Nitrate pollution due to agriculture: project report No.1: policy in the United Kingdom

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August 1995

Discussion Paper in Ecological Economics

94/7

Series Editor Dr. Clive L. Spash

NITRATE POLLUTION DUE TO AGRICULTURE, PROJECT REPORT No. 1: POLICY IN THE UNITED KINGDOM

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Contents Page

INTRODUCTION

This paper is a review of nitrate policy attributable to agriculture in the United Kingdom (UK) as a non-point source pollution (NPSP). The paper provides a description and analysis of the development of UK nitrate policy within a National and European Union (EU) context.

This paper will examine the following areas and will progress in five sections. First an overview of the present situation concerning nitrate pollution in the UK will be presented. This will be considered through the number of abstraction sites for drinking water that are in violation of the 50 mg/l limit. Eutrophication problems attributable to phosphates can be studied in the UK (Loch Leven, Fife, Rutland water, Leicestershire and the Norfolk Broads). The UK's deep coastal waters and extensive tidal movements means that little nitrogen limited marine eutrophication occurs which is not the case for many of the countries bordering the North Sea (OsParCom, 1993). Eutrophication limited by nitrates in freshwater is not as common but is acknowledged in the following Scottish rivers; the Ythan, Eden and those flowing into the Montrose Basin.

The second section will detail the current UK nitrate pollution policy through the Nitrate Sensitive Area (NSA) scheme both the pilot scheme and the scheme to be implemented as part of the Agri-Environment Regulations contained within the 1992 CAP Reform. This is currently the only policy operating in the UK which directly effects agriculture although this will soon be augmented by the establishment of Nitrogen Vulnerable Zones (NVZs) under the Nitrates Directive. No nitrogen tax or quota system (either tradeable or non tradeable) operates in the UK. This section moves on to examine pollution legislation through the operation of the Control of Pollution Act (COPA) 1974, which imposed constraints on the discharge of waste and other effluent, and the Environmental Protection Act (EPA) 1990. This incorporates 'duty of care' standards for waste operations. This section then moves on to consider the implementation of two EU regulations the Urban Waster Water Treatment Directive (UWWT) and the Nitrates Directive. Greater attention is given to the implications of the Nitrates directive because of its' specific relevance to the non-point specific pollution of water by agricultural activity.

The fourth section investigates and details the actors and interest groups involved in the current nitrate pollution debate. The representative actors in the debate are analysed in terms of their attitudes to the debate on agriculture's role in causing nitrate pollution in surface and groundwater sources and also examines attitudes to alternative policy instruments such as a Nitrogen tax or quota (tradeable or not).

1. NITRATE POLLUTION PROBLEMS

The EC Directive on drinking water (80/778/EEC) (OJ L229 30.8.80) set standards for the quality of water to protect human health. Since drinking water sources must be relatively free from contamination this directive provides an environmental gain. The Directive contains some sixty two water quality standards. The standard for Nitrates was set at 50mg/l, which compares with the WHO recommended safe level of less than 50mg/l (although the range 50-100 mg/l was considered safe). The possible implications this has on health is well documented (see for example Hanley (1991)). Compliance in the UK was delayed and deferred. By March 1987 derogations had been made for 197 water supply zones in England

of which 48 were concerned with nitrates (Haigh, 1990). Available figures indicate that the number of abstraction sites exceeding the 50 mg/l limit of the Drinking water directive continues to rise. In 1989 154 sites exceeded the limit rising to 192 in 1990 (MAFF 1993d). This limit is still at the centre of controversy; the farming sector argue that the limit set for drinking water is "scientifically unsound" (Farmers Weekly, 1994) whilst a House of Lords Select Committee concluded that the limit was "prudent" and could only be questioned in terms of cost effectiveness (House of Lords, 1989).

Water passes most quickly through well structured rock types such as limestone whilst rock types with a less fissured structure such as chalk and sandstone reduces the movement of water. This implies a slower movement of nitrate into groundwater and drinking water. The map in appendix A details the location of chalk, sandstone and limestone rock types in England and Wales. Rainfall levels are an important factor in the dilution of N inputs and hence nitrate concentrations. In particular the winter levels of rainfall are crucial. High concentrations of nitrate occur in the drier eastern and central areas of Britain which co-incide with free draining soils (for those more scientifically inclined see Burt et al, 1993). Appendix B reports the location of the pilot and new NSAs, this can be seen to correlate closely with the underlying rock type and rainfall patterns. Two factors that indicate that agriculture may play a part in the solution are firstly, moderate effective rainfall (between 250mm pa and 400mm pa) and secondly aquifers which are rapidly recharged in response to rainfall such as those located in limestone and sandstone (Department of the Environment, 1988).

The main source of increased levels of nitrates in groundwater is agriculture. The losses from agriculture are dependent upon the farming system. This in turn determines the balance between nitrogen inputs (fertilisers and feedstuffs) and the level of nitrogen outputs (harvested crops or animal products). The contribution of atmospheric inputs of Nitrogen are significant. Research estimates that atmospheric inputs of Nitrogen in central and south-eastern England (the location of a number of NSAs) contribute 40-50kg N/ha/yr. Further, on arable land receiving inorganic fertiliser at recommended rates, nitrogen from atmospheric inputs could account for 15-50 per cent of the total nitrate leached, dependent upon soil type and crop cover (MAFF 1993d).

A number of approaches to identifying and quantifying the nature of the nitrate problem exist. Schleef and Kleinhanss (1994) estimates net nitrogen balances across EU countries and regions in an attempt to identify potential nitrate "problem zones". This approach can be contrasted with Lord (1992) who develops a field-by-field estimate of nitrate leaching.

Schleef and Kleinhanss (1994) suggest that a nitrogen-balance surplus of 100Kg/ha would be sufficient to identify countries and /or regions which are vulnerable to nitrate leaching. Table one identifies the countries with severe problems as Germany, Denmark, the Netherlands and Belgium. Table two concentrates on the surplus Nitrogen balance in the United Kingdom and reports the N-balance for the main agricultural administrative regions. The net balance exceeds 100kg/ha in regions which have a high degree of agricultural activity, predominantly by livestock production or intensive horticulture. The regions in the west of England are of potentially lower risk than those areas with high net balance figures in central and eastern England due to the higher average rainfall in the west. The results

reported by Schleef and Kleinhanss (1994) in tables 1 and 2 corresponds to the present situation with regard to identifying and abating high nitrate concentrations in groundwater through the adoption of policies such as Nitrate Sensitive Areas (NSAs) and Nitrate Vulnerable Zones (NVZs).

Table 1: Nitrogen balances for selected EU countries.

Member State	Year	Total N supply from agriculture (kg/ha)	N uptake (kg/ha)	Net N balance[2] (kg/ha)
Germany	1990	210.0	104.5	113.0
France	1990	147.0	79.5	72.0
Denmark	1990	244.5	128.1	103.8
Netherlands	1990	557.8	172.8	318.8
Belgium	1990	379.2	161.0	186.5
United Kingdom	1990	155.2	82.6	71.3
Republic of Ireland	1988	127.5	70.7	46.9
Spain	1989	73.3	49.2	19.4
Portugal	1988	69.5	43.7	18.3
Italy	1990	97.0	59.0	34.2

source: Schleef and Kleinhanss, 1994.

[2] This is the Nitrogen input from mineral fertiliser, animal wastes and depositions from the atmosphere reduced by the nitrogen uptake of harvested crops and ammonia losses to the atmosphere.

Table 2: Nitrogen balances for UK agricultural administrative regions, 1990.

Region	Total N supply from agriculture (kg/ha)	N uptake (kg/ha)	Net N balance (kg/ha)
United Kingdom	155.2	82.9	71.3
North	169.6	85.5	77.0
Yorkshire & Humberside	191.8	103.6	94.5
Humberside	216.7	120.5	108.9
East Midlands	199.3	112.8	99.9
Leices., Northham.	208.8	115.2	103.0
Lincolnshire	203.2	115.9	106.7
West Midlands	196.5	102.1	94.5
Shrop., Staffs.	207.3	105.8	99.4
North West	213.8	103.5	106.1
Cheshire	245.5	122.6	116.6
Lancashire	206.5	96.3	104.8
East Anglia	201.4	112.2	98.0
South East	161.5	92.4	76.7
Essex	182.1	105.5	89.8
South West	191.3	98.1	83.1
Wales	182.5	85.0	85.3
Scotland	96.8	55.2	35.5
Northern Ireland	183.0	88.5	75.8

source: Schleef and Kleinhanss, 1994.

2. UK POLLUTION LEGISLATION

This section outlines the major pieces of legislation that deal with environmental pollution. It then goes on to concentrate on the legislation with particular reference to how it impinges on agriculture.

The Environmental Protection Act (EPA) 1990 sought to finish the reform initiated by the Control of Pollution Act (COPA) 1974. This was accomplished by bringing together a number of statutes dealing with environmental legislation, although provisions for air and water remained in other pieces of legislation. No single pollution agency was established, however an Environmental protection Agency (EPA) will be established in England in Wales in 1995 and its Scottish equivalent (Scottish Environmental Protection Agency (SEPA)) will be formed in 1996.

The EPA uses the *"polluter pays principle (PPP)"*. The Act introduces the idea of Integrated pollution controls (IPC) operated by Her Majesty's Inspectorate of Pollution (HMIP). This has jurisdiction over the most polluting industrial processes (schedule A processes). For the remaining processes the Local Authorities (LAs) have responsibility for pollution control. The EPA imposes a 'Duty of care' on waste disposal operations. Producers, haulage operators and other parties involved in the production and processing of waste must all show a 'duty of care' or the licences they need to operate may be refused. Representatives of the Local authorities, RPAs (Scotland) and NRAs (England and Wales) can enter premises under COPA and EPA (IPC) if they suspect pollution is occurring. The EPA increased the maximum fine (from £2 000 to £20 000) imposed on agricultural and non agricultural water pollution offences. Control of water pollution rests principally, however with the NRA (England and Wales) and River Purification Authorities (Scotland).

Applications for consent to discharge any effluent to a water course are granted under section 32 of COPA (1974). For a point source discharge a number of environmental quality standards for known contaminates are established. This limits, for example, the amount of organic matter in the discharge. One of these criteria for the quality standards refers to the level of ammonium in the discharge, as this is a toxin and also oxidises thus exerting an oxygen demand. The upper level for ammonium is normally set at 0.8 mg/l of nitrogen. When the discharged effluent is in the water then the conditions laid down under section 32 of COPA stipulates the ammonium concentration should not exceed 5 mg/l. If the consent to discharge is breached, the authorities may prosecute depending on the severity of the contravention, although relatively few breeches of consent conditions are brought to court. In a majority of cases the agency will rely on persuasion and threats instead.

Pollution Legislation and Agriculture

The disposal of agricultural waste is exempt from COPA and EPA unless it contravenes the legislation. General operations, such as manure spreading, can be performed, since it is a 'conditioning or otherwise beneficial improvement of the land ' (EPA, 1990).

Powers to enter premises for perceived pollution problems come under the Control of Pollution (silage, slurry and agricultural fuel oil) Regulations and this itself comes under COPA (section 53) as amended by schedule 23 of the Water Act 1989. This legislation regulates the design, the construction criteria for installation of a new system, the substantial

enlargement (defined as more than 10 per cent) or the perceived threat of pollution. The RPA (Scotland) or NRA (England and Wales) can serve notice on the farmer to improve the storage system to prevent pollution.

In 1990, MAFF established a pilot farm waste plan, covering three river catchments in England, this initiative was subsequently extended to other river catchments in England and Wales (MAFF, 1993b). Farmers are offered either a free initial advisory visit from ADAS or written guidelines to prepare their own farm waste management plans, being subsequently checked by ADAS. In addition, a number of river catchments are targeted for an intensive farm waste plan campaign. MAFF also issues Codes of Good Agricultural Practice for the Protection of Water and Air (for example see MAFF 1991). The Code for the protection of Water was introduced in July 1991 for England and Wales. The code provides guidance on the way farmers can avoid causing water pollution. Codes with similar guidance were introduced in Scotland and Northern Ireland (Countryside Management Code). These codes were strengthened in October 1991 with the Water (Prevention and Pollution) Code of Practice Order giving a statutory basis. The statutory basis of the codes implies that violation of the code could be taken into account in legal proceedings, but inadherrence to the code is not itself an offence. The code for the protection of air was introduced in July 1992, whilst Scotland launched the comprehensive 'Prevention of Environment Pollution for Agricultural Activities'. The codes are in legal terms simply guidance to farmers to maintain good agricultural practice. The code for air includes a section on good agricultural practice for 'odours and ammonia'. The information to farmers states that loss of nitrogen as ammonia reduces the potential value of manure as a fertiliser which can directly damage plants through the enrichment of soil by nitrogen and acidification of soil. Ammonia emissions from housed livestock account for approx 35 per cent of all ammonia emissions from agriculture in the UK. Advice on the minimisation of loss of ammonia during land spreading suggests rapidly incorporating the waste to avoid ammonia emissions. Land spreading is estimated to account for a further 35 per cent of ammonia emissions from agriculture. (MAFF 1992).

Groundwater protection legislation

Ground water protection policies in the UK were consolidated by the Water Resources Act (WRA) 1991 (Harris and Skinner, 1992). For agricultural pollution there are two forms of pollution point and non-point sources of pollution. Point source pollution from agriculture is controlled by the NRA under section 88 of the WRA (1991). As for non-point sources of pollution (NPSP) section 112 of the Water Act 1989 introduced Nitrate Sensitive Areas (formerly the pilot NSAs) to control agricultural land use. These controls were extended into the WRA (1991) through sections 93 and 94. Section 93 controls allow the NRA to request the Government to designate areas where land use practices may be controlled to prevent water pollution. Some activities could be prohibited absolutely and some allowed only by formal consent from the NRA. No area has been designated under this section but potentially it could be used for inner zone protection under the NRAs Groundwater Protection policy (NRA 1992). Section 94 controls make similar provisions to s.93 controls but with specific provisions for pollution by nitrates which are excluded from s.93. Thus the pilot NSA areas established under s 112 of the Water Act 1989 are consolidated by s.94 of the WRA 1991. This allows MAFF / DoE to designate areas and pay compensation for loss of income associated with adopting land use restrictions. In addition to these legislative tools the NRA also promotes "education and persuasion" as a tool for encouraging awareness (NRA 1992).

3. NITRATE POLICY PROGRAMMES IN THE UNITED KINGDOM[3]

The following section details the schemes implemented under the legislation discussed above. It progresses in chronological order starting with the pilot Nitrate Sensitive Areas (NSA) scheme and presenting some of the preliminary results for the success of the scheme before moving on to consider the "new" NSA scheme introduced as part of the Agri-Environment Regulations accompanying the CAP Reform agreement. Finally in this section the implementation of the Nitrates Directive is detailed as the designation of NVZs will augment the designation of NSAs within a national agricultural NAPS viewpoint.

The Pilot Nitrate Sensitive Areas Scheme

The main policy programme used by the UK Government has been the Pilot Nitrate Sensitive Areas (NSAs) Scheme. This was designated under the Treaty of Rome and the Water Act 1989. UK Government policy was enhanced with effect to nitrates with the European Commission's draft directive on nitrates (4136/89 COM(88) 708)[4]. This appeared finally as EEC Directive *on the protection of waters against pollution caused by nitrates from agricultural sources* (91/676/EEC). The UK Government's response to the draft proposal was the introduction of the Nitrate Sensitive Areas (NSA) scheme in 1990. The pilot NSA scheme contained two elements, the establishment of Nitrate Advisory Areas (NAAs) and of Nitrate Sensitive Areas (NSAs). Ten sites were chosen and receive compensation under the NSA scheme with nine areas subject to an advisory campaign through the Nitrate Advisory Areas (NAA) Scheme. The 10 NSAs extended to some 10,700ha and the NAA to some 24,000ha. The location of the NSAs established under the pilot NSA scheme are contained in appendix B (are referred to as 'existing NSAs').

The policy aimed to tackle the problem of unacceptable levels of nitrate leaching from farmland into water sources (MAFF 1990a). The NSA scheme makes no direct mention of the 50mg/l drinking water directive limit. However limits are set through the implementation of EC directives, notably the Urban Waste Water Treatment Directive (91/271/EEC) and the Nitrates Directive (91/676/EEC). (Further discussion on these directives appears later in this section). The Nitrate Directive requires member states to introduce restrictions on agriculture in catchment areas for water extraction which either already exceeds the 50mg/l limit, or is at risk of doing so. These areas are to be designated as Nitrate Vulnerable Zones (NVZs) by 1993 (in the original regulations) with adoption of the measures by 1999 (MAFF 1993c).

In the advisory areas farmers were asked to voluntarily undertake to observe restrictions on their agricultural practices. Specific measures included a recommended maximum fertiliser application for the specific land/crop type, the avoidance of autumnal N applications, ensuring single fertiliser applications should be no more than 120 kg/ha, adoption of regulated and systematic applications of livestock manures avoiding excessive applications especially in the autumn, attempts to minimize bare land in the autumn and winter, and guidelines to minimise the ploughing up of grassland.

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[3] A chronological listing of the development of nitrate policy in the United Kingdom is given in appendix D

[4] "Proposal for a Council Directive concerning the Protection of Fresh, Coastal and Marine waters against Pollution caused by nitrates from Diffuse Sources."

The NSA scheme was a voluntary one and represented the more important policy development. It contained two payment tiers, the Basic rate scheme and the Premium rate scheme. Both schemes could be entered into for a minimum of five years. The basic rate scheme demanded the following changes to farming practise; a reduction in the levels of N fertiliser below the normal level by the amounts described in table 3; no N fertiliser applications in the autumn and with a maximum of 120kg/ha to be applied at any one time; all N applications to be recorded; the maintenance of a winter cover crop to avoid leaving the ground bare during periods of high rainfall resulting in possible nitrate leaching; the drawing up of a manure plan to demonstrate adequate storage and spreading capacity; a limit of manure applications to 175 kg/ ha, and a ban on slurry or poultry manure applications between 1 September and 1 November for grassland and between 1 July and 1 November for annual cropped fields.

Table 3. Reductions in Fertiliser Use under the Basic tier of the Pilot NSA scheme.

Crop	Reduction in fertiliser Use (Kg / ha)
Winter Wheat	25
Winter Barley	25
Oilseed Rape	50
Forage catch crop	25

Source: MAFF, 1993f.

For inclusion in the Premium rate scheme farmers had to meet the following conditions: first all eligible land must be entered in the basic scheme, and second, arable land must be taken out of intensive production and switched to one of the following four grassland options:

1 No fertiliser applications and ungrazed.
2 No application of fertiliser but with livestock grazing permitted
3 Limited fertiliser (up to 150kg/ha N) applications and optimal grazing allowed.
4 grassland established within the Farm Woodland Scheme.

In addition the permitted grazing was restricted to a grazing density supported by the grass growth (MAFF 1993f). The payment levels offered under the scheme were based on the level of income foregone plus any additional costs which contained an element for management time involved in participating in the scheme.

Uptake of the Scheme

Table 4, below, reports the areas that actually entered into the NSA schemes' basic and premium tiers. The total areas within the NSA scheme extended to some 10 700 ha of which 9300 ha or some 87 per cent was entered in the scheme. Of this area some 7800 ha qualified for the basic tier payments, representing 73 per cent of the total area in the scheme, and 1550 ha entered the premium payment scheme, representing some 14 percent. The takeup of the individual schemes can be seen to vary quite substantially ranging from a takeup rate of 36 per cent in Kilham to 100 per cent in Sleaford and Branston Booths. The differential takeup between the basic and premium schemes is of interest and were investigated (Parsisson et al, 1994). The number of farms entering the NSA scheme was 163, representing 80 per cent

of the total eligible number.

Table 4. Total Areas entered in the Pilot NSA scheme

Nitrogen Sensitive Area (NSA)	Basic tier (ha)	%	Premium tier (ha)	%	Agric Area (hectares) (est.)	Overall Takeup (%)
Sleaford	1930	67.1	945	32.9	2875	100
Branston Booths	1380	86.8	210	13.2	1592	100
Ogbourne St. George	580	58.8	130	13.2	984	72.0
Old Chalford	415	66.8	165	26.6	621	93.4
Egford	175	41	42	9.8	427	50.8
Boughton	1610	97.4	16	1.0	1652	98.4
Wildmoor	668	92.4	15	2.1	723	94.5
Wellings	315	60.2	10	1.9	523	62.1
Tom Hill	450	78.9	20	3.5	570	82.4
Kilham	275	36.4	0	0	756	36.4
Total	7798	100	1553	100	10723	87.2

Source: Personal communication, MAFF 1993 .

Initial results from the Pilot NSA scheme

As part of the assessment of the scheme, monitoring of nitrate concentrations were undertaken by ADAS on behalf of MAFF (MAFF 1993f). This has been carried out over the 3 winter periods starting from 1990. This section reports the results from the monitoring exercise carried out over the winter period. Due to the very short time scale the runoff from the soil was collected at a small number of abstraction points across each catchment at a depth of 90-100cm. Below this depth the nitrate concentrations will not reflect the changes in agricultural practice through operation of the policy.

The impact of the scheme is more difficult to define, the very early stages of the pilot scheme mean that any results that emerge should be taken with extreme caution due the potential variability of many factors not least the variation in rainfall. However examining some of the changes that have occurred since monitoring began may provide some indication of changes in farmers behaviour which should eventually affect groundwater nitrate concentrations. For the premium grass option nitrate concentrations were found to be significantly reduced and lower than for land under arable cropping. In around 50 per cent of cases peak concentrations were below the EC limit of 50mg/l nitrate. The expected role of cover crops is to reduce the

nitrate concentrations of water leaving the root zone in late winter. Cover crops were estimated to halve the nitrate loss when compared to fields down to winter cereals. The expected results from cereals under this scheme were assessed to be potentially small, especially if farmers were previously operating near to the economic optimum, in terms of the yield response curves faced with reductions in output prices.

For the root crops, especially potatoes and sugar beet, the nitrate losses continued to be low, factors which contributed to this include:

i reduced fertiliser inputs;
ii a good growing season resulting in high yields;
iii drainage of water from the soil profile occurring before the beet harvest, thus the combination of nitrate removal by plant uptake and leaching by rainfall left little nitrate in the soil.

The issue of fertiliser use is critical in having changed farmers patterns of farming. For organic fertiliser applications large reductions in nitrate losses were initially achieved by the cessation of manure spreading at very high rates and the application of nitrogenous fertiliser fell substantially for areas participating in the scheme, table 5 reports the reduced use of inorganic fertiliser by crop type for areas covered by agreements.

Table 5: Nitrogen fertiliser applications by crop type for areas covered by NSA agreements (KgN / ha / yr).

Year	Basic Grass	Winter Wheat	Winter Barley	Spring Barley	Potatoes	Sugar Beet	Winter Oil Seed Rape	Overall (including premium grass)
1990	165	183	127	99	227	116	210	141
1991	151	165	115	92	214	111	180	127
1992	138	173	109	92	208	99	96	103
% reduction	16.4	5.5	14.2	7.1	8.4	14.7	54.3	26.95

source: MAFF (1993f).

Initial conclusions suggest that compensating farmers for changing their agricultural practices' beyond the code of good agricultural practice is reducing the concentrations of nitrate leaving these sensitive areas and moving towards complying with the EC limit (Maff 1993f; ENDS 1995). Overall across the whole of the ten NSAs, four areas complied with the EC limit and a further two were within ten per cent. The areas with the highest nitrate concentrations were those predominantly arable in cropping and located in the Eastern part of England.

Continuation of the Pilot Nitrate Sensitive Areas Scheme.

MAFF announced in October 1994 that the 10 pilot NSAs would be continued and issued in February 1995 proposals outlining the intended measures for continuation, stating that

> "the original NSAs (pilot) continue to represent important sources of public drinking water and we accordingly propose that they should continue on the basis of a revised

and updated scheme which adopts the latest NSA rules."
MAFF (1995a)

The set of proposals for the continuation of the scheme incorporate many of the lessons learnt from the recent rounds of legislation in terms of nitrates and agri-environmental polices more generally. The new rules allow more flexibility for the farmer in terms of entering individual areas of land into the scheme (unlike the pilot scheme where it all or nothing) but stipulating that all land within the designated area must be farmed in a manner of good agricultural practice (GAP). It is because the conditions of the NSA scheme demand that the farmer to goes beyond GAP that compensation is offered, whilst farming to GAP attracts no additional payments from government. The additional conditions imposed on this continuation of the old policy bring it in line with the new NSA scheme which is described later in this section.

Having described the implementation and preliminary results of nitrate abatement policies for non-point source pollution in agriculture this paper will now proceed as follows; first the other measures introduced as part of the EC Agri-Environment will be outlined then the introduction and operation of the "new" NSA Scheme will be described, thirdly the implementation of the EC Nitrates directive will be detailed and then the Urban Waste Water Treatment (91/271/EEC) directive will be mentioned.

The CAP Reform Agreement of 1992 has started to radically change in the way agriculture is supported in the UK and EU. The requirement to set-aside 15 percent of the arable area combined with an overall reduction of 35 per cent in prices on arable crops will alter the input/output price ratio leading to large reductions in fertiliser applications. This change in emphasis for farm support away from production related towards more extensive agricultural policy has fundamentally affected perceptions of the aims of agricultural support. These changes towards extensification programmes will in time will have effects on the levels of nitrate concentrations in aquifers, although the time horizon for this change is likely to be decades.

UK Adoption of the Agri-Environment Regulation
The extension of the NSA scheme is only one of the measures contained in the environmental section of the 1992 Reform agreement. The implementation of these measures should be completed in 1996. They are described here briefly.

1 The creation of a Habitat Improvement Scheme designed to remove selected areas of land from agricultural production for a period of twenty years and manage it in an environmentally beneficial way. The options for habitat creation areas are as follows;
   i) The creation of intertidal habitats for birds especially salt marshes.
   ii) Establishment or enhancement of water fringe habitats alongside lakes and water courses
   iii) Management of valuable habitats established under the Five year set-aside scheme

2 The creation of six new ESAs in England and Wales, increasing the total to twenty-two in England and with six in Wales. Scotland will have an additional five ESAs bringing the total to ten.

3 The provision of new voluntary access opportunities within ESAs, targeted on land suitable for new or significantly increased access. Access payments would be available, based on 10m wide access strips across fields and reflecting the increased level of costs. In addition, 80 per cent capital grants will be available for investments in such items as stiles and footbridges.

4 The establishment of a new Moorland Scheme to improve the condition of heather and moorland vegetation, and wildlife habitats by reducing the number of grazing livestock, especially sheep. The scheme will also be available to sheep producers in LFAs farming on heather moorland outside ESAs.

5 The establishment of a Countryside Access Scheme to encourage public access on set-aside land. This would be non-rotational set-aside land under the Arable Area Payments Scheme and would be made on land that was of particular interest or attractiveness. This scheme is a development of the Countryside Premium Scheme.

6 A new Organic Aid Scheme available throughout England, it's aim being to encourage organic farming for the benefit of the environment. Farmers will be required to farm in accordance with the standards of the UK Register of Organic Food Standards (UKROFS).

Nitrate Sensitive Areas Scheme

This scheme implemented, by MAFF, as part of the EC Agri-Environment Regulation is seen as an extension of the Pilot NSA scheme. Announced in April 1993 more than 56,000 hectares in England were initially identified as part of the 30 proposed areas under the NSA scheme. These areas are displayed in Appendix B. The aim of the scheme is to protect selected groundwater sources used for supply of drinking water where nitrate levels exceed or are expected to exceed 50 mg/l. The scheme is a voluntary one, attempting to change farming practices and so reduce nitrate leaching. In addition the targeting of boreholes identified as being affected by rising nitrate levels, and so being designated as Nitrate Vulnerable zones (NVZs) must occur under the implementation programme for the EU Nitrates Directive. Following the consultation period the "new" NSA scheme was launched in July 1994: the 22 new NSAs cover 28 separate water sources (two of the proposed areas withdrawn following advice from the NRA) with nitrate levels exceeding or likely to exceed the 50mg/ litre limit. The 22 areas cover 35,000ha (MAFF 1994). The scheme allowed farmers to enter land on a field-by-field basis, encouraging flexibility, for five year agreement periods. It will enter land into one of three categories with a number of additional options:

1 Basic Scheme:

Arable low nitrogen scheme;

Option A - Restricted Rotation.

This option restricts the use of Nitrogen fertiliser to 150kg/ha and prohibits the production of vegetables and brassicas.

Option B - Normal Rotation.

This allows for any crop to be cultivated with fertiliser application at the crop requirement (restricted to a maximum of 200kg N/ha) for one of the five growing seasons and to 150kg N/ha for the four remaining years.

For both options the use of farm yard manure is permissable and will contribute to the specified nitrogen limits.

2 Premium Arable scheme:

This scheme encourages the switching of land from arable to extensive grassland production with graduated management prescriptions, four options are available;

Option A: No fertiliser applications or grazing.
Option B: As for (a) but with encouragement to use native meadow grasses .
Option C: No fertiliser applications but with limited grazing allowed.
Option D: Fertiliser and grazing restrictions.

3 Premium Grass Scheme:

This scheme encourages the conversion from an intensive to extensive use of grassland, restricting nitrogenous fertiliser inputs to 150kg / ha.

Table 6 below lists the payment levels available through the scheme. The bands of payments reflect the differential in gross margins and yields between geographical areas. Table 7 reports the number of farmers and the respective areas entered into the scheme in the first year of its operation. To simplify matters the pilot NSAs and the newly established were entered into a unified NSA scheme (MAFF (c) 1995) covering 32 separate NSAs.

The most significant development in terms of simplifying the policy background and increasing the attractiveness of the NSA scheme to the farmer came when MAFF won an agreement that market and environmental set-aside could be linked (MAFF (d) 1995). This means farmers will be able to arable land into the relevant option under the NSA scheme and in addition be able to count this land as set-aside under the arable areas payment scheme. Many groups representing the farmer (especially the Country Landowners Association (CLA)) had been lobbying for this ruling as they feared imposing restriction on their land use and management practices would have a negative impact on land values (see for instance Farmers Weekly 1994).

Table 6 The NSA Scheme: Levels of payment.

Option	Upper Band (£/ha)	Middle Band (£/ha)	Lower Band (£/ha)
Basic A	105	105	80
Basic B	65	65	65
Premium Arable A	550	450	450
Premium Arable B	590	490	490
Premium Arable C	520	420	420
Premium Arable D	440	340	340
Premium Grass	250	250	250

Table 7 Uptake of the new NSA scheme

NSA Area	Number of Farmers	Premium Arable				Premium Grass	Basic		Total
		Option A	Option B	Option C	Option D		Option A	Option B	
N. Lincolnshire Wolds	43	0	535	0	95.9	88.4	4125.1	0	4844.4
Pollington	48	3.1	530.6	4.9	100.1	64.5	683.4	153.4	1539.9
Hatfield	15	8.75	47.6	4.0	17.4	61.5	109.4	40.11	288.75
Carlton	7	0	15.7	21.3	40.1	67.8	109.6	0	254.5
N. Newbald Springwells	9	0	47.6	0	17.2	2.5	89.8	205.6	362.6
North Nottinghamshire	22	0	63.3	44.6	34.5	0	884.4	281.4	1308.2
Amen Corner	14	39.25	0	0	42.6	0	395.3	0	477.2
Far Baulker	9	27.7	4.7	33.15	21.1	0	212.4	6.9	305.9
Aswarby	28	1.6	169.1	0	144.4	25.7	1353.6	11.8	1706.3
Sheriffhales Grindle Forge Bednall Hopwas Oakeley Farm Kinver Hagley	24	3.9	0	0	15	87.9	253.5	5.41	365.7
Bromsberrow	9	76.1	49.3	2.6	9.6	0	102.8	0	240.5
Duckaller Sedgeford Birchmoor	6	23.44	0	0	13.4	0	1001.5	0	1038.3
Slip End	7	0	40.4	0	0	0	421	0	461.3
		2348.9					10446.4		
Total	241	183.7	1503.3	110.6	551.3	398.2	9741.8	704.6	1319.73

Source: MAFF (c), 1995.

Implementation of the EU Nitrates Directive (91/676/EEC)

This section presents a more detailed discussion of the EU Nitrates Directive. First the aims of the directive are investigated before describing the implementation process and stage the UK Government has reached at the time of writing. Finally the implementation of the Urban Waste Water Treatment (UWWT) Directive is described; this is because although there is a considerable degree of overlap the UWWT Directive forms a more encompassing abatement tool in terms of water pollution.

The objectives of the directive under article one are firstly to reduce water pollution caused or induced by nitrates from agricultural sources and secondly to prevent further such pollution.

The Nitrates Directive seeks to protect waters against pollution by nitrates from agricultural sources. Protection will be through the designation of Nitrate Vulnerable Zones (NVZs). The directive provides standards for the identification of polluted waters and stipulates that Member state governments must, by certain dates, have carried out the following provisions;

By December 1993 all waters must be monitored by the NRAs and RPAs, with Nitrate Vulnerable Zones (NVZs) being established. These are defined as land areas contributing to drinking water quality problems (the limit of 50 mg/l of nitrates) or eutrophication by nitrate problems. A Code of Good Agricultural Practice (GAP) to minimise nitrate leaching must have been produced.

By December 1995 action programmes dealing with the measures contained in the new code (GAP) must be in place. This should include a number of extra criteria aimed at minimising nitrate leaching. These programmes are mandatory and must be established by December 1995 and implemented by December 1999.

The designation of Nitrogen Vulnerable Zones (NVZs) will be enforced where 'polluted waters' exist. These are designated when the following criteria are violated.

i Fresh Water, estuaries, and coastal marine waters are eutrophic or may become so. The eutrophication is induced by nitrates only.

ii Surface Freshwater intended for the abstraction of drinking water contains more than 50mg/l of nitrates.

iii Ground water contains, or could contain, more than 50mg/l nitrates unless protective action is taken.

In addition there must be a review and revision (where necessary) of Vulnerable Zones every four years.

Farming Restrictions in NVZs

These restrictions are contained within the action programme:

i) Applications of organic manure to be limited to 210kgN/ha for the first four years of the programme and subsequently reduced to 170 kgN/ha.

ii) Storage capacity for manure adequate to comply with the closed periods for manure application.

iii) Inorganic fertiliser application limited to net nitrogen crop requirement.

iv) mandatory keeping of fertiliser and manure usage which may be inspected by government officials.

The restrictions on farming within NVZs are based on good agricultural practice and therefore although are mandatory attract no compensation payments. The proposed designation in England and Wales has been identified as affecting 11 river systems and 141 groundwater abstraction points.

The UK government is already well behind schedule in designating the NVZs, the consultation document for England and Wales was issued in May 1994 proposing 650,000 hectares in 72 separate zones (MAFF 1994); whilst in Scotland the consultation document, issued in June 1994 proposes designation of two areas, one river catchment extending to 68,000 hectares and one borehole with an area of 435ha (SOAFD 1994). Having received some 500 written comments in connection with the consultation document MAFF announced the setting up of a independent review panel with the remit of "examining whether the Governments' policy on designating NVZs . . . has been reasonably and justly executed" (MAFF 1995b). This will involve referring to disputes over hydrological boundaries originally proposed by the NRA. The panel will report to ministers by 29 September 1995. The report also announced the re-introduction of farm waste grants for farms within NVZs. These grants were originally abolished in November 1994 but because of the mandatory rules on waste storage and handling facilities for organic manures were re-introduced since farmers in NVZs do not receive compensation as the restrictions imposed as part of the action programme do not go beyond "good agricultural practice".

Implementation of the Urban Waste Water Treatment Directive (91/271/EEC)
The implementation of the Urban Waste Water Treatment (UWWT) Directive and of the Nitrates Directive are on going processes with a considerable degree of overlap. The scope of the Nitrates Directive, to protect waters against pollution by nitrates from agricultural sources, is a narrow one. A description of the UWWT directive is both necessary and valuable in the context of this project and in the operation of future UK action.

The UWWT directive prioritises the treatment of sewage according to the size of discharge and the sensitivity of the receiving water. It sets out as the required standard a secondary treatment level but allows for primary treatment in less Sensitive Areas (SAs) and more rigorous treatment in SAs. In comparison the Nitrates Directive seeks to protect water against pollution by nitrates from agricultural sources. It allows for the designation of Vulnerable Zones (VZs), and sets out standards for the identification of polluted waters. Sensitive Areas (SAs) are designated if the following three criteria are fulfilled;

i Freshwaters, estuaries and coastal waters are eutrophic or may become so in the near future if protective action is not taken.

ii Surface Freshwater intended for the abstraction of drinking water could contain more than the concentration of nitrate laid down in the Surface Water Abstraction Directive (75/440/EEC) of 50mg/l nitrates.

iii Where the requirements of other directives necessitates more stringent treatment than the standard secondary level required in the UWWT Directive.

This allows action to be taken where eutrophication problems exist where the main cause has been shown not to be nitrate emissions from agriculture.

4. ACTORS IN THE UK NITRATE POLICY DEBATE

This section offers a description of the relationship between interest groups in policy formulation in a national and EU dimension. The analysis will trace the interaction of Government, administration and organised interest groups in the nitrate policy debate.

A feature of the EU system is of dispersed power among a large number of organisations and political actors both vertically and horizontally in a multinational neo-federal fashion (Porter and Butt-Philip 1993). The scope of the issue appeals to be very limited to a small number of political, social and economic groups. Thus there exists a limited number of influential actors forming a small "policy community". However when this is extended to a european level where the interactions of environmental policy assumes a greater political and social significance then there is increased awareness and more informed debate as all actors and interest groups are forced to mobilise resources and develop group strategies. Mazey and Richardson (1992) argue the case of increasing assertiveness of the EU in developing the policy agenda. This is augmented with increased public and interest group awareness of european legislation in a number of overlapping sectors. In addition the development of an unpredictable agenda coming from national agendas results in a degree of competitive agenda setting within the EU itself. They conclude "British environmental policy is likely to be much more open to external influences because of EU initiatives . . . . . (it) provides new opportunities for the environmentalist to shift the balance of power in their favour than has been the case at the national level in the UK."

This interest group activity operating at a national level and directly influencing EU policy making decisions occurred in the development of the nitrate policy debate (Hill et al (1989); Baldock (1992)). This is also discussed in further detail in section 3.

To analyse the actors in the UK nitrate policy debate the actors will be divided into three groupings and their roles will be characterised with respect to their relative roles and positions across the spectrum solutions to non-point source pollution with respect to nitrates and agricultural use. This may usefully tackled through examining the groupings respective views on the current scientific knowledge and the calls for fundamental shift in agri-environmental policy.

i) agricultural actors
ii) environmental organisations
iii) national agency / administrative actors

i Agricultural actors

The major participants in the agricultural group are the NFU and the CLA. The NFU views the nitrate problem as an 'unforeseen side effect of the drive to increase the nation's self sufficiency in food led by government' (NFU 1993b). The issue is described as a political one rather than health orientated problem. The agricultural actors typically question the scientific soundness of the 50mg / l limit for nitrate in drinking water, arguing that it is 'unfair to victimise UK producers with heavy nitrate restrictions' (Farmers Weekly 1994a).

Active in the lobbying arena the NFU stresses that the agricultural industry and the water industry must be actively involved in the debate. The NFU argues compensation for farmers who are located in nitrate vulnerable zones is required since NFU argues nitrate pollution is a non-point source pollutant and increases in agricultural productivity were Government led.

The NFU believes that compensation is needed for any change in practice which goes beyond good agricultural practice and that the concept of the 'polluter pays' is inapplicable in these situations.

The CLA view is a more traditional intensive agriculture standpoint characterised by the quote from their chief policy advisor 'instead of achieving it's aim the scheme would reduce the farmer's economic options and blight land values' (Farmers Weekly (30.5.93)).

The fertiliser manufacturers play down the magnitude of the issue claiming that application of fertiliser at the current economic optimum rate (on most crops) will fulfil the objectives contained within the nitrates directive but more provocatively ask 'surely the political pressure to punish farmers is not so great that such (scientific) facts are ignored?' (Farmers Weekly, 1994b)

ii Environmental groups

Friends of the Earth (FoE) have long been campaigning for increased awareness of the presence of nitrates in ground water. The FoE policy is to establish water protection zones in catchment areas providing drinking water. These zones would be targeted at the agricultural level to remove land from intensive agricultural production. Farmers should receive compensation for this and be encouraged to farm with conservation aims in mind. FoE also advocates that tax should be levied on artificial nitrogenous fertiliser. The revenue from this would be used to pay for the costs of removing nitrates from drinking water and for policies on reducing nitrate pollution in general (FoE 1988).

iii) Administrative Actors

Formerly one organisation, the Nature Conservancy Council (NCC) English Nature (EN) and Scottish Natural Heritage (SNH) are statutory advisors to the UK Government, through the respective environment and agriculture departments, on environmental and conservation issues. Further reorganisation and amalgamation in 1996 will lead to the forming of the Environmental Protection Agency (EPA) and the Scottish Environmental Protection Agency (SEPA). The National River Authorities (in England) and the River Purification Agency (Scotland) are responsible for monitoring and enforcing water quality standards and for the enforcing pollution control.

Of the administrative grouping EN and Scottish Natural Heritage SNH view the debate from a habitat creation aspect. The pilot NSA scheme designated agriculturally intensive areas with little scope for habitat creation. EN in their proposals for the pilot NSA scheme advocated an environmental tier. This was rejected since the aim of the policy was to reduce the risk of pollution from nitrates. At present EN have identified a number of meres in Cheshire and Shropshire which have eutrophication problems, twenty of these are SSSI designated. They suspect that some of these are Nitrate limited. EN is unsure if they should respond to the NSA consultative document due the lack of habitat creation opportunities.

As regards government departments, the nitrates directive is a joint statutory regulation between the Department of the Environment (DoE) and the Ministry of Agriculture, Fisheries and Food (MAFF); the DoE's Water and Environment division concerned with the UWWT,

the nitrates and the bathing water directives. In addition MAFF possessed the local expertise at the catchment level through it funding of the Agriculture Development and Advisory Service (ADAS) and therefore for the nitrates directive the DoE is the lead department with support from MAFF.

The DoE / MAFF's position within the Nitrate policy debate is an interesting one, since although the UK Government supports the 'polluter pays principle' MAFF argues it is impracticable to apply the principle to the nitrate problem because of the non-point nature of the pollution. As regards other policy tools for dealing with nitrate pollution MAFF's opinion is as follows; the evidence for the introduction of a nitrogen quota indicates that their use would have a limited impact on nitrate leaching, would be difficult to administer and would place UK farmers at a competitive disadvantage. A fertiliser tax would, MAFF believes, have a number of drawbacks: it would have to be applied to all farmers, this blanket approach would mean an inequitable policy with a low degree of targeting. The tax would be costly to administer and would place UK farmers at a competitive disadvantage. It would have to be set at a high level in order to affect land use patterns which would be needed if the problem of nitrate leaching was to addressed; and it would be unable to affect some major sources of nitrate leaching, such as the ploughing up of grassland or leaving the land without a crop cover in the autumn.

At a contact level with farmers ADAS have engaged on a policy of disseminating information to areas were new management practices would have to be introduced to comply with limits on the spreading of organic fertiliser.

Of interest is also the interest taken by overseas government departments. In a report by the US Department of Agriculture, it forecast that large reductions in livestock numbers would be necessary in order to meet the pollution targets (Financial Times 1994).

5. SUMMARY / CONCLUSIONS

This paper has concentrated on reporting the development and refinement of pollution abatement policy with relation to nitrate pollution related to agricultural activity. The paper starts by considering nitrate pollution problems and identifies areas, both within a european union and a national context, where the nitrogen balances are likely to cause nitrate pollution problems. The paper then moves on to examine the pollution legislation for the UK that controls environmental pollution , again special attention is focused on the agricultural sector and ability to control non-point source pollution through the adoption of the *polluter pays principle*. Attention is then paid to the description of UK government nitrate policy programmes. This outlines the voluntary schemes already in existence, namely the pilot NSA and the new NSA schemes. These schemes, because they demand the farmer restricts agricultural activity beyond Good Agricultural Practice (GAP), attracts compensation for the participating farmers. However future policy will be the continuing implementation of the nitrates directive and this demands that Nitrate Vulnerable Zones (NVZs) be established where mandatory farming restrictions, in terms of minimising potential nitrate pollution, will attract no compensation since it does not go beyond GAP. The paper then goes on to describe the latest policy developments which include farmers being able to include land entered under the NSA scheme as part of their set-aside obligations, this links market and environmental policy

support. The paper is then moves concluded by detailing the actors and their interactions in the nitrate policy debate, one that has been running for some twenty years before legislation appeared to deal with it.

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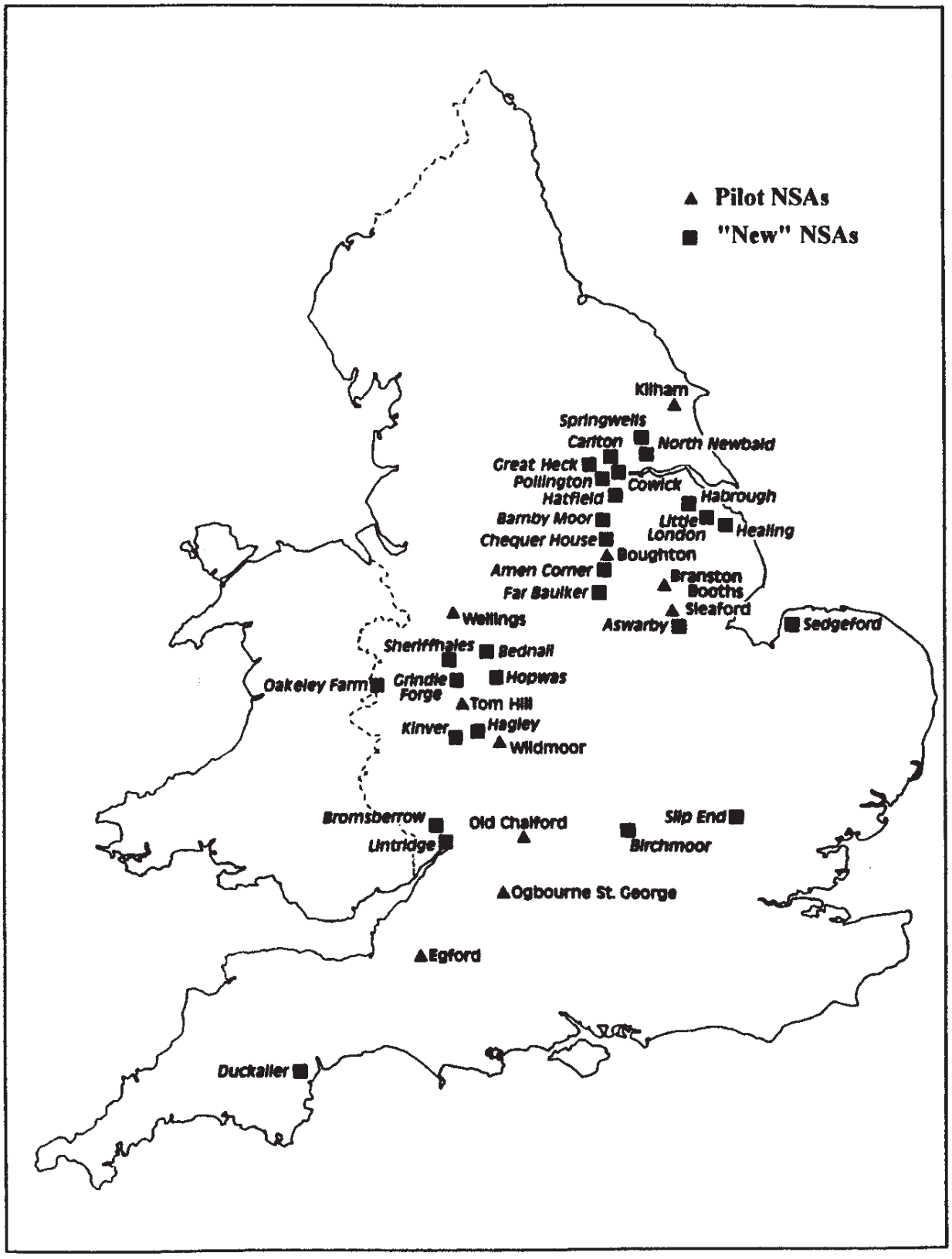
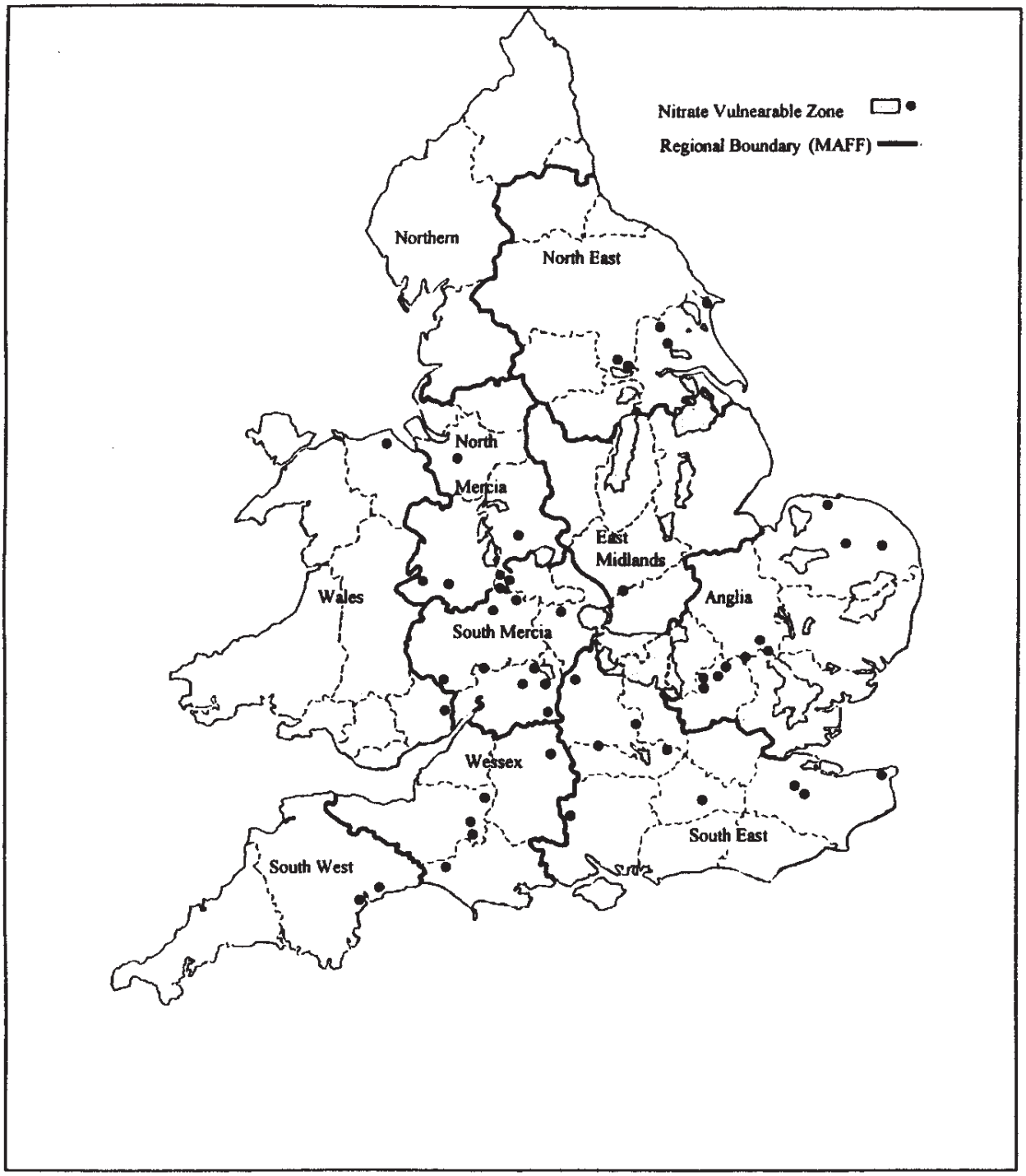
Appendix A: Location of rocktypes In England and Wales likely to contribute to increased nitrate concentrations in groundwaters.

Appendix B: Location of pilot and "new"Nitrate Sensitive Areas.



Appendix C: Location of Proposed Nitrate Vulnearable Zones (NVZs) in England and Wales, under the Nitrates Directive (EEC/676/91)



source: adapted from MAFF, 1994.

Appendix D: Chronological listing of major nitrate policy events

1990	Pilot NSA scheme launched with agreements lasting for five years.
1991	Nitrates Directive (91/767/EEC)
April 1993	Agri-Environment Regulation launched as "Agriculture and England's Environment: New NSAs" Issue of the consultation document for the new NSAs scheme part of the package of seven proposals
December 93	MAFF Pilot NSA scheme: Report on the first three years announces the Pilot NSA scheme as successful in achieving its objectives
May 1994	MAFF issues consultation document; Designation of Vulnerable zones in England and Wales under the EC Nitrate Directive (91/676).
July 1994	New NSA scheme launched; 22 new NSAs launched by MAFF.
June 1994	Issue of the consultation document for NVZs in Scotland.
Octocber 1994	MAFF announces continuation of the 10 pilot NSAs
February 1995	MAFF proposals for the continuation of pilot NSAs issued.
May 1995	MAFF issues document "Government response to the consultation on the designation of Nitrate Vulnerable Zones in England and Wales".
July 1995	Pilot NSAs are continued and unified policy of NSAs is established
July 1995	Following EU ruling on linking market and environmental set-aside the introduction of new set-aside option in Nitrate Sensitive Areas becomes available

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