European Union. This reform was implemented through two regulations. The first, and most important regulation, was one that introduced the new key fundamentals in the CAP reform, which addressed the future of the Single Farm Payments. New rudiments for single farm payments were put in place, such as respecting public health, animal health, environmental and animal welfare, EU norms, and overall good agricultural practices. This reform used a "Cross-compliance Approach", which meant that payments would only be distributed if "cross-compliance" provisions were met. The second regulation made farmers gear their productions towards the markets in need and the demands of consumers. Once again, payment would only be provided if these "cross-compliance" provisions were appreciated.

In the areas of support, the member states had the choice to keep some subsidies "partial decoupling payments" linked with restricted production. France decoupled the payments for sheep at 50%, while in Great Britain, all payments were decoupled. Under this reform the EC agreed on a process called "modulation" in which they were able to move some funds from Pillar I "Old CAP" to Pillar II "Rural Development Budget". In turn, Pillar II was increased by €1 billion a year in 2008.

Clearly, the 2003 CAP Reform established important principles, comprised of the decoupling of income support from production support. In addition, it freed the funds needed in order to promote the compliance with some broader objectives of regulating environmental pollution and animal welfare, and preserving traditional rural landscapes.

- **The “Health Check” of the CAP Reform 2008**

The “Health Check” of the CAP Reform was the most recent development of CAP. It was adopted to reassure farmers that there will be no additional reforms. It represents the last opportunity for CAP to reform before the debate about EU budget that will take place after 2013. This reform completely changed the way that the EU provided support to the farm sector. The key elements of the reform were entered into force from 2004 to 2007 and covered the following issues:

- A single farm payment was combined with severe compliance mechanisms of respecting environment, food safety, animal and plant health, and animal welfare standards. In addition, it was made independent from production.
- Adoption of a “cross-compliance” approach to keep all farmland involved in good agricultural practices and environmental condition.
- An increase in EU funding to strengthen rural development policy, as well as new measures to help farmers meet EU standards for environment, water quality and animal welfare started in 2005.

- Acceptance of the “modulation” approach to reduce the direct payments to bigger farms and provide funding to the rural development policy. This was done to take financial control and guarantee a fixed farm budget up until 2013.
- Reduction of the monthly increments in the cereals sector by half, asymmetric price cuts in the milk sector, and reforms in other issues such as rice, durum wheat, nuts, starch potatoes and dried fodder sectors.

The EU Finance Minister suggests that the EU budget for CAP will reduce after 2013. The tax-payers money will go towards research, workforce and economic growth. In addition, it will go towards other issues which more acceptable to tax-payers, such as subsidies for farmers in less-favored Areas and promoting specific environmental or land management benefits for rural areas. The “Health Check” of CAP reforms is considered a preliminary action for the budget review and a trend away from funding the first pillar “old CAP”. The concept of “Modulation” was first introduced in Agenda 2000 Reform as a voluntary action. In the 2003 Reform, it was reintroduced because it was not adopted by member states. Under this reform, it was introduced as a compulsory action (GAIN Report, 2007).

As explained above, it can be concluded that the main objectives of the “Health Check” of CAP Reform were: to improve the Single Farm Payments, to modernize the management tools of the agricultural market, and to take appropriate action to face current environmental challenges. Water management, biodiversity, and climate change are the

three environmental issues of priority that are identified by the new CAP. These priorities are being addressed by targeting subsidies to promote sustainable farming practices (e.g. agri-environmental schemes) and enhance the compliance with environmental laws.

The integration of environment into agricultural policy, especially in relation to nitrate pollution, has been directly influenced by several regulations and directives. As mentioned above, the Agenda 2000 Reform of CAP had an influence, and I will now explain how the Nitrate Directive, Water Framework Directive, and other EU Directives have also had a significant impact.

### **2.3- How has the EU Addressed Water Protection?**

Legislation is a statutory way to regulate, provide, authorize, sanction, grant, declare or restrict. EU has two types of legislation: directives and regulations. A directive is a legislative act that binds one or more member states. Since it is executed by the member state, implementing measures and a timetable for the implementation are required. A regulation is self-executing and there is no need for any implementing measures. An EU regulation directly applies to all member states, while an EU directive is transformed into national laws. The implementation and administration of a directive is based on the constitutional structure of each country. Directives are binding; therefore the member state chooses the form and method of the implementation.

In order to balance the burden of subsidies, taxes, and other economic instruments, and to integrate environmental policies and national or local

policies, the EU has adopted more than two hundred environmental directives. Twenty-five of these directives are related to water issues (Hansen and Kranz, 2003). Water pollution was the first area that was tackled by EU Environmental Policy. This is because water related issues have been one of the top priorities when considering principles of social and economic development and environmental protection. What made the EU want to adopt these directives?

The main objectives of adopting environmental directives are:

- To specify an explicit authority to regulate the environmental protection issues.
- To offer a means for member states to introduce stricter environmental measures.
- To encourage legislation that allows member states to live in harmony with the environment and promote “sustainable and non-inflationary” growth.

Throughout the next sections, I will provide a detailed review of the Nitrate Directive and Water Framework Directive. Both are EC directives that deal with water protection and nitrate pollution caused by agricultural practices.

### **2.3.1- The Nitrate Directive**

The EC adopted the Nitrate Directive in 1991 (91/676/EEC). The Nitrate Directive was drafted in groundwork for the CAP reform in 1985. Although the document declared that “the agricultural policy must take a greater account of environmental policy”, the Nitrate Directive attempts to find a solution for a

series of nitrate problems under environmental authority, rather than under agricultural authority.

There are two specific aims of the directive. The first aim is to reduce the nitrate pollution caused by agricultural activities and the second aim is to prevent such pollution in the future. There are five key requirements that member states must meet in order to comply with the Nitrate Directive:

### **1) Designate Nitrate Vulnerable Zones (NVZ)**

This requires the member states to identify water with nitrate pollution, as well as the land that contributed to this pollution. The identification is based on the environmental standards of Council Directive in 1980 (80/778/EEC), which sets a nitrate concentration of  $50 \text{ mg NO}_3.\ell^{-1}$  as a maximum allowable concentration for human consumption.

By December 1993, the member states had identified the surface and groundwater that had or could have had a nitrate concentration above  $50 \text{ mg NO}_3.\ell^{-1}$  and surface waters which could have an accelerated growth of algae and other plants (eutrophication) that caused by excess of nitrate and phosphate. Electively, the member states can opt to apply this requirement for NVZs to their whole territory, or to identify specific NVZs (Andrews et al. 2000).

### **2) Establish an Action Program in each NVZ**

The transposition of the directive into national laws included the establishment of an Action Program, including “rules” by December 1995. Rules of the use and management of manures and fertilizers had to be implemented by December 1999. The following measures had to be covered in the established rules:

- Control the stocking density by comparing the manure produced on the farm to the available land for spreading manure.
- Forbid manure and fertilizer application during the period of the year when the risk of nitrate loss to water is highest.
- Sufficient storage capacity, plus additional capacity, in order to cover the closed spreading period and unsuitable conditions for spreading.
- Limit the application of manure and nitrogen fertilizer by taking into account several factors such as the crop requirement, soil type, and the residues of nitrogen in the soil from the previous cropping. Table 2 identifies additional actions can be taken at farm in order to comply with Nitrate Directive.

**Table 2: Actions to Consider on the Farm that are Associated with Nitrate Directive**

Fertilizer Application Rate	Farm Fertilizer Plans
Application Practices	Irrigation Controls
Design and Capacity of Animal Manure Storage Facilities	Composition of Animal Feed
Emission Control Measures for Storage Facilities	Animal Feed Practices
Crop Rotation Systems Off-farm with Environmentally Sound Disposal	Ratio of permanent to annual tillage crops when determining cropping patterns or amounts grown
Vegetation cover during rainy periods	Livestock patterns or numbers

Source: Andrews et al. (2000)

### **3) Define A Procedure to Derogate the Application of Nitrogen from 170 Kg/ha.**

The amount is calculated on the bases of animals numbers and the member states can permit up to 210 Kg N/ha for the first four years of action programs.

### **4) Review NVZ Designation and Action Programs**

Every four years (at least), the member states have to review their NVZ designation and the Action Program measures to ensure of the effectiveness of program and the compliance with the code of good agricultural practices.

### **5) Report Progress**

By June 1996, the member states had to report their first four years of implementation of Nitrate Directive to the Commission.

There are some criticisms of the Nitrate Directive. One is that it has introduced vague standards for information required in the report, and for this reason only Ireland submitted its report on time. In addition, the Directive ignores the role of the local and regional authorities. However, it is difficult to succeed in implementing the directive at a low cost and therefore, the assistance of the local and regional authorities can not be neglected. Later in this thesis, I will further discuss local and regional authorities and their role as a sensitive criterion and strategy in implementing the Nitrate Directive.

### **2.3.2- The Water Framework Directive (WFD)**

The Water Framework Directive (WFD) entered into force on December 22, 2000. It was considered a new style of EU decision making, as indicated by the expert of 25 years from the European Water Legislation. To briefly summarize, the Water Framework Directive is meant to promote:

- Achievement and maintenance of a good status for all of Europe's water by 2015.
- Stimulation of the active participation of citizens.

The main advantage of the WFD was that it encompassed many important aspects of a good water policy, which are as follows:

- Sustainable Management Practices: The WFD requires different basic water management to involve the sustainable use of water, control of trans-boundary water problems, and the protection of aquatic ecosystems.
- Integrative Water Management: The integrated management approach involves considering the water, in addition to the entire catchment area and all factors influencing water quality.
- Economic Administration: This aspect represents the most important innovation in the WFD; it required economic analysis in the first phase of the implementation until 2004. It provided cost recovery for water services by 2009, in addition to identifying the most cost-efficient measures.

- **Public Participation:** The WFD emphasized that it should be an open process. This welcomed the inquiry of all interested groups in the implementation of this Directive.
- **Rationalizing the Community's Water Legislation:** Throughout the implementation of WFD, several directives were repealed or will be repealed, as the following Table 3 shows.

**Table 3: the repealed directives which regulating the management of water resources.**

<b>Legislation to be repealed</b>	<b>Date of repeal</b>
Directive 76/464/EEC (Article 6 only): Dangerous Substances	22/12/2000
Directive 74/440/EEC: Surface Waters for Drinking	22/12/2007
Directive 77/795/EEC: Exchange of Information	22/12/2007
Directive 79/869/EEC: Measurement and Sampling	22/12/2007
Directive 78/659/EEC: Fish life	22/12/2013
Directive 80/68/EEC: Groundwater	22/12/2013
Directive 76/464/EEC (except article 6): Dangerous Substances	22/12/2013

Source: Hansen, W and Kranz, N, 2003.

The key goals of the WFD are listed below:

- By 2003, the individual river basins within the national territory should be Identified and assigned as Individual River Basins Districts (RBD). (Article 3, Article 24)
- By 2004, the River Basin Districts should be characterized in terms of impacts and economic of water usage. (Article 5, Article 6, Annex II, Annex III)
- By 2006, the inter-calibration of the ecological status classification system should be applied and come together with the European Commission. (Article 2 (22), Annex V)
- By 2006, operational monitoring networks are to be made. (Article 8)
- By 2009, a program of measures to achieve the environmental objectives of the directive is to be identified. (Article 11, Annex III)
- By 2009, the River Basin Management plans for each RBD will be published. (Article 13, Article 4.3)
- By 2010, there will be an enhancement of sustainable water resources by implementing water pricing policies. (Article 9)
- By 2012, the measures of the program will be made operational. (Article 11)
- By 2015, the environmental objectives will be achieved through implementing the program measures. (Article 4)

The report of the first stage of the implementation process, in March 2007, emphasized the unsuitable transposition of the directive into the national law. It also brought attention to the delay that many member states have faced with trying to incorporate economic instruments into water management (CEC, 2007). In this progress report, the Commission introduced several actions to enhance the implementation results, such as a common implementation strategy (CIS), the integration of the WFD into other policies, and recognizing the role of climate change in implementing the WFD.

### **2.3.3- Other Directives Relevant to the Nitrate Directive**

European legislations in the water sector have begun to include water quality objectives. Such legislations include: Bathing Water Directive (76/160/EEC), Freshwater Fish Directive (78/659/EEC), Shellfish Water Directive (79/923/EEC), Dangerous Substances Directive (76/464/EEC), and Ground Water Directive (80/68/EEC). This wave of legislations was initiated in order to control the quality of specific uses of water. In 1988, the European legislations focused on pollution control, which addressed pollution from urban waste water (91/271/EEC) and water nitrate pollution due to agriculture (91/676/EEC). Most of the mentioned directives are overlapped with Nitrate Directive, for example, the “Sensitive Areas” in the Urban Waste Water Directive are similar to “Vulnerable Zones” in the Nitrate Directive. Both directives also tackled the same phenomenon- pollution of water by nitrates. In order to increase efficient and wise use of water resources, communities have begun to adopt more global approaches to water management (Water Framework Directive (2000/60/EC) which has helped to promote a sustainable and the coherent movement in the area of water policy.

## **3 – The Current Reality of Nitrate Pollution in the European Union**

### **3.1- Implementation Issues Faced by the EU**

Agri-environmental strategy should involve three basic elements: 1- Legislation (the policy formulation), 2- Plan of Action (the implementation), and 3- Spatial Dimensions of Regional and Local Conditions). The European Union plays an integral role in the first element by creating legislations (Directives & Regulations), monitoring progress, and litigation. The second and third elements are dealt with at a national level, which will be discussed within the next chapter.

In 1972, European Union's role began with four environmental action programs (EAPs) 1972. These programs mainly focused on limiting pollution and were shaped by commitments to respect the environment, but they lacked legislative force. In 1987, EC added a new title "Environment" to the Treaty of Rome. Articles 130r, 130s, and 130t articulated a need for three actions: the use of guiding principles of environmental policy, the establishment of legislative processes, and the introduction of more stringent environmental measures. Under the Treaty of Maastricht (European Union Treaty) and the Treaty of Amsterdam, the EC adopted the concept of "a policy in the sphere of the environment", which integrated environmental protection requirements into other community policies. The EU improved their environmental legislative power through two fundamental mechanisms: Regulations and Directives (as mentioned in Section 2.3). EU water management has been based on these

Directives due to their flexibility in accommodating national conditions. However, Legislation should not be the only action taken when dealing with water protection. The question is: **Are there additional steps that the EU can take to have a greater impact on water protection?**

The Water Sector is the most regulated area of EU environmental legislations. The formulation of policy is not the only way to achieve good water management. Along with legislations, the EU has played a prominent role in the implementation of EU agri-environmental politics, which has proven to be difficult. This is confounded by the fact that there are many variables and differences found between member states. The most commonly occurring shortfalls are:

- Improper interpretation and transformation into national law.
- Unclear requirements.
- Deadlines are not met.
- Integration into other directives.
- Deficient monitoring of activity.
- Insufficient subsidies.

Over the years, community action has developed in the EU. Further steps have been taken to resolve many of the mentioned shortcomings. Additionally they have adopted a legislation framework that entails a high level of environmental protection. The EC has finally introduced financial and technical instruments in order to monitor the application of each community law. In order to improve on monitoring the proper application of Community law, they adopted the

“infringement procedure”. This new procedure gives the EC the power to address “the first written letter” and “the final written letter” to the member state concerned, and to ask the court to impose a financial penalty on a member state if necessary. It is also important to take into consideration the Environment Agency, which was developed from advisory role and it played a crucial role in adopting new measures and assessing the impact of adopted decisions.

The top-down style of EU policy only increases the complexity of implementation. That is why the EU has started to give larger prominence to the “voice of people”. This allows there to be public participation and transparency in the EU decision- making process. So it is essential for the implementation process to be open to scrutiny by various groups that are affected, such as citizens, non-governmental organizations, and other interested parties. With regard to Nitrate Directive, public participation plays three important roles which are outlined below.

- 1- It opens communication so that, if required, local information can be collected in order to properly designate potentially affected areas.
- 2- It reduces costs through increasing the farmers’ awareness about appropriate usage of fertilizers and pesticides.
- 3- It becomes easier to enforce and monitor national regulations which, in turn, demands substantial efforts to deal effectively with nitrate pollution.

The implementation efforts that have been discussed in the section above show that the EU plays a key role in supporting the successful implementation of targeted Directives. The EU does this through monitoring the process to ensure

that is timely and efficient, raising awareness by promoting social, economical, and environmental benefits, and encouraging others to take responsibility for implementing directives at different levels (national, regional, and local).

### **3.2 – Nitrate Directive Implementation in the UK, with a Focus on England**

The study of the practical implementation of all EU Directives involved with water protection would be an extremely large task. I chose to do a concise case study on the implementation of the Nitrate Directive in the UK, with a particular focus on England. This gave me an indication of how the Directive works in practice in a member state. I have learned of the specific problems that the UK has faced throughout implementation which I will outline now. Then I will go into more detail about my case study on England in the next section.

Implementation of an EC Directive requires the adoption of necessary legislations by Member States, as well as the ongoing monitoring of the Directives application. In the case of the UK, most of the required legislations already existed. The Water Act, from 1989, was one of the UK's efforts made to reduce water pollution from agricultural practices, which was considered an important source of Nitrate pollution. Under the authority of section 112 of the Water Act 1989, the Ministry of Agriculture, Fishers and Food (MAFF) determined the most effective methods to control Nitrate pollution in specific areas. These areas were referred to as Nitrate Sensitive Areas (NSA) and the goal was to reduce Nitrate pollution on this specific agricultural land. Farmers within the NSAs could voluntarily sign a contract with the Minister of Agriculture, Fisheries and Food (MAFF) in which they agreed to follow a set of

commitments (S.I. 1990). This contract entitled farmers to annual compensation that reflected the losses caused by restricting farming practices, and gave the MAFF a means to observe and assess the efficiency of land management measures. In addition to NSAs, UK introduced a scheme to reduce nitrate pollution by converting arable, farming land into grassland. This was accompanied by payments to compensate for converting land to unfertilized and un-grazed land (S.I. 1993). In fact, the UK had already adopted restricting farming practices with financial compensations to reduce Nitrate pollution prior to the adoption of the Nitrate Directive by the EU. Under Nitrate Directive, all of the UK areas that were designated as NSAs also fell within EU areas that were designated as Nitrate Vulnerable Zones (NVZs). Therefore, they remained eligible for compensation payments.

While the UK has taken some positive steps to address agriculture as a main source of Nitrate pollution, they still struggle with implementing the Nitrate Directive. About 85% of the UK environmental requirements were derived from EU Directives and were later translated into legislations. There were separate legislations produced for England, Scotland, and Wales and Northern Ireland (Shenot, 2005). Now, more than seventeen years after the initiation of the Nitrate Directive, the UK government has failed to adequately implement the Nitrates Directive. England has noticeably high Nitrate concentrations that are close to exceeding the EU limit. As a consequence, the government has leaned toward more strict rules (Jacobson et al. 2002).

I will now outline what I have discovered from my case study on England's compliance with the Nitrate Directive. There are several acts of "formal compliance" (legislations & institutions) and "practical compliance" with the Nitrate Directive that have led to problems in England.

### **3.2.1- Case Study: England's *Formal Compliance with the Nitrate Directive***

England is part of the United Kingdom and its population represents 48% of the total UK population. Within England's population, 19% of people live in rural areas. London is the capital of England and it is the only region in England void of rural districts. England has 50.351 square miles of land and over 70% of this total land area is used for agriculture. Land use in England is classified as follows: 19 per cent urban land and non-specified land, 9 per cent forest and woodlands, 36 per cent grasses and rough grazing, 30 per cent crops and bare fallow, and 5 per cent other agricultural land. There are excessive Nitrate levels produced from agricultural sources which have reached drinking water. England drinking water has exceeded the maximum Nitrate (NO<sub>3</sub>) concentration (50 mg/l) allowance that was established and set by the EU Drinking Water Directive (Seymour &Cox, 1992).

In the attempt to control water pollution, England has passed through several phases of institutional re-arrangements. Before 1972 the local government departments combined with water supply sub-sectors to take responsibility for initiating pollution control infrastructure while regulations related to water management were the delegated to river authorities (one for each one of the nine major river basins). From 1972 to 1982 there was a trend towards increasing the scale of organizations and combining all water management functions into a single entity. This led to the creation of nine water authorities, through the mergence of many sub-sectors, which brought regulatory and executive functions together. Between 1982 and 1989, the water authorities were placed under supervision of the national environmental ministry in order to increase the efficiency and effectiveness of these authorities.

After 1989 there was a push to meet the requirements of the EC Environmental Directives. As a result, the government sold the water supply and waste water infrastructure to public and private investors, whereas water quality management functions and river management rested under National Rivers Authority (NRA). In order to ensure that water companies complied with government policy, the Office of Water (Ofwat) was created as a financial regulator. In 1996, an American-style environmental protection agency (the Environmental Agency) was created (Helmer and Hespanhol, 1997). In 2001, a new organization formed to represent the integration of agriculture and environmental bureaucracies which was called the Department for Environment, Food and Rural Affairs (Defra). This government department was established to deal with all aspects of water policy in England and to help regulate drinking water quality, quality of water in rivers, lakes, coastal and marine waters. Defra played a very important role in the regulation process in England. It was Defra that pushed the cabinet level to take responsibility for environmental and agricultural issues, most remarkably at the EU level, which led to policy development for England.

Formal compliance is achieved through choosing a competent authority to manage the water sector, as well as establish legal regulations. The beginning of water pollution control in England began in 1951 when it was stipulated that the Rivers Board assent to sewage and industrial discharge. The administration for the legal framework was split between the Department of Environment and Regional Water Authorities (MAFF, 1993). Then, the Water Act in 1989 centralized the water pollution responsibility to the National Rivers Authority (NRA). It was replaced again by the Water Rivers Act in 1991, which was revoked later with the enactment of the Environment Act in 1995. The burden

was then transferred to the New Environment Agency in April 1, 1996 (Ball & Bell, 1991).

Nitrate Sensitive Areas were designated with a flexible provision by Water Act 1989. The Water Resource Act in 1991 included similar provisions that imposed mandatory requirements, with or without compensation. Section 94 delegates the designation of Nitrate Sensitive Areas through the enactment of statutory instruments to determine which activities are carried out in the designated areas (Howarth, 1997). Section 95 authorized voluntary management agreements between government and landowners or tenants. These provisions were signed by appropriate Minister and published as statutory instruments. They represent the early Nitrate programs in England. Early efforts to integrate environmental goals into agricultural policy were evident when the Agriculture Act in 1986 authorized Environmentally Sensitive Areas (ESAs). The farmers who signed an agreement for multi-year management under this act received annual payments and prohibition practices related to specific time periods of the ESA such as harvest, cultivation, and application of fertilizers. The ESAs were partly supported by EC funding, and later became a component of the agro-environmental measures authorized in regulation 2078/92. This formulated a background for the evaluation of Nitrate Sensitive Areas (Agriculture Act, 1986, Council Regulations, 1991, and Council Regulation, 1992).

The Ministry of Agriculture, Fishers and Food (MAFF) paved the way to the pilot scheme under Section 112 of the Water Act 1989. This involved conducting a theoretical study to determine the most effective methods in controlling Nitrate pollution. The results showed that the appropriate solution to Nitrate pollution largely depended on the characteristics of each individual area.

Acting under the Nitrate Sensitive Areas (designation) Order from 1990, individual areas were labeled as Nitrate Sensitive Areas, These NSAs had Nitrate concentrations that surpassed or could surpass the EC standard and they encompassed about 10,500 hectares of England (Nitrate Sensitive Areas, Order, 1990).

Later on, the Nitrate Advisory Areas (NAA) added ten NSAs into the pilot scheme, increasing the total area to 20,100 hectares. The farmers within the NAA received written advice about how they could change their practices to reduce Nitrate, including recommendations for applications of Nitrogen fertilizers. There was no compensation other than the free advice that was provided and frequent visits were made to these areas to help monitor farmers compliance to the recommendations for good agriculture practices (MAFF, 1990).

Under regulation, in accordance to the agro – environmental measures of the Mac Sharry CAP reform in 1991, each member state had to design multi- annual programs to promote sustainable agriculture practices. These were mandatory programs for the member states, but only required voluntary participation to farmers.

The UK utilized the Council Regulation 2078/92 to continue with several programs which they already had enacted to promote environmentally-friendly practices (Council Regulation, 1992). In 1994, England launched twenty – two new NSAs, adding 35,000 hectares to the pilot NSA scheme to protect ground waters. In 1995, they re-launched the ten pilot NSAs as part of the 1994 scheme, summing up to thirty- two NSAs with a total areas 45,000 hectares of land (MAFF, 1994). These were identified as NVZs by policy makers under EC

Nitrates Directive 1991 (S.I. 1995). On the first of June 2006 a regulation came into force to protect water against agricultural nitrate pollution in England and Wales. This amended the regulations made in 1996, which implemented Article 2 of Directive 2003/35/EC. It confirmed public participation in the preparation, review, or revision of any action program in England or Wales. Regulation 3 only applied to England to ensure application of public participation for additional designation of NVZs, which were designated by regulations in 2002 (S.I. 2006 No. 1289). Defra launched consultation on its proposed Action Program in summer 2007. Some of the proposals were welcomed, but others needed further refinement, which was given by the Nitrate Directive to the 195,500 farmers who would be affected (Defra, 2008).

In addition to institutional arrangement and regulations, England's concerns about agriculture and the environment are increasing. Many steps to encourage farming practices to protect water from Nitrate pollution have been introduced within the EU policy framework, and those steps have translated into the schemes summarized below:

- UK designated Nitrate Vulnerable Zones (NVZs) must comply with EU Nitrate Directive (91/676). In 1996 there were 72 designated NVZs, bringing total coverage to 55% of England. As published in December 2007, the NVZs will cover 70% to 100% of English farm land. The farmers within NVZs have to comply with mandatory measures including limitation of fertilizers application and organic manures within closed periods as well as keeping records for these applications and waste handling and storage facilities.
- The Nitrate Sensitive Areas scheme designated areas to reduce or stabilize nitrate levels in public water supplies. The scheme offered five-year

voluntary agreements to farmers for adoption of specific practices to comply with this scheme.

- The Organic Farming Scheme offers payments to farmers to promote conversion to organic farming and to help existing organic farmers. In 2005 Defra replaced its agri-environment schemes (including OFS) with a new scheme (Environmental Stewardship Scheme).
- It is important to address the diffuse pollution from agricultural and non-agricultural sources, so Defra has begun parallel reviews which include the transport and construction sectors, industrial sources, the forestry and contaminated land such as:

**Integrated Water Resources Development and Management:** In November 2002, the government published a policy document called `Directing the Flow-Priorities for Future Water Policy` to encourage water companies to integrate their approaches to water policy issues, which illustrates the Environment Agency's role in achieving sustainable management of water resources.

**Defra and the Department of Trade and Industry (DTI):** DTI has produced guidelines for environmental reporting that set out indicators for how to produce a good quality environmental report, where the guidelines were developed with a wide range of stakeholders.

**Impact of Climate on Water Resources:** In February 2003, the government published a report on the impact of climate change on water resources, outlining how water resources will be affected by longer, drier summers and milder, wetter winters. This will place more stress on water resources, causing

the Environmental Agency and water companies to consider changes to their 25-year forward plans of water resource management.

**Envirowise:** Envirowise is a program run by Defra and DTI to deliver practical environmental advice about a range of issues. The Codes of Good Agricultural Practice for the Protection of Water were published by the Ministry of Agriculture, Fisheries and Food (now Defra) to provide practical advice for avoiding pollution. The Agency provides information on water resources through its website and helpline, which connect callers to advisors in local Environmental Agencies,

**Research and Technologies:** To improve the understanding of water resources protection and to develop the standards for the sustainability of agriculture, the government has a wide-ranging research program and has funded research into water resources. Furthermore, the Research Council, along with the Department for International Development (DFID) and other international bodies have contributed to a range of training and research programs in developing countries covering issues such as water resources, agriculture, forestry, and human health. As Macleod et al, 2008 recommended, the UK government adopted an integrated approach between the research and policy communities. Their recommendation depends on the lessons concluded from two mechanisms adopted by UK government: the close-down and opening – up. The closed-down activities included the policy research cycle, while the opening – up confirmed the importance of increasing social capital such as sharing, reciprocity, trust, and increasing the awareness of the way in which the projects are carried out and regulations are implemented (Macleod et al. 2008).

The agri-environmental schemes that are reviewed above offer voluntary and competitive programs to tackle environmental problems, where farmers receive funding from government only if they are accepted into the programs. The government offers published reports, practical advice, a website and helpline to provide information about these schemes.

It can be concluded that England has a very centralized approach to environmental protection. The main reason behind the centralization is the choice of Defra and the Environmental Agency as competent authorities, because the decentralized institutions are unable to generate the required finance and technical knowledge (Green and Bilbao, 2006).

### **3.2.2- Case Study: England's *Practical Compliance with the Nitrate Directive.***

The current implementation of European Directives faces practical problems not only in England. Similar problems are reported in other Member States such as the Netherlands, Belgium, and Spain. The reasons behind the problematic implementation of processes are very different from one Member State to another and even from one directive to another, as shown by the deficits of EC Directives implementation (chapter 3).

The UK government now takes the issue of controlling Nitrate pollution from agriculture sources more seriously than in 1970. Under the EC Nitrate Directive, twenty-two areas were added to ten sensitive areas that were already identified by National Rivers Authority (NRA) and designated by MAAF under the Water Act 1989. Farmers are compensated annually based on expected reduction of income in return for the limit of fertilizers, area of bare land, and change management of organic manure. In 1994, the NAR formulated the government

consultative proposal for implementing the Nitrate Directive by establishing 70 Nitrate Vulnerable Zones, in addition to providing water quality data, boundaries of NVZs, and Action programs to reduce the nitrate pollution from agricultural sources. The designation of the NVZs represents the first step for implementing the Nitrate Directive. The government has two years to put the Action Plan into place, and four years to implement its plan. In December 2000, the European Union of Justice judged that the UK had not adequately identified polluted water and designated the nitrate vulnerable zones (NVZs). The Court decision pays specific attention to the following question. **Why has the UK government failed to comply with the EU Nitrate Directive?**

Throughout the implementation process, the government has not been clear about which measures will be selected, or if they are effective in reducing Nitrate pollution to meet the quality standards. Furthermore, they lack information about the intention to reduce Nitrate pollution in the long-term and what grants will be introduced to farmers in NVZ areas. The government has also failed to adequately designate Nitrate Vulnerable Zones since they omitted all surface and ground waters not used for drinking, which limited the designation of the areas as NVZs.

After receiving a Commission letter, a "Letter of Formal Notice" in December 2001, the NVZ land covered about 55% of England's land and this could increase to 70% or 100% of land as published in the Defra Consultation of December 2007. Increasing the area of NVZs is not a unique change under the pressure from the European Commission. Many other steps have been taken to address Nitrate levels such as: increasing the length of the closed period, expanding the regulations to cover more land, increasing on- storage of slurry.

All farmers now have until 2012 to comply with the closed period and slurry storage regulations.

Despite the above efforts that were made to comply with the EC Nitrate Directive, Defra published several comments about the Nitrate Directive. Among the most accepted comments were:

- The Nitrate Directive is an old-fashioned directive that lacks the flexibility of more recent EC Directives.
- It is based on unclear requirements.
- It lacks specific action programs.
- The deadlines are not applicable.
- The implementation of directive will be integrated with new framework directive. This means, the re-evaluation of Nitrate Directive implementation process will be more complex once combined with WFD.

The next question is “**Does the English system to comply with the EC Nitrate Directive work?**” Through the next section, I will analyze the performance of Nitrate Directive by looking at three indicators: the change in nitrate levels since the Directive was adopted, the main problems, and the cost effectiveness of the applied programs. To further understand of how the government responses to stakeholders comments, I will focus on a consultation paper that was launched in August 2007.

### **3.3- Does England's System Comply with the EC Nitrate Directive?**

#### **3.3.1- Nitrate Level Trends**

The main objective of the Nitrate Directive is to achieve declining levels in nitrate. Therefore a nitrate level trend is the best indicator of how effectively England has used the approved system to control nitrate pollution. This trend has been analyzed from different stake-holders viewpoints, as I will demonstrate below.

The National Farmers Union (NFU) reported that a number of important rivers with large catchments in NVZs showed a 20% downward trend. Specifically, they found a 20% reduction in the Rivers Trent, a 10% reduction in the Thames, and a 15% reduction in Warwickshire Avon. On the other hand, the Severn and Great Ouse Rivers show a static 15-year trend. The NFU's analysis didn't include groundwater because the nitrate levels in groundwater reflect the farming practices before implementation of Directive.

Defra monitored points on England's rivers and found that 77% were static or declining between 1999 and 2004. That decline was attributed to:

- A change in farming practices, especially reducing nitrogen fertilizers use by 40% from 1987.
- A reduction of livestock numbers which led to a reduction in manure applications.

- Improvement of crop management techniques.
- Increased contribution of farmers.

Despite the fact that groundwater reacts more slowly than surface water, 27% of the groundwater sites show downward trends. The rising trend that is found on the rest 73% of the monitoring sites has been attributed to poor land use up to 20 years ago, or more.

The Environmental Agency analyzed 7,300 river monitoring points and it was found that 17% of those sites exceeded the 50mg/l (limit for drinking water), and the levels in the groundwater had increased. These results are most likely due to the ineffective application of the current system. Unfortunately, they have not been able to change the pollution trends to decline or at least prevent an increase in pollution.

The Tenant Farmers Association (TFA) confirms the positive side of the nitrate trend, and they believe there has been a localized substantial improvement in nitrate concentrations in recent years, even over a wider number of catchment sites than have been suggested. The TFA and the NFU have agreed that the land previously designated as NVZs, that have shown downward trends in nitrate concentrations, must be de-designated and there should not be increased regulations in these zones. This argument proposed by the TFA and the NFU argument is based on the data from NFU and it has not been taken seriously by the government.

The Country Land and Business Association stated that the high levels of nitrates in many stable water bodies is due to historical events (affected by the drive for food production in WW2), but the content of nitrates in these water

bodies varies across the country, with general downward trend. The improvement of water quality is likely to be more a function of local efforts rather than through governmental programs, which confirms the need of localized assistance in improving their water facilities.

### **3.3.2- Targeting Nitrate Pollution Problems**

The effects of reducing nitrate levels led me to think about targeting the problems which represent the main barriers in addressing the causes of pollution, putting the appropriate 'Action Programs' in place to deal with the current problems, and competently facing future problems. Action Programs represent the second requirement of the EC Nitrates Directive. Alternatively to the designation of NVZs, the member states can decide on applying an Action Program across their whole territory. The UK government chose to designate NVZs and impose Action Programs within these designated areas. The imposed Action Program represents appropriate practices in the form of rules and mandatory measures which address the use and management of manures and fertilizers in order to remedy the main pollution causes. The first designations focus on drinking water, covering 8% of England, were made in 1996, while the second designations were made in October 2002 which increased the designated areas in England to 55%. The initial Action Program was established in May 1998, which constitutes the current Action Program for NVZs. In sequence, sufficient data did not exist for an effective four-year review to be undertaken in 2002. The carefully chosen measures of the current Action Program under the UK conditions are hugely based on scientific knowledge (Shepherd & Chambers, 2007). These measures seek to prevent and/or reduce nitrate loss from soil when leaching or surface run-off occurs in

autumn. All the while, controlling the source of nitrate does not represent the only potential solution.

Source-mobilization-transport represents a common framework used to assess if the measures in the current Action Program are ineffective or if there are any other potential methods that could be effective. A list of over 40 potential mitigation methods to control the loss of nitrates, phosphorus, sediments, and pathogens on farms have identified by Haygarth et al in 2006. This list covers the majority of the current types of potential mitigation methods that are being used. The analysis of these measures showed that:

- The methods are more appropriate for controlling phosphorus/sediments and pathogens than nitrate losses.
- The current Action Program included methods that focused on manure and fertilizer management, while methods such as cover crops and reducing nitrogen fertilizers, which are expected to be effective, were not included.
- Some of mitigation methods that show potential are difficult to incorporate into a farming system and/or bear a high cost.

The effectiveness of a measure is not only dependent on its capability to control leaching and nitrogen pollution, but also on how widely it can be applied.

With regard to management of manure, Defra has adopted a more rigorous approach. NFU states that the major issue for farmers is the rigidity of closed periods and the changeability of soil conditions from year to year. For this reason, the NFU believes that the types of soil should be taken into account in the re-linking of storage with closed period. NFU argues that farmers need to be given a longer period to meet manure storage requirements (more than two

years), due to the time required for planning, securing financing, and obtaining planning permission.

Again, the frame of regulations is the main obstacle in achieving compliance with the obligations. Furthermore, the closed period for manure application carries a risk of increased ammonia emission.

The NFU demonstrated in its letter to Defra in 30 April 2006, that it had serious concerns about the shortcomings of the previous methodology and operations. The most important concerns emerged with the Nitrate Assessment Technical Group and the Steering Group, who were overseeing the review of designation. Defra invited all stockholders to attend this review. The happenings are listed below.

- De-designation was not discussed.
- Designation of entire upstream catchments was discussed by Defra.
- Exclusion of the technical group and other stockholders from deciding whether to use a new principle for defining boundaries, one which depends on the direction of flow within the groundwater bodies.
- Removal of all inactive monitoring sites; this meant that any improvement in nitrate levels in such locations would not be taken into account in the designation process.
- Operation of methodology represented the NFUs' biggest concerns. Defra's decision to keep a closed process has not helped and caused a reaction from NFU because it limits their ability to provide or implement the new proposed methodology properly.

The trade association for the dairy industry, which was represented by Dairy UK, has referred to the proposed two years period as inadequate and attributed that to the new slurry storage facilities, which undertake lengthy planning applications (about 12 months). This period will be even longer if appeals to the procedures are invoked, which could mean that the construction of additional storage capacity will be in a single year. This will in turn lead to inflated prices with no capacity to meet demand. Therefore, the four years transition period proposed by Dairy UK will be more suitable.

With regard to estimated loading limit proposed by Defra, Dairy UK believes it will affect about half of all dairy farmers in NVZs, which will force farmers who can not meet the whole farm limit on livestock production to choose one of two alternatives. The first, they will have to acquire more land and that will impose additional costs. The second, they will have to reduce their stocking density and that will undermine cost efficiency, meaning fixed costs will have to be spread over smaller output`.

The Association of Chief Estates Surveyors and Property Managers in Local Government, Rural Practice Branch, referred in its memorandum submitted to Defra, to the previous argument. This suggested that the effectiveness of regulations depends on targeting the pollution problems in a more appropriate way, no matter if targets are aimed at a small area with a limited number of farmers, or throughout a wide area. This calls for a well-targeted pollution control approach which supports provisions of regulations and provides advice and support for farmers.

### 3.3.3- Cost – Effective Analysis

The cost-effective analysis is considered the crudest tool to assess the rationality of the existing approach, because many regulations that are efficient are also costly. On the other hand, efficiency is a problem when trying to achieve the same objectives at much lower costs.

The UK government has introduced many costly programs to control water pollution such as setting up capital grants farm wastes handling for many years and applying Farm and Conservation Grant Scheme for developing the storage (Doe, 1993). Furthermore, the free initial advice to farmers about how to minimize the risk of water pollution given by the Agricultural Development and Advisory Service (ADAS) is a costly program, but it is evidently effective in improving water quality.

The prediction measures are the best way to quantify environmental benefits, due to the difficulty of the quantification of benefits. The reduction of nitrates is predicted by Defra as 5.5 -15.5%, however the actual percentage change is expected to be greater. The costs to the agricultural sector from the revisions range from 35.5- £80.8 and 52.8- £105.9 million. The ammonia emissions are predicted to increase 0.2-2% despite Defra's identification of Codes of Good Agriculture Practices. The damage cost from the ammonia increase would be up to £212 million/annum. This clearly shows that reducing nitrate loss is not the only benefit of Action Program and it is important to take into consideration its impact on other contaminants. As NFU mentioned, the negative environmental costs of the revised Action Program, in addition to the social and economic costs, make the net of benefits very doubtful.

The Association of Chief Estates Surveyors (ACES) and Rural Practice Branch provided the county farm service with 62 local authorities (estates). The investment capital was around £9.8 million on all 62 estates in 2006 to 2007. These investments were targeted at the development of modern facilities for pollution management on intensive dairy holdings and this figure represents farms within NVZs, not those in the other farms. These other farms may need additional infrastructure, which is another example of how the side effects of applying an Action Program can reduce the effectiveness. ACES also confirmed that the adoption of anaerobic digestion was a way to manage manure and it would add a management burden on farmers. Particularly, the small intensive units will have difficulty receiving small commercial gain that could be achieved by implementing such AD scheme. According to the Promar's Report, which was based on the study of practical and financial implications to Defra's proposal, the measures relevant to the dairy sector will decrease nitrate losses between 1.1-1.5% per year. Along with this, the total cost to dairy farmers over 10 years would amount to £678 million. Dairy UK mentioned that the costs are disproportionate to the potential benefits. On average, the TFA estimates that dairy farmers will have to spend £50,000 per farm to erect new slurry storage. Under the 1986 Agricultural Holdings Act, it will be the landlords responsibility to meet statutory standards, and most of will not have the financial capacity to do so. Therefore, it is non-debatable from the TFA's perspective that the government has to introduce a grant scheme to help fund to erect new slurry storage.

### **3.4- Discussion of the Realistic Implementation of the Nitrate Directive in England**

This thesis outlines three indicators that determine the effectiveness of implementation: the nitrate levels trend, the targeting of pollution problems, and the cost- effective balance. From my perspective, I chose these because I feel they are critical indicators to consider when assessing the success of any pollution control system.

The nitrate levels trend showed different trends from different stakeholders point views. I found it interesting that such institutions were incapable of specifying one trend. It confirms the reliance of government on its formal organizations (Defra & EA), and it indicated to me that there is a need for adequate and durable institutional arrangements to solve such problematic features (and difficult agri- environmental problems).

The governmental policies represent transaction between the regulator and the farmers. To ensure that it is easier for farmers to comply with the environmental requirements, the provisions of these transactions have to be drawn up from the lower levels (local & regional) to the higher levels.

Local participation plays a significant role in dealing with the heterogeneity of many environmental problems such as soil quality, site, and situation specificity. For the UK, there were three main causes of violation of the Nitrate Directive: one, failure to keep adequate records of nitrate applications within the NVZs, two, the use of excess amounts of manure by intensive livestock farms, and three, storage requirements were not met (Jongeneel, 2007). Such violations explain how the Defra insistence to keep a closed process “as the

NFU described” led to a costly approach in England. The arguments above explain how the past implementation of the Nitrate Directive in England has increased costs, allowed for a deterioration of water quality, and increased the risk of penalty due to infraction of EU rules.

The more debatable issue here is the connection between the acceptance of legislations by farmers and the controllability of measures, many of which add further expense and heavy burdens. The UK control system is enforced by Environmental Agency, which has the power to take lawful action against farmers in the case of non-compliance (Jacobsson et al. 2002). The achievement of objectives is inherently considered part of good implementation. This highlights the importance of social values as an engine to fulfill compliance with regulations and Directives.

The direct participation of farmers who know very much about their land and harmful activities` are necessary in the decision-making process. They can help to reduce costs through a reduction in the time and capacity involved in collecting information that the administrators find difficult to obtain in such detail. The cost of administration, monitoring, and enforcement can be lowered and minimized by using a bottom-up approach (Hanna, 1995). In addition, it is important to form institutions that have effective regimes and governance structure to deal with new problems which arise from changes in agriculture technology and structure. The consequence of poor institutions is that it requires them to take into account actors interests (groups concerned with political decisions), which could translate to regulative ideas.

I paid specific attention to the balance of power between farmers and governmental agencies. I feel that a pragmatic way for the government to deal

with the complexity of agri-environmental issues is to reduce the risk of unacceptance of their regulations by delegating more responsibility of agri-environmental policy to farmers.

In addition to the advantages mentioned above, the exchange of experiences and ideas will stimulate them to introduce solutions to their problems and create an atmosphere of trust between regulators and implemented actors. The importance of trust in natural resources management has been emphasized in much literature (for more details see Polman & Slangen, 2002). This means that policy should include both governmental arrangements and actors involved.

One of the positive steps that have been taken towards creating a network of actors, including regulators and implementers, was the consultation paper that was launched in August 2007. The consultation included 609 written responses, three quarters of which were from farmers. There were over 2700 attendees at the Defra-funded information procedures, which were held in support of the consultation. There were two parliamentary debates, an inquiry by the House of Commons Select Committee on Environment, Food and Rural Affairs (EFRA), and large number of parliamentary questions and letters. Among the most important issues commented on were: NVZs versus whole territory, closed period for organic manure, capacity of storage vessels, and financial assistance. There were many points mentioned in comments made by stakeholders such as to continue with designation of NVZs versus whole territory approach (142 of 609), and to de-designate of NVZs areas that were designated in 2002 (79 of 609). They also argued that the proposals were too long, spreading depends on soil conditions, the costs of the environmental methods cannot be justified (221 of 609), the minimum storage capacity requirements were too long, and that more than two years is a sufficient time

to: obtain the finance, planning permission, and contractual arrangements (120 of 609).

With regard to NVZs, the government provided a procedure to appeal against the inclusion of farmers land within NVZ, in addition to de-designation of approximately 1.5% of England areas that were designated in 2002. As for the issues with the closed period, the government did not intend to alter the length of the proposed closed period. They intended to arrange the closed periods in order of end dates according to soil type, and also put additional restrictions on spreading following the end of the closed period. With regard to the capacity of storage vessels, the government also said that they did not intend to reduce the capacity required, but did increase the implementation time to three years. With respect to the financial support, a new Annual Investment Allowance was introduced under the Capital Allowance Act.2001, in addition to the continuation of previously existing financial programs (CSFDI, RDPE, and FREP)

The government's response demonstrated several positive steps toward creating a network of actors that included regulators and implementers. These efforts were evident through:

- Changes in the Action Program which corresponded to the stakeholders comments, in addition to introduction of replacement actions if the alteration was difficult.
- The introduction of five dedicated officers to join the existing network of forty-two, who's job it was to work closely with farmers and address the practical difficulties associated with implementation the proposed measures.

- The water strategy “future water” was published in 2008, which described the practical governmental steps that will be taken across all sectors to achieve the government’s vision for how they want the water sector to look by 2030. This was an effort made to foster a greater understanding of policy goals by farmers.

It is clear from the items discussed above that most governmental efforts were directed towards the adoption of decentralization and the participation of different stakeholders in agri-environmental issues. The success of such institutional arrangements has been the focus of many literature works (White & Runge, 1995; Veit et al. 1995).

After studying the England implementation of EC Nitrate Directive, I can deduce some important lessons which I have summarized below:

- The merge of agricultural and environmental bureaucracies into a single organization in 2001 represents the first step toward sustainable agriculture.
- Defra, EA, and other advocacy groups, have a holistic view of sustainable Agriculture and the best agricultural practices. This means that such an approach would help to tackle a range of priorities without supporting new regulations on farmers.
- There has been a departure from past policies, with a gradual elimination of governmental support for agriculture, which started in 2005. There is now an investment in agri- environmental schemes (the single payments scheme) where farmers qualify for government support if they maintain their land with good agricultural and environmental conditions.

## 4- Conclusion

This study of England's approach to implement the EC Nitrate Directive shows that the regulatory functions are typically the responsibility of a national government, but are occasionally delegated to full government agencies (such as Defra & EA in England). Whereas, the implementation functions are typically the responsibility of local bodies (farmers). In this paper, I have discussed the role of institutional arrangements, particularly the involvement of public bodies and agencies within all phases of a pollution control system (from regulation stage to implementation stage).

Indeed, there is a need for different institutional arrangements from those that have been used in the past, which is considered to be a challenge for such a centralized government. I argue that, although England and Wales have gone through several phases of institutional arrangements, all efforts led to bringing all water management functions into single entities.

The UK government has tended to remain more centralized. The decision to distribute the responsibilities (planning, regulations, monitoring, implementation, and reporting) between national, regional, and local bodies was made to align with the strict EC environmental directives. Irrespective of that the decision-making process, they are still operating within a central government.

I considered that rearrangements of the existing institutions are necessary to:

- Reduce costs of administration, monitoring, and enforcement.
- Exchange ideas that could translate to regulative ideas.
- Create an atmosphere of trust between regulators and implementers.

- Make the compliance with political regulations easier.

In conclusion, my perspective on the England approach to control nitrate pollution is that despite of this traditional centralization, the government has taken several steps towards decentralization, and possibly towards mixed institutions. These steps are summarized below:

- Changing Action Program based on stakeholders comments made by consultation launched in 2007.
- Introducing more officers to work closely with farmers.
- Publishing “future water” as an effort to help stakeholders understand the government’s next practical steps to achieve its vision for 2030.

These steps indicated that the government is trying to be more open and responsive to local concerns.

Finally, this study touched briefly on lessons that can be learned from the UK approach to control nitrate pollution. These lessons could be used as helpful tips when considering other pollution control systems:

- The first step toward sustainable agriculture is to integrate agriculture and environment into a single organization.
- Give priority to include agricultural issues in environmental regulation issues.
- Take a holistic approach, in which agricultural practices are twisted to achieve multiple benefits.
- Move away from supporting agriculture and start investing in agro-environmental schemes (the single payments scheme).

- Gain citizens trust in their government by taking into account the importance public participation and making it a major priority.

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