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Chapter 4 in *The Fiscal System and the Polluter Pays Principle - : a case study of Ireland*

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Chapter 4: AGRICULTURE AND FORESTRY S. Scott

This chapter begins by surveying the environmental effects of the sector and any evaluations of them. A rundown follows of the existing fiscal treatment of the sector and its environmental impacts. We will see that in the case of agriculture, what can broadly be termed fiscal policy in the last couple of decades has had profound environmental effects, especially through its encouragement of intensive agriculture, though farming and forestry can provide many environmental benefits to society, such as maintenance of bio-diversity. Options for addressing the problems, based on information from Ireland and abroad, will be assessed, leading to suggestions as to which economic instruments should be adopted. The underlying aim is neither to raise revenue, nor, necessarily, to achieve a stated environmental objective; the aim is to raise wellbeing by reducing pollution, so long as the benefits of so doing outweigh the costs, with external effects taken into account. This is an "ideal" approach, because external benefits and harms are not easily valued. Though the ideal is likely only to be approximated, the general direction of the use of economic instruments will be indicated, as well as the immediate steps which can be taken.

4.A Agriculture

4.A.1 Environmental Impact of Agriculture and the Costs of Damage

Climate change, acidification, impacts on air quality, damage to nature and biodiversity and to the quality and quantity of water - these are the harmful effects attributed to agriculture. By contrast, it is sometimes less widely realised that agriculture, in its role as major occupier of land, can be a force for good in the countryside, providing stewardship of the rural landscape and maintaining habitation in rural areas and villages. We will discuss these effects in turn; they are summarised in Table 4.1 below. The table indicates, in general terms for any region, which elements are released or affected by agricultural activity, their importance and, in the final column, the potential for improvement.

Agriculture's effect on climate change arises through the sector's use of energy and burning of straw, which release carbon dioxide, through methane emissions from livestock, which is a prominent effect in Ireland, and through release of nitrous oxide from fertilisers.

Table 4.1: *Effects of Agriculture on the Environment*

Theme	*Element*	*Importance of Agriculture*	*Potential for Change*
Climate change	Carbon dioxide CO_2	**	**
	Methane CH_4	***	**
	Nitrous oxide N_2O	***	***
	Overall	*	*
Acidification and air quality	Ammonia NH_3 and Nitrogen	**	***
	Volatile organic compounds VOCs	*	-
	Overall	*	*
Nature and biodiversity	Soil loss	****	***
	Habitat loss	****	****
	Overconcentration of species, genetic engineering	**	**
	Overall	****	***
Water quality/management	Water shortage	***	***
	Nitrates NO_3	****	****
	Phosphates PO_4		
	Pesticide residues	****	***
	Overall	***	***

Note: More asterisks mean more importance or potential for change.
Source: Adapted from DRI et al.(1994) (Travers Morgan Environment).

Agriculture's effect on air pollution and acid rain arises through the release of ammonia by slurry spreading, of nitrogen from fertilisers, and of volatile organic compounds by a variety of activities. In addition to the effect on climate change from methane emissions from cattle, the main impact of agriculture in Ireland is on the last two themes in the table. Its impact on nature and biodiversity arises from many causes, including soil loss due to overgrazing or spread of

contaminated wastes, and habitat loss brought about by use of pesticides, fertilisers, monoculture, removal of hedges and ditches and other land developments. The other major impact of agriculture in Ireland is the deterioration of water quality - impact on water quantity not being the problem that it is in several mainland European countries - through release of nitrogen and phosphorus from manure and fertiliser application, and through pesticide residues.

Agricultural activity, undertaken on a small scale and non-intensively, does not in general impose serious adverse effects. It is large changes and heavy concentrations which, depending on the characteristics of the surroundings, can cause degradation. Over the 1980s much land was converted from arable uses to pasture for an increasing number of beef cattle, and for a dramatic increase in sheep, which more than doubled.[1] Poultry and pigs also rose in numbers, with heavy concentrations in counties Monaghan, Cork and Cavan. Ireland has the highest concentration in Europe for sows; over 80 per cent are in units of more than 100 sows, compared to Germany where only 16 per cent of sows are in units of over 100. Relative to European standards the numbers and herd size in Ireland are small: it is the extent of localised concentrations, and the sensitivity of the surroundings, which makes them significant. Another important change with environmental implications is the strong swing away from hay-making to silage. The pollution potential from silage effluent (in terms of BOD_5) is some 20 times greater than that for untreated domestic sewage.[2]

Thirty million tonnes of manure must be managed by farmers each year. Though the nutrient value of this is put at some £117 million, disposal as a waste is more frequent than use as a nutrient. Total BOD and phosphorus content of animal wastes (excluding that from grazing animals) is put at 663 000 tonnes and 32 000 tonnes respectively, which is six times the levels from sewage and industrial wastes combined. Some 85 per cent of dairy and beef cattle manure is in the form of slurry from slatted sheds, most of the remainder being in farmyards. The pollution potential can be controlled by careful timing and manner of spreading, but this tends to cause extra work and inconvenience to farmers.

[1] Lee (1996), who is the source of most of the environmental information in this sub-section.
[2] Department of Agriculture, Food and Forestry (1996).

Meanwhile fertiliser is relatively cheap and easy to use and it is not surprising to find that fertiliser use has increased significantly. Annual phosphorus (P) fertiliser use quadrupled between 1950 and the early eighties, since when it has been static at about 60 000 tonnes. Nitrogen (N) fertiliser use shows a similar pattern, having levelled off at about 380 000 tonnes. The other important source of phosphorus is animal feed, which amounts to 9000 tonnes of phosphorus in concentrate fed to cattle and sheep, and 5850 tonnes in concentrate fed to pigs and poultry. Where there are heavy concentrations of manure there would be high levels of phosphorus.

The upshot of these developments is the increased risk of pollution from manure concentrations requiring disposal, from fertiliser application and from silage effluent. Are these features having an effect on the environment, can we put a value on the effect or, at any rate, can we say whether or not it is serious?

4.A.1.1 Effects on water quality

Despite the relatively good quality of most Irish surface waters, a continuing decline is noted by the Environmental Protection Agency (1996). This is of particular concern because of the salmonid status of Irish rivers. The trends are best understood by looking at Table 4.2 which shows the evolution of the quality status of 2900 km of river length from 1971, in the first two columns. Since 1987-90, 96 per cent of total river length has been monitored, amounting to 12 700 km, and the trend in their quality status is shown in the last two columns.

Table 4.2: *Trends in Quality of Water in Selected Rivers*

	2 900 km of river		**12 700 km of river**	
Quality status	**1971**	**1994**	**1987-90**	**1991-94**
Generally unpolluted	84.3	57.5	77.3	72.2
Slight to moderate pollution at times	9.7	41.4	21.7	27.2
Serious pollution at times	6.0	1.1	0.9	0.6
TOTAL	100	100	100	100

Source: Data used for *Water Quality in Ireland 1991-1994*, Environmental Protection Agency,

(1996).

The Table shows the decline of the two extreme categorisations, that is, unpolluted river length and river length which is seriously polluted at times. Meanwhile the length of "slightly and moderately polluted river at times" has increased. The increase since 1971 for these categories is from 9.7 per cent of length to 41.4 per cent in 1994, for the shorter stretch of monitored rivers. Results of the wider coverage in the last two columns show a firm increase in slight to moderate pollution, to over a quarter of river length. This leaves no room for complacency. Agricultural runoff, industrial waste and sewage are all involved. However, the fact that in many cases known "point" sources are not implicated suggests that agriculture is the major cause: farms are very dispersed, and pollution off the land flows from "non-point" sources. These features in fact make it difficult to monitor and control, and will constrain policy as we will see.

The nutrients which are implicated are phosphorus and nitrogen. Levels of phosphorus in water above 20mg per cubic metre (or 0.02 mg per litre) in slow-moving waters can lead to eutrophication, a situation where excessive supply of phosphorus and nitrogen leads to growth of algae, thus disturbing the oxygen balance, with loss of fish, diminished aesthetic quality, reduced amenity value and a deterioration in the quality of drinking water.[3] Even small quantities of phosphorus can be harmful. The problem is apparent in certain lakes, since in these waters phosphorus levels can build up. In rivers, particularly those that are fast flowing, the nutrients are ultimately flushed out to sea, though, more recently, nutrient excess has been identified as the main cause of deterioration in river water quality.

Average phosphorus levels in soil samples have increased ninefold since 1950 to 9 mg per kg. A balance sheet study undertaken for 1988, detailing the inputs of phosphorus (P) to farms and the amount embodied in outputs of farms, expressed in tonnes, is summarised in Table 4.3 below:

Table 4.3: *Phosphorus Inputs to Farms, Outputs from Farms and Remainder (tonnes P)*

P inputs to farms	**77 296**

[3] McNally 1995

of which:	Chemical P fertiliser		62 446
	Concentrates fed to cattle and sheep	9 000	
	Concentrates fed to pigs and poultry	5 850	
P outputs from farms		**27 810**	
of which:	Tillage crops		12 177
	Cattle and sheep production		8 717
	Milk		5 170
	Pig and poultry production		1 746
Remainder			**49 486**
of which:	Soluble P loss to water	3 445	
	Build up of soil P		46 041

Source: Tunney (1990).

The table shows that inputs are over double the amount accounted for in output from farms. The problem then is that the remainder can find its way to inland waters. The ideal is to have a balance so that soils have adequate fertility for production, and that losses to water are low enough not to cause pollution. One study showed that farmers could get 6 years growth with no phosphorus application, if they had proper manure control (McGarrigle 1996). This represents an unnecessary cost to farmers, and some £25 million is wasted annually in unnecessary application of inorganic phosphate fertilisers (EPA 1996). By contrast it should also be said that 25 per cent of soil samples have been found to be deficient in P, which is an indication of the diversity of conditions and also has implications for policy.

Phosphorus losses from agriculture have been identified as a significant cause of water quality decline in Lough Conn, Lough Derg, the Lee catchment and county Monaghan. Large surpluses to agriculture's requirements of phosphorus were found, at 7 kilograms per hectare per year for the Lough Derg catchment, and at 28 kilograms in county Monaghan. This was attributable to animal wastes and chemical fertilisers. Concern about eutrophication in Inniscarra reservoir during the summer months, the annual build-up of phosphorus and the threat posed to domestic and industrial users of water, led to a detailed study of the river Dripsey catchment by Reynolds (1996). Results suggest that more than half the excess P comes direct from farmyards and overland flow from fields is probably still excessive. Slurry spreading after the first silage cut is recommended rather than in October and November. Even with no application of chemical P

fertiliser it will take many years to reduce the P level in soils from their present figure, of over 10 mg per kg, to a recommended 6 mg per kg. These recommendations indicate that policy should encourage specific behavioral changes.

Turning now to nitrogen, a nitrogen balance sheet by Sherwood and Tunney (1991) shows that 72 per cent of N inputs are not recovered in the soil or in animal product, and must therefore be lost to water and the atmosphere. However a study of the vulnerability of soils and groundwater to nitrate leaching showed that only 4 per cent of Irish soils are at high risk. Recent measurement show that effects on surface waters are generally low, and well within the limits set for abstraction and drinking waters. However, contamination affects a considerable number of rivers and streams at times, particularly in the south-east where there is a greater than average proportion of land under tillage. In addition, the south-east displays a continued upward trend in nitrate levels.

A further warning against complacency arises from the fact that pollutants carried in overland or subsurface flows may not reach groundwater supplies of lakes and streams for years after their generation, according to Shortle and Abler (1996). Contemporary problems can reflect decisions and events that occurred many years in the past. Time lags of 30 to 60 years have been reported in Southern California and, similarly, the benefits of current control actions may not be fully realized for many years. While Irish geology is different, it is important to be on guard.

4.A.1.2 Value of harm to water

What is the harm done by excess nutrients and eutrophication? What is the value of the ensuing damage? As is frequently the case with environmental damage, many aspects are uncertain or controversial. For example, nitrate pollution of drinking water has been linked to methaemo-globinaemia in babies (blue baby syndrome) and stomach cancer. A measure of the value of harm is the cost of treating water for abstraction and drinking, where this is considered necessary.

There is also evidence of the harm of eutrophication, other than to health, though no studies have been undertaken for Ireland. Barde and Pearce (1991) describe a number of evaluation studies.

One study estimates the willingness-to-pay of around a thousand river-corridor users for water quality improvements. Results, based on interview surveys by WRC/FHRC (1989), indicated that the average household would be willing to pay an additional £6 per year in water rates for further water quality improvements. These studies, called contingent valuation studies aim to elicit people's valuations contingent on an option being available.

Another study, undertaken in the Netherlands by Baan (1983) is quoted, which aimed to give an overview of potential benefits of improvements in the quality of Dutch surface waters. Benefits were calculated relating to recreation, fishing, commercial fisheries, navigation, reduction in public water supply costs, agricultural productivity gains and better drinking water. Many benefits were not estimated, such as aesthetics, effects on eco-systems, or option value. The once-off total monetary benefits were estimated to be between £76 and £210 million (Dfl 200 and 550 million).

A further study aimed to elicit how much Norwegians would be willing to pay for a halving of nutrient leaching to the North Sea (Magnussen 1992). People stated that they would be willing to pay between £50 and £200 annually in increased sewage taxes, which also indirectly gives a measure of the value of the damage.

While not implying that results from foreign studies are a substitute for a proper evaluation of the harm done by eutrophication caused by agriculture in Ireland, they demonstrate that people can place a high value on the quality of surface waters, and that this is without even taking account of the benefits of tourism angling, image abroad, restoration of habitat and the like. Indeed we note that, without prompting, concern for water quality is ranked as issue number one by Irish respondents to a recent survey of attitudes to the environment (Murphy et al. 1994).

4.A.1.3 Effects on nature and biodiversity

Agriculture is central to the shaping of the rural landscape. Farming activities take place on more than 80 per cent of the land area in Ireland and continuation of habitat is vital to nature and biodiversity. There is little truly natural habitat remaining in Western Europe so that the wildlife resource is concentrated largely on agricultural land. In general, the systems most compatible

with wildlife are the more traditional farming systems, which are characterised by low intensity, low nutrient input, low or zero use of pesticides and herbicides, relatively large area of semi-natural vegetation and hedgerows, less drainage and irrigation and more continuity (Baldock 1995) - in effect, the opposite of the trend in agricultural development of the past few decades. Chemical contamination and introduction of exotic species may also be harmful.

Grassland being the dominant type of land use, Ireland is a low user of pesticides, annual sales being about one half the EU average and measured concentrations in the soil are correspondingly low. However DDT and its breakdown products are still present at significant levels in some agricultural soils (especially fruit growing) and in town garden soils. Assessment of the effects on soils and habitats of increased hill grazing by sheep is under way. Grazing sheep have additionally led to erosion of peat soils, which enter rivers and lakes and cause harm to fish. Not being a straightforward case of pollution where clearly defined administrative procedures and legislation exist, extensive damage has occurred before any serious attempt at control.[4]

In Ireland, hedgerows are a part of the traditional landscape and form semi-natural habitats for farm wildlife. Since 1938 a loss of 16 per cent of hedgerow has been reported, equivalent to two kilometres squared. While this is not a huge loss, it is a loss which should not continue indefinitely. This is not to advance the idea that all change is harmful or that farming cannot evolve. However there are benefits which farmers themselves may be foregoing if they do not conserve semi-natural habitats, such as[5] reduction of pesticide use by exploiting pest predators and parasitoids, enhancement of crop pollinator populations, reduced soil erosion,
maintenance of landscape diversity, promotion of game species and the like. As this list indicates, from the farmer's point of view, existence of habitats does not purely entail costs and, for the farmer's family, the preservation of landscape diversity would tend to be a benefit.

Some wildlife species have seen improvements in their numbers in the last decade, such as pine martens, Greenland white-fronted geese and buzzards, to name a few. However there is also a significant number of endangered, vulnerable and extinct species. For example, in relation to

[4] Sheehy-Skeffington et al. 1996, Douglas 1996, Whelan 1996, EPA 1996.
[5] Marshall (1993) cited by Lee op. cit.

plants and ferns in Ireland, 10 species are probably extinct, 6 endangered and 44 are vulnerable (Curtis and McGough 1988). In relation to birds, Table 4.4 gives some examples. Internationally important species include the Irish hare which is under threat from agricultural intensification, the Greenland White-fronted goose from afforestation and peat extraction, the otter from afforestation, water quality changes and recreational pressure, and so on.

Table 4.4: *Some Examples of Birds under Threat and Nature of Threat*

(see page from OPW Wildlife Service: Red Data Book, Vertebrates)

Source: Whilde (1993)

Experience in Ireland echoes some of the problems encountered in the UK where, for example, there has been contraction of 24 out of 28 species of farmland birds between 1970 and 1990, the populations of seven species falling by more than half. Loss of habitats is a prominent cause. Ireland has some features which make it special in world terms and which will probably become more special as they become rarer worldwide and better known. For example, Ireland's waters and estuaries are strategically positioned on the migratory routes of many birds; and the extent and richness of its peatlands are only rivalled in Europe by those of Finland. While indeed extinction, as well as evolution of new species, are natural features of life, extinction of species is now taking place at an unprecedented rate, possibly 1000 times greater than the background or natural rate (Pearce 1993). OECD (1996) puts the rate of extinction of species at a possible 100 per day, probably the fastest rate since the natural catastrophes of 65 million years ago, which rendered the dinosaurs extinct. This is a loss to present generations and, owing to probable irreversibility, to future generations also.

Several studies have been undertaken which aim to place a value on the conservation of species, eco-systems or habitats. There is much overlap between countryside and habitat. Generally speaking there is a high demand for leisure in the countryside and a sizable portion of this demand would be for the continuation of habitats. In Great Britain, for example, it is estimated that people spend one-fifth of their free time in the countryside, and 85 per cent make at least one

excursion to the countryside per year, of which nearly 30 per cent visit the countryside regularly. For Germany, an informal estimate puts the value of a countryside visit at the equivalent of a cinema ticket, giving a value of some £4 billion per year (DM 10 billion, (Leser 1995)). Even on such a crude basis, the magnitude of values involved is an indication of the significance of the countryside.

However the value of visits to the countryside might be a poor guide to the valuation of some rare and possibly little known species. A study specifically aimed at estimating people's valuation of threatened species in Norway, namely brown bears and wolves (by Dahle et al, described by Navrud (1992), involved a contingent valuation survey of about 2000 persons. The mean annual willingness-to-pay per household for preservation as well as for extinction was calculated. As the animals are predators, respondents were given the choice of preservation or extinction. Willingness-to-pay for conservation was eight times that for extinction and the net annual willingness-to-pay per household worked out at £20.60 (210 NOK). While disposable income is a good deal higher in Norwegian households, the scale suggests that there would still be significant demand for bio-diversity in Ireland. This again omits other interests such as tourism and benefits to future generations.

4.A.1.4 Other Effects

Other aspects of agriculture's impact on the environment will merely be itemised. Climate change was already mentioned above, however it is less well-known that grassland is believed to serve as a sink for carbon dioxide and nitrous oxide, and thus to help reduce climate change. However, ruminants which feed off grassland emit 200 grammes of methane gases per head daily. Ploughing and removal of grassland releases large amounts of carbon dioxide through decay of soil organic matter.

We have not considered the important effect of pollution on agriculture, but this will be indirectly covered by other chapters. Except in a few spots, pollution of soil by heavy metals is low, though there is concern at the effect of increased loading of sewage sludge on land, arising

from the Council Directive Concerning Urban Waste Water Treatment[6].

4.A.2 Existing Fiscal Treatment and Environmental Effects

The European Community's Common Agricultural Policy (CAP), the introduction of milk quotas in 1984 and the MacSharry reforms of 1992, are major influences on agricultural activity and its effects on the environment. A summary of the relevant aspects of European policy needs to be given here. The CAP it must be said has been highly effective as an economic instrument in terms of support for farm incomes in aggregate, levels of agricultural output, the yields that it promoted and the deceleration of urbanisation. It had manifest drawbacks however in the size of the surpluses generated, and the lopsided distribution[7] of benefits (Fitz Gerald and O'Connor 1991). The main original aims of providing stable affordable supplies of food and a fair standard of living for the agricultural community (EC Treaty article 39) seem to have been lost sight of. As predicted, the mismatch of using output price support, when it was incomes that required support, has become clear. With output prices held high, the cost of inputs appeared relatively low, causing a tendency for farmers to apply excessive amounts of inputs such as fertilisers (Delpeuch 1994). Profit-maximising farmers could raise net revenues by increasing output, but with land being a fixed factor, methods had to become more intensive.

Of course, even without the CAP, external effects arising from agricultural activity, as with any other activity, would require to be rectified, but the operation of the CAP exacerbated the problems. The damage that ensued was effectively subsidised by the taxpayer who, while evidently willing to support agricultural incomes, has become increasingly dissatisfied with paying for an undesired outcome. In addition to the environmental toll, the cost to the European taxpayer and consumer[8] (at well above Ireland's GNP), the surpluses and the likely admission to the EU of large agricultural producers such as Poland and Hungary, have recently caused much concern and added to pressure for reform.

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[6] European Commission (1991).

[7] 80 per cent of the support went to 20 per cent of the farmers who produced 80 per cent of the output.

[8] O'Connor (1995) has estimated Producer Subsidy Equivalents (PSEs) for Ireland which measure the proportion of the revenue of farmers which accrues as price support. The main PSEs are: 60 per cent for beef, 61 per cent for milk, 58 per cent for sheepmeat, 20 per cent for poultrymeat, 8 per cent for eggs and for pigmeat, 57 per cent for

4.A.2.1 CAP reforms in 1992, environmental implications and other grant schemes

The most far-reaching reforms were those introduced by MacSharry in 1992, and they have environmental implications. The main features for the two items, cereals and animal products, are as follows. Support prices for cereals were to decrease by 29 per cent (from 155 ECUs to 110 ECUs per tonne). Income loss was compensated by subsidies in fixed amounts per hectare, distinguishing between small-scale and large-scale farmers. Large-scale farmers, operating more than 15 hectares, are only eligible to hectare compensations if they set aside at least 10 per cent (previously 15 per cent) of their average acreage which was allocated to crops during 1989 to 1991. Compensation per hectare is computed as the compensation per tonne (a figure between 25 and 45 ECUs) multiplied by 6.08 (which is Ireland's reference yield in tonnes per hectare). Small farms receive compensation without any set-aside obligation. The compensation is paid regardless of actual output and is determined purely on an area basis. Producers whose yields had been above the reference yield would face an effective reduction in total revenue (Boyle 1995).

The reform measures for animal products are not quite so strong, with the intervention price for butter and dairy products reduced by 9 and 7.5 per cent respectively and intervention prices for beef lowered by 15 per cent. Premia for bulls and cows are subject to stocking limits, and stocking densities which do not exceed 1.4 livestock units per hectare receive an additional extensification premium. Farmers are still able to stock more but they do not then receive the premium. This is the first time that stocking limits have been specified. Given that Ireland is more active in livestock farming than in growing cereals, this structure of reforms is perhaps to Ireland's advantage. There are accompanying measures for forestry, conservation and amenity (the agri-environment programme[9]) and early retirement. Import tariffs at the Community border are maintained but under the General Agreement on Tariffs and Trade, (now the World Trade Organisation) it is intended that they be further reduced.

The agri-environment programme in the McSharry reforms includes aid to farmers who reduce applications of fertilisers and pesticides, adopt organic farming, move to extensive production, rear rare breeds, set aside farmland for 20 years for purposes connected with the environment

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wheat, 62 per cent for coarse grains and 67 per cent for sugar.

[9] under Regulation 2078/92

and manage land for public access and leisure activities. To qualify, member countries have to prepare implementation programmes, which will reflect their priorities. Farmers' participation is voluntary. In Ireland, the Rural Environment Protection Scheme (or REPS, described below) was prepared by the Department of Agriculture in 1992. Co-financing by the EU was put at 75 per cent in Objective 1 regions like Ireland.

Reservations have been expressed that the reforms were dominated by concern for farmers' incomes with lesser concern for the environment, which features rather modestly. Funding within the package dedicated to environmental subsidies is forecast at a mere 2.5 per cent of CAP spending (Dixon 1995). Other reservations arise concerning the adequacy of resources of staff to evaluate the proposals, which is a perennial problem with subsidies. Further worries focus on the relatively high subsidies to afforestation (which, for instance, under the Spanish forestry plan submitted to the Commission, could threaten a rare species of bustard, and which need to be carefully applied in Ireland's case, as we will see below). There is also a feeling that the most harmful farming practices will not be reined in.

These criticisms may stem from an underestimation of the benign incentive effects of the price changes in the McSharry reforms to the CAP. The study by Boyle, which investigates the likely response in Ireland to the cereal reforms, indicates that cereal production could fall by 9 to 14 per cent and consequently use of fertiliser in this sector could fall by 9 to 19 per cent. This is the result of disassociating revenue somewhat from output. It would be interesting to see if the impact on the environment were stronger as a result of the curtailment of these underlying incentives to production, rather than as a result of new subsidies for environmental activities. External events however may alter Boyle's results, in that world agricultural prices have recently risen, giving farmers a renewed production incentive. Then, more recently still, turmoil in the beef market could alter the outcome again.

So much for the all-important background. One must however question what lies in store for the future - will European taxpayers be able or willing to continue to pay similar supports to farmers in the EU, given that farmers' numbers will increase with entrants from Eastern Europe? This question is beyond the scope of this chapter, though it is probable that European taxpayers

will prefer to pay for a system which is compatible with a healthy countryside.

The following is a list the main agricultural grant schemes affecting the environment, which are specified in more detail in Appendix 4.1. Given their likely transitory nature, it is important that the best possible use be made of the EU monies.

List of grant schemes to agriculture which have environmental impacts

- Control of Farm Pollution Scheme (currently suspended)
- Livestock Headage Schemes in Disadvantaged Areas (for cattle, equines, sheep and goats in Disadvantaged Areas)
- Livestock Premium Schemes
- Nutrient Management Planning via the Advisory Service
- Rural Environment Protection Scheme (REPS)
- Early Retirement from Farming
- Organic Farming

These grant schemes are recent and no evaluation has been undertaken. However the fact that the main scheme, REPS, is aimed at the smaller farmer means that the big polluters will be less influenced. On the other hand, the regions where takeup is likely to be strong are the more remote areas. These are indeed the areas which have most to offer in terms of biodiversity, and may be the more vulnerable, but again perhaps have less to offer in terms of pollution abated. The grants are not directly differentiated according to the existing levels of pollution. There is need for ongoing assessment of the grant schemes.

EU Nitrates Directive

Though the Nitrates Directive is not an economic instrument, it requires a mention because implementation of the Directive abroad will be of interest, and the issue of nitrogen has some parallels with the phosphorus issue here. Recognising the problems caused by application of chemical fertiliser and manure, the Directive aims to achieve a groundwater standard of not more

than 50 mg N per litre and the reduction of nitrate pollution of surfacewaters and marinewaters. Member states are required to identify vulnerable zones. No areas have been designated as vulnerable in Ireland. Member states must adhere to an action programme within these zones, as to timing and manner of fertiliser and manure application. Codes of good practice, including conditions such as the manner of application near watercourses, also have to be drawn up, and an Irish Code of Practice has recently been issued by the Departments of the Environment and of Agriculture (1996). Some farms in the UK which are located in Nitrate Vulnerable Zones are claiming that the restrictions are reducing the value of their land, by up to £200 per acre in some cases, and that nitrogen leaving their farms is in fact deposited from the atmosphere. Some 72 areas have been zoned. Conditions are imposed on them without compensation, and there are apparently 87 appeals to the UK Department of the Environment. How the situation evolves will inform the debate on when and how economic instruments versus regulations should be used.

Fiscal treatment of chemical fertilisers, feed and pesticides

Unlike other EU member states, Ireland has a concessionary zero rate of VAT on chemical fertilisers as shown in the Table 4.5.

Table 4.5: *Rates of VAT Applied to Fertilisers in Member States*

Country	Rate of VAT
Ireland	0
Luxembourg	3
Italy	4
Other EU member states	Standard rate

Source: European Commission DG XXI (1995)

In addition to fertiliser, animal feed is also zero-rated for VAT. These are two inputs to farms which contribute to the nutrient levels on the land. Pesticides, on the other hand, are charged VAT at the standard rate of 21 per cent.

While on the subject of VAT, a current anachronism should be mentioned. A manure additive

was introduced on the market recently, which has the environmentally benign effect of helping the spreading of manure on land. However its rate of VAT is 21 per cent, meaning that its use is at a disadvantage vis-a-vis the application of zero-rated fertiliser.

4.A.3 Options Based on Information from Ireland and Abroad

In addition to the efforts made by the European Commission to rationalise the CAP, a Ministerial Meeting at OECD (1991) stated that there was a need to "introduce low-energy, low polluting systems based on new technologies; and prices for agricultural inputs that reflect more fully their environmental costs". A major difficulty, as we shall see, is that agriculture is characterised by highly variable and frequently unpredictable environmental conditions, and by the fact that its pollution tends to be "non-point", that is, diffuse, rather than emerging from an identifiable pipe or smokestack. The communique underlined the need for governments to identify and eliminate those subsidies, taxes or other market interventions that distort the use of environmental resources. "Getting the price right" for raw materials, goods and services was seen as critical, to enable them better to reflect their full environmental and social costs. A recent meeting of the OECD policy committee at ministerial level OECD (1996) stated the need for cost internalisation to be part of environmental policies to enable trade liberalisation to contribute to sustainable development, and welcomed the attention focused on the environmental implications of subsidies and tax disincentives. In similar vein, the first recommendation relating to agriculture in the report prepared for DG XI of the European Commission (DRI 1994) was that all subsidies on fertilisers be removed.

Before making practical suggestions for agriculture, we will briefly examine the scope for removing concessions, and for the imposition of pollution taxes, quotas and deposit-refund schemes, to see what each has to offer to deal with excess use of fertiliser. We will also look at competitive tendering to see what that might offer to the protection of biodiversity.

4.A.3.1 Removing concessions

One option is to remove the concessionary zero rate of VAT on fertilisers and feed. Some 98 per cent of farmers (out of a total of 108 600 farmers who come within Revenue Commissioners' remit) in Ireland are not registered for VAT and so they are not reimbursed their VAT payments

in the usual manner by reclaiming them in VAT returns. Instead they receive a flat-rate rebate when they sell their output to a registered person. The rebate received is 2.8 per cent of the value of their sales and represents the amount of VAT paid in the *average* farmer's output. As the average farm spends £1659 annually on fertiliser (Teagasc 1995), the absence of VAT on fertiliser inputs is worth £348 at the standard rate, or £208 at the reduced rate. If VAT were imposed on fertilisers, the flat-rate rebate would be correspondingly raised so that the agricultural sector as a whole, and average fertiliser users, would be overall financially unaffected, but would face higher fertiliser prices than at present. On the other hand, intensive users of fertiliser would be worse off and low intensity users better off. Average expenditure on feed is £3597, the absence of VAT is worth £755 and £450 at the standard and reduced rates, respectively.

The 2000 farmers who are registered for VAT would also be no worse off, except that they would face the costs of financing the VAT paid on inputs, until they received the rebate due on their VAT returns. These farmers would tend to work the larger farms which in some cases may be doing the more environmental damage. The problem of how to correct the incentives facing VAT-registered farmers will be addressed below. Some non-registered farmers may in fact decide to become registered after the imposition of VAT, if they use more than the average amount of fertiliser per unit of output, in order to get the rebate. These might be dairy farmers, who use nearly double the average farm's input of fertiliser. As organic produce is grown without fertiliser, it would enjoy a relative advantage from the removal of the VAT concession on fertiliser. Organic farmers would receive the rebate on output, without having used and paid VAT on fertiliser as an input, leaving them better off.

In sum, given that expenditure on fertilisers in 1994 was £248 million (CSO, 1996), VAT on fertiliser would amount to something above £50 million at the standard rate, and about £30 million at the reduced rate. All farmers would be compensated in the rebate, but for 98 per cent of them the rebate would be according to a flat rate. As stated this would overcompensate relatively low fertiliser users, and vice versa. In other respects it is a non-specific compensation. It is an economic instrument with two good features: provided that fertiliser prices are stable it would operate like a tax per unit of volume of fertiliser. Secondly compensation is assured. This is in marked contrast with many proposed environmental incentives, where the problems of

compensation to alleviate hardship and shortage of funds are serious stumbling blocks to their introduction. It is an ideal route for rectifying the current anachronistic incentive structure. The same could be applied to animal feed.

4.A.3.2 Pollution taxes

As opposed to merely removing concessions, a further step which is already implemented in a few countries, and being considered in others, is to introduce specific taxes on fertilisers. This is in order to pay for the damage that they do. If this damage is not charged for there is a distortion to relative attractiveness of use of fertiliser versus use of manure and the development of technology for spreading manure is at a disadvantage. The same relative price distortions apply to biomass. "If biomass production is less fertiliser intensive than agricultural production, the effects of underpricing fertilisers through a failure to take account of environmental externalities is probably to raise agricultural production above its socially optimal level. The corollary is that the production of biomass may be reduced below its socially optimal level."[10]

The story is somewhat similar when we consider pesticides. Agricultural chemicals are again just one of several factors of production which the farmer combines in order to yield output. The use of pesticides has been likened to the purchase of insurance against a possible attack of pests. In determining what level of chemicals to apply, the farmer weighs the costs of additional chemical usage against the prospective benefits from its use. There are exceptions of course but, in general, the farmer's private calculations will systematically result in over-application of pesticide, because the farmer does not include as a cost the potential health risks to other persons and the danger to wildlife, according to Swanson and Lloyd (1994). Without government regulation or tax there will be excessive application, in the sense that total costs (including environmental damage) outweigh benefits. Regulation, including bans, is the correct instrument for highly toxic or persistent substances. For example organochlorines were banned in the 1960s by many western countries, though paradoxically still produced for sale (eg DDT) in less developed countries. In tropical countries it was estimated that DDT had saved 10 million lives in a campaign to eradicate malaria: an example of the weighing of costs and benefits of chemical

usage.

Chemicals of lesser toxicity can be taxed. In Denmark it was found that regulatory measures, such as stricter pesticide registration standards, mandatory education programmes and pesticide application book-keeping, have failed to attain the targeted reduction in pesticide use, according to Dubgaard (1996). That said, the essential role of regulations is not in question. Advising farmers and providing them with information on agri-chemicals are also necessary tasks, requiring funding.

We saw above that pesticide usage in Ireland is about half the EU rate. However it appears that for Ireland to comply with the EU Pesticides Directive, the level of monitoring will need to be strengthened. This will require extra funds, for which the Department of Agriculture has apparently been calling for five years. In the UK, the costs of monitoring of foods and the environment (eg water and wildlife) are now borne by the UK pesticide industry through a levy on the annual turnover. At the minimum in Ireland there should be sufficient funds to monitor pesticides. The annual costs of registration and monitoring would be at least £0.5 million and extra equipment could add more. Given that expenditure on crop protection is £36 million (or £50 million if one includes total pesticides) then we are talking of imposing a levy in Ireland of very roughly 2 per cent.

Other considerations of pollution taxes are worth examining. In Denmark there has been some concern about the nitrate "front" gradually percolating towards many aquifers in certain regions. Farming organisations have wanted to solve this problem through voluntary measures and have understandably opposed statutory control or taxation of nitrogen. Complicated legislation was introduced in 1988 on manure storage capacity, but it soon became clear that there was no political willingness to furnish environmental control agencies with the resources needed to enforce this legislation. However, the non-point nature of nutrient runoff makes it difficult to devise a tax which discriminates according to the actual amount of pollution in the waters. The more indirect and crude measure of taxation of the nutrient input is therefore resorted to. Rude and Dubgaard undertook a study (described in Dubgaard 1991) of levying a hefty 150 to 200 per

[10] Fitz Gerald and Johnston (1996)

cent tax on the nitrogen in chemical fertiliser to achieve a targeted 30 to 35 per cent reduction in the use of nitrogen, alongside a flat-rate refund per hectare. As such a high level of tax would be required, they prefer it to be levied on marginal quantities only. Such a scheme could be implemented by allocating a tax-free quota of nitrogen per hectare to farmers, and taxing additional nitrogen purchased. A levy on nitrogen in chemical fertiliser is currently being discussed by policy makers in Denmark. Meanwhile a pesticide levy has increased pesticide prices by about 50 per cent on average - with some differentiation between the various products. It is still too early to tell what the impact of this levy will be in terms of reduced pesticide utilization. In any event some of the strongest effects might occur in the longer term.

Turning to analysis undertaken in Germany, most studies, according to Nutzinger (1994), agree that significant reductions in fertiliser application could only be achieved by large fertiliser taxes. However a gradual introduction would enable adaptation. Farmers' incomes could be compensated on the basis of hectares. More economical use of manure would be encouraged and more re-integration of animal breeding and plant cultivation would occur, the latter at present having no manure to substitute for fertiliser.

A survey by OECD in 1994 shows that five countries impose levies[11] of some sort on fertilisers as shown in Table 4.6. The four European countries charge on the basis of the N, P and K content whereas in the USA the charge (raised at sub-federal level only) is based on tonnage. Charges based on P, which is of interest in Ireland, range from 0.14 ECU per kg P in Sweden, which amounts to 10 per cent of the price, to 0.27 ECU per kg P in Finland, which is 20 per cent of the price. In Finland there was a decrease in the use of phosphorus per hectare which may be due to other policy instruments as well, some revenue from the charge being used for agricultural subsidies. The tax has recently been discontinued. In Norway, phosphorus usage per hectare decreased by around 40 per cent between 1980 and 1988, remaining constant thereafter. In Sweden there has been a small fall in the use of nitrogen.

[11] A rise in the price of fertiliser will generally decrease the output of agricultural produce. The profit maximising farmer will increase fertiliser application to the point where: Price of fertilizer/Price of output = marginal productivity (or change in output per unit increase in fertiliser use). An increase in the price of fertiliser in the absence of increased marginal productivity will cause a reduction in fertiliser application, reduced yields and reduced pollution. The relative reduction in output will be small in comparison to the reduction in input and

Table 4.6: Levies imposed abroad on fertilisers and pesticides

Country	Charge base, rate and percentage of price	Incentive		Revenue spending
		Int	Act	
Fertilisers				
Austria	N-, P- and K- content: ECU 0.31, ECU 0.18 and ECU 0.09 per kg	-	-	Subsidies, environmental expenditure
Finland	N- and P- content: ECU 0.41 and ECU 0.27 per kg (5-20% of the price)	+	#	Agricultural subsidies, general budget
Norway	N- and P- content: ECU 0.13 (19% of the price) and ECU 0.24 per kg (11% of the price)	+	#	General budget
Sweden	N- and P- content: ECU 0.07 and ECU 0.14 per kg (10% of the price)	+	+	Subsidies, environmental expenditure
USA (certain regions)	ECU 0.07-1.11 per ton (< or = 2.5% of the price)	¨	¨	Environmental expenditure
Pesticides				
Norway	13% on wholesale price	+	¨	General budget
Sweden	ECU 0.9 per kg active ingredient, ECU 3.6 per treated hectare	+	#	Environmental expenditure

Source: OECD (1994), p.75

Notes: Int = intended as an incentive instrument. Act = actual incentive instrument.
+ = yes; - = no; ¨ = no data available; # = unclear.
ECU exchange rate applies to 1 January 1992.

The table also shows charges on pesticides, which are levied in Norway and Sweden. In Denmark an eco-tax was imposed on pesticides in January 1996, increasing pesticide prices by 15.35 per cent, depending on the type of pesticide. The model simulations indicate that the tax-

pollution (Simonsen 1995).

induced reduction in pesticide use will probably be less than 10 per cent. It appears that rather than strengthening bureaucratic control, politicians may be becoming more willing to use economic incentives (Dubgaard op.cit.). In Sweden at the beginning of the 1980s it was decided to reduce usage of pesticides by 50 per cent. The Swedish Board of Agriculture has analysed the responsiveness of pesticide use to its price. They estimate that a 10 per cent price rise results in a decline in use of 2 to 5 per cent. In a study by Gren (1994), also for Sweden, the decline in use after a 10 per cent price rise would be 9.3 per cent for herbicides, 5.2 per cent for insecticides and 3.9 per cent for fungicides. In the Netherlands a levy on pesticides is planned which will aim to raise over £10 million for use in pesticide reduction action programmes.

Monitoring costs for enforcing legislation in general, and who should bear them, are also sources of debate. In Denmark, for example, a national monitoring programme, measuring nitrogen, phosphorus and organic matter in the aquatic environment was started in 1988. This is based on 255 monitoring stations on streams and rivers, 68 groundwater monitoring points and measurement of concentrations at 37 selected lakes. Some coastal waters are monitored also, as are a number of sources of pollutants. The programme costs Dkr 100 million, or over £11 million, per year. Turning to another country, Norway has a 6 per cent control charge on pesticides, in addition to the 23 per cent tax. In other countries, apparently, the high costs of monitoring have inhibited the monitoring programmes or restricted them to small areas, as in Finland. Ensuring adherence to environmental legislation can be complicated, requiring individual assessment as in Denmark. Some prescriptions are hard to control effectively at realistic cost, such as the upper limit on the amount of nutrients that may be applied per hectare, or the 12 hour time limit after spreading for working manure into the soil. At any rate, with control so difficult and monitoring so expensive, the argument for the removal of concessions which are incentives to over-application is strengthened.

4.A.33 Tradable input quotas, pollution quotas or deposit-refund schemes.

Tradable quotas are worth investigating because they are well-suited to situations where technical or agricultural conditions vary. Pollution taxes, on the other hand, are suited to situations where there is a measurable level of pollution. Will there come a time when measurement of water quality, and hence of pollution, becomes exceedingly cheap and

automated? Even if one could overcome the measurement problems there might still be great variation as to an area's vulnerability. Each catchment area could be a special case, such that a uniform tax (not a mere removal of a concession) would be inappropriate, though possibly better than a blanket regulation. Quotas can have advantages over both.

In the option of imposing the standard rate of VAT on fertiliser, mentioned above, we saw that some 2000 farmers in Ireland are registered for VAT and that removal of the concessionary rate would have virtually no effect on them, because they can reclaim the VAT that they paid. Yet it is these large farmers which probably release a large share of the excess nutrients and require an incentive to farm in an environmentally conscious manner. Several ideas are being discussed, such as tradeable pollution quotas, within catchment areas that are vulnerable.

The advantage of the tradable quota regime is that the authorities can be more sure that a limit on use will be met. Another advantage is that the authorities do not need to have information on the abatement costs. One possibility is for a fertiliser quota to be imposed in vulnerable areas, such as a quota of 90 or 80 per cent of present application. Quotas would be based on the advice of experts such as soil scientists and chemists. Selected localities would be reasonably small such that the quota of fertiliser permits could be allocated on the basis of a uniform rate of application per hectare. Fertiliser permits would then be tradable within the area. Those farmers who decided to use less fertiliser per hectare, by managing manure more carefully or altering their product, would be able to sell their excess permits. They would want to sell if the price offered were higher than their marginal abatement cost. If the output foregone is as minimal as the agronomists imply, then the trade price might be quite low, adding to the scheme's acceptability. However some funds will be required for monitoring and administration.

There are several difficulties with a tradable quota scheme however, including the fact that there are other sources of nutrients such as feed, and adherence to the quota on inputs would need to be verified somehow. One suggestion is that the quota of fertiliser be coloured and that only coloured fertiliser be allowed within the region (like agricultural diesel being coloured to differentiate it from motoring diesel for tax purposes). No examples of such a scheme have come to light and there is a worry that the set-up costs for trading fertiliser permits might be a

disadvantage.

On a theoretical level, tradable permits are advised when the cost of damage from an extra unit of pollution is rising steeply relative to the abatement costs. By contrast, taxes are recommended when the marginal damage cost curve is relatively flat. Even if we suspect that cost of damage is rising steeply in some areas, theory may have to give way to practicality for now, though an experiment with tradable quotas in a certain area would be worthwhile.[12]

4.A.3.4 A practical solution

We can now draw the threads together to devise a practical solution. It is noted that nutrient management calculations are and will have to be increasingly undertaken. The calculations might cost a farm in the region of £200 to £300 per year to undertake. They entail the sampling of soil and the recording of inputs to, and outputs from, the farm. REPS participants undertake abbreviated nutrient management plans. Some other regions of the world, Pennsylvania for example, have mandatory nutrient management plans. Local authorities in Ireland now have legal powers to require farmers to submit nutrient management plans where they consider this to be necessary.[13]

We should further remember that ideally it is not that the P input needs to be discouraged, but rather the P excess, or remainder, when the soil type, inputs and outputs have been taken into account. In this context it may be better to think more in terms of a deposit-refund scheme, where a tax on nutrient inputs is refunded on nutrients in the recorded outputs. Unaccounted nutrients would then actually bear the tax. The items in the recorded calculations, like in Tunney's nutrient balance in Table 4.3 above, bear a marked similarity to the information required in calculating one's VAT rebate. If VAT were charged on fertilisers and feed, but the rebate were related to some adjusted P content of the output, VAT-registered farmers would have an incentive to minimise their inputs and maximise their outputs of P, or "to return the bottles" drawing on the returnable bottles deposit-refund analogy.

[12] As suggested by Johnston (1995)

[13] Local Government (Water Pollution)(Amendment) Act, 1990, as amended by section 66(3) of the Waste Management Act, 1996.

Rather than set up a new procedure to deal with the phosphorus problem it would be worth considering how the VAT system might be exploited. Information required to calculate nutrient remainder would also need to cover changes in stocks on farms. This is not required in the VAT returns. Further information required would also include the timing of manure spreading, adherence to good practice in silage storage and the like. It is not just "how much" nutrients are applied that matters, but also "how" they are applied. The proposal, then, is that VAT-registered farmers would be charged VAT on inputs of fertiliser and feed, but the rebate would be made conditional on a satisfactory nutrient balance being demonstrated by the farmer. The rebate might be only a proportion of the VAT originally paid, the proportion being guided by the ratio of nutrient outputs to nutrient inputs. The higher the proportion of outputs to inputs the higher the rebate. The higher the nutrient excess or remainder, the higher the effective tax.

To overcome the mis-match in timing, that VAT is calculated 2-monthly and that the nutrient remainder should probably be calculated annually, cumulation of the intra-annual figures would be needed. To counter the variability problem, that nutrient excess in some regions may be doing a lot of harm and doing none in other regions, local authorities, which are the bodies with direct responsibility for Water Quality Management Planning[14], would have the authority to stipulate adjustments to the calculated proportion. For example there might be, say, three types of region: (1) non-vulnerable, (2) potentially vulnerable and (3) vulnerable regions. In non-vulnerable areas, the full rebate could be paid in the usual manner, perhaps.

If the system were not operated via the VAT mechanism, that is if the VAT procedures are not amenable to extensions of this sort, then this deposit-refund suggestion might at least be operated alongside the VAT procedures, so that there is some economy of administration. It would remove the need for setting up a completely new structure for gathering the same information again from the 2000 farmers. Possibly the most practical solution is the appointment of not much more than one or two extra persons to administer it, who would have to be situated inside the Revenue Commissioners Office - since the information cannot be released outside the Office.

Impediments to making the VAT rebate conditional on a satisfactory nutrient balance arise because under present legislation the right of VAT deduction may not be limited. In the meantime, however, a complete overhaul of the common system of VAT in the EU is underway and has been set out in a work programme[15] for 1996-1999. The overhaul will include the need to modernise the existing provisions relating to the *right to deduct*, which in fact is the rebate which we are discussing. In order to incorporate the condition which we are proposing here, approval of all EU member states would be needed. Failing this, as mentioned, the proposed method can operate alongside VAT procedures.

So much for the 2000 or so farmers who are registered for VAT. What of the 98 per cent of farmers who are not registered? These tend to have small farms, though some might be intensive fertiliser users and have a large amount of manure for disposal. If VAT were imposed on fertiliser and feed, as described,they would automatically be compensated on a crude averaging basis, by a higher flat-rate compensation on their output. There may be an initial time-lag, while the flat-rate is adjusted and introduced. Farmers who use relatively less nutrients would gain, above average users would lose, and the incentives to use of manure relative to fertiliser will be improved - all of which are good features. Farmers employing organic methods would gain, and in theory subsidies awarded to them could be reduced. Fertiliser-intensive farmers may opt to become VAT-registered, in order to receive the full rebate, which is perhaps another good feature.

In sum, using the VAT mechanism with a rebate conditional on good nutrient management is worth considering because:

- it tackles the real problem, namely the nutrient excess.
- only the excess is taxed, benign behaviour will not incur a net tax.
- the documentation on inputs and outputs is already obtained by the system.
- the tax authorities are better placed to take on such a task, as they can withhold the deduction from VAT.
- the number of extra personnel required is relatively small, though this depends on how much "compliance" is incorporated in the conditions.
- it could be applied in a manner which is sensitive to different regional conditions.

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[14] under the Local Government (Water Pollution) Acts of 1977 and 1990.

[15] Phase Three, General principles of VAT, First package of formal proposals, mid-1997, (Commission of the European Communities, 1996).

- it requires large farmers in vulnerable areas to calculate nutrient balances, which they should be doing anyway.
- the VAT system is ideal because it is somewhat similar to a deposit-refund system.

Many difficulties with such an approach can be foreseen, but these should be looked at in the context of the scale of the problem, and of the objections raised to every other proposal for remedying excess nutrient application.

4.A.3.5 Competitive tendering

Competitive tendering is worth considering when the issue of nature and biodiversity is being discussed. To date, subsidies have been used and there are many areas in the reformed CAP where "cross-compliance" is required. That is, for example, grants are only payable if the farmer complies with stocking density levels and the like. It is important that these methods be adequately monitored and sufficiently sensitive and flexible to deal with specific problems as they arise, such as the over-grazing of hill sides, as an example given earlier. We need to be mindful of the ease with which perverse incentives are introduced, and the difficulty of considering beforehand all the things that might go wrong.

A more targeted approach is for society to view farmers as potential providers of environmental services, which society wants to buy. DRI et al, in their report to DGXI, conclude that governments should ask farmers to tender for biodiversity projects which the government would list. In this way, rather than pay a fixed amount to all farmers who undertake to carry out a specific activity - maintaining meadows or historic breeds for example - farmers would be able to bid to undertake this activity.

Box 4.1: *Biodiversity activities which governments might put out to tender.*

Example 1: Biodiversity and Habitat Protection
The authorities might invite farmers with land in specified areas, such as Environmentally Sensitive Areas, to submit bids for the minimum subsidy which they would demand in order to provide some type of habitat, or to encourage the expansion of a species. Care would be needed in defining success or failure, be it, for example, density of species or area of groundcover. A limited budget could then be spent in such a way as to obtain the best value for money in an area.

Example 2: Landscape Enhancement
Farmers in an area of natural beauty might be asked to submit bids for the minimum subsidy, based on length or area perhaps, which they would require in order to manage their hedges, ponds, turloughs, et cetera. A pre-determined density of these features could thus be assured at the lowest available cost.

Example 3: Crop Diversity
The authorities might determine that a certain share of crop should be of a specific variety. Bids could be invited from farmers for the minimum subsidy per hectare that they would require in order to grow the variety, enabling the target share to be reached at lowest cost.

Example 4: Sustaining species
The authorises could invite bids from farmers prepared to rear endangered breeds of animal or species of plant. This should allow a guarantee of survival of a set number of each particular breed or plant at the least cost, enabling more conservation to be achieved, given limited budgets.

Source: Derived from DRI et al.

The logic behind this proposal is that some farmers will be especially well disposed to this activity or have good conditions, as well as being knowledgeable and able to carry it out more cheaply and effectively than others. In this manner, society will have achieved its objectives at a lower cost. A list suggested by DRI of the sort of activities which governments might put up to tender is given in Box 4.1. In effect the Countryside Stewardship Scheme in England, and a like scheme in Wales, use a similar approach: they will accept proposals from farmers which bring greatest environmental and public benefits.

The success of such policies is often more dependent on how it is undertaken rather than on what is done. The advantage of competitive tendering is that it could be well-focused but, as with REPS (the Rural Environment Protection Scheme, see appendix for details), its success would depend largely on correct definition of objectives and monitoring of results. Cross-departmental and, indeed, cross-agency cooperation could be helpful. Non-governmental organisations, which have knowledge of local conditions and can assess results cheaply, could participate to good effect, as with recent efforts to revive the population of corncrakes.

4.A.4 Suggested Use of Economic Instruments

Before summarising the proposals for agriculture, the question must be addressed as to whether one should tax the harm being done or subsidise those avoiding doing harm. A slightly different question arises in the case of past damage. How does one treat farmers who have caused degradation in the past relative to those farmers who genuinely, and at personal cost perhaps, operated in a careful manner, preserving turloughs and thickets and maintaining soil balance and water quality? Should not society pay its debt to them, rather than reward those who did the opposite by awarding them contracts to undo the damage? Moral hazard lies at the core of this issue: encouragement to future damage may be given if polluters are "rewarded". This is a basic criticism of many subsidy schemes. Furthermore, the award of a subsidy implies that the polluter had the right to pollute, which is now being bought. The fact that certain people have been polluting ought not to mean that they then have the right to do so. For practical purposes however, they may have the right. Apart from these reservations concerning moral hazard and uncertain rights, we have to start from the present and aim to get best environmental quality at cheapest cost to society, in the short and longer term.

There is a related issue, which is perhaps a question of definition. It is sometimes difficult to determine where the actual boundary lies between doing good and not doing harm. For example, is habitat conservation a good which should be rewarded, or simply the absence of a bad which, if the bad occurred, would need to be penalised? One is looking at a variable definition and, again, rights lie at the root of the question.

As for the context for framing proposals, there is continuing pressure from the World Trade Organisation to reform the system of price supports under the CAP and the prospect that all EU supports, at over 50 per cent of farmers' incomes, will no longer be affordable within an enlarged EU. Such supports are a clear example of an effective but misdirected subsidy. In sum, there is double downward pressure on farmers' future incomes. European consumers however would be more willing to support agricultural incomes in return for better environmental quality. While the major CAP reforms may lie in the (not so distant) future, they require realistic consideration and preparation now. Meanwhile there are practical economic instruments for protecting the

environment which can be readily adopted as follows.

1. Concessions on fertiliser and animal feed should be removed. VAT should be levied, in the knowledge that farmers are automatically compensated. For 98 per cent of farmers the compensation will materialise as an increase in the flat-rate rebate on their outputs (at present 2.8 per cent), but the important point is that the relative price of fertiliser will have risen. This situation of no net financial effect on average and relative price change is ideal. The remaining 2 per cent of farmers, consisting of some 2000 farmers with high turnover who are registered for VAT, would be individually unaffected financially by this measure, unless the next proposal is adopted.

2. The 2000 farmers who are registered for VAT should be required to supply a satisfactory nutrient management balance in order to receive the VAT refund on their nutrient inputs of fertiliser and feed. Alternatively, given that information on inputs and outputs is to hand in the VAT procedure, the tax could be effectively imposed on nutrients unaccounted for or "lost". The VAT system is in fact a good procedure to link into, because it resembles a deposit-refund system. Ideally the overhaul of the VAT system which is underway would reform the rules on deductibility to facilitate the introduction of conditional rebates. Even if unanimity is required among EU states, this may not be a greater obstacle than the objections raised to every other proposal made to date for remedying the problem of excess nutrient use in agriculture.

An alternative, is to operate a similar scheme, consisting of a fertiliser tax with a rebate conditional on satisfactory nutrient balance, alongside newly-introduced VAT charges in the usual system, which exploits the same data. Less satisfactory suggestions include the imposition of a tax on the phosphorus content of fertiliser. Introduced at the lowest rate applied abroad, specifically at the rate 0.14 ECU per kg P (or £0.112 per kg) used in Sweden, this tax would raise some £6.7 million annually. Alternatively, the tax could be raised in vulnerable areas where only coloured fertiliser would be allowed, or else a fertiliser tradable quota scheme might be used. These last two suggestions are untried, however.

3. A realistic monitoring charge should be levied on inputs which oblige authorities to

undertake monitoring. These would include pesticides and possibly fertilisers. Present monitoring for pesticides is apparently under-resourced, and more knowledge of current pesticide levels is needed (Dollard 1994). Monitoring fees are already raised by authorities for industrial waste water discharge.

4. As long as CAP benefits are related to output, it is worth requiring cross-compliance, with set-aside, stocking limits and the like.

5. In addition to removing the perverse incentives to intensification, some landscaping and bio-diversity enhancing projects should be put out to tender. For example farmers could be invited to tender for maintaining barn owls or habitats, or lichens, once a satisfactory means of verifying the existence of the item has been developed. Environmental benefits will then be achieved at minimum cost to society by the farmers most disposed to providing them.

These proposals amount to a two-sided approach to agriculture and the environment. On the one hand the polluter pays, for damage to water mainly. On the other hand the farmer as steward is paid an efficient price, where the farmer acts as guardian of nature and guarantor of bio-diversity.

4.B. FORESTRY

4.B.1 Environmental impact of forestry

After clearance of the indigenous deciduous woodland over many centuries, Ireland was left with less than 1.5 per cent of the country under forest at the turn of this century. Some of the forest has recently been restored, not with deciduous species but with conifers, and forests now cover 8 per cent of the land area (Department of Agriculture, Food and Forestry, 1996). It is in this context, of quite rapid afforestation predominantly by conifers, that we discuss the interaction between forestry and the environment. This contrasts with the situation in many other parts of the world where there is rapid deforestation, or forest decline from mainly airborne pollution.

As with agriculture, forestry has positive and negative external environmental impacts. On the positive side, trees take carbon dioxide from the atmosphere and store it. Therefore planting trees, or increasing their growth rates, can delay the buildup of greenhouse gases in the atmosphere and delay global warming. Lowland forests store more carbon than upland forests and fast growing trees, such as poplar, will take a shorter time to fix (or sequester) a given quantity of carbon than, say, oak trees. The carbon sequestered is eventually, but only gradually, released from the timber and paper, the final products, as a result of decay (Cannell and Cape 1991). The release time might range from hundreds of years for timber incorporated in construction, to less than a decade for pulpwood, pallet and packaging.

Also on the positive side, soil erosion can be reduced by the existence of established forest, once the planting stage is well over. Extremes of water levels can be smoothed. Furthermore forests have amenity value, in providing forest walks and adventure areas, as well as enhancing views and providing windbreaks, and habitats once the forest is established. An estimate of external benefits of forests of £21 million is quoted by the Department of Agriculture, Food and Forestry (op. cit.). Most of these benefits bestowed on society are not rewarded, and in this sense, without state intervention, forest planting will be lower than its ideal level.

On the negative side, forestry can have a detrimental and intrusive effect on scenery, at least if planting has been insensitive to the existing landscape. This could become a disadvantage for tourism, as visitors do not come to Ireland with its forests in mind. Another negative environmental impact is soil and water acidification, occurring particularly at the mature stage when the plantation has been carried out on acid-sensitive soils, with detrimental effects on surface waters and fish. This occurs on sites such as over granite, which are said to be "poorly buffered", that is they cannot absorb the deposition which occurs when clouds and fog droplets impact on the rough surface of a forest causing polluting gases to deposit on the trees and drop to the ground. Trees also filter pollutants in the air which deposit on them, and are washed to the ground by rainfall. So the presence of the forest can increase acid deposition, resulting in increased acidity and heavy metals, particularly aluminium concentrations as a result of the sulphur and nitrogen pollution in sensitive upland freshwaters.
In fact these problems should apply to a minority of water catchments, that is where calcium-

poor bedrock is overlain with peat or acid mineral soil, but it is important because the affected catchments are frequently salmonid fisheries. Vulnerable areas would include upland catchments in Wicklow, west and south county Galway, and parts of counties Mayo, Donegal, Clare, Kerry and Cork which have the largest acid-sensitive areas in the country.[16] In such areas, afforested streams tend to be more acid than unafforested counterparts. Acidified streams in Britain, as in numerous other places, are characterised by impoverished invertebrates and they may be fishless (Alott and Brennan, 1993). In Ireland all aquatic forms of life, water weeds, invertebrates and fish, were severely impaired by acidification as a result of afforestation according to Bowman (1993). If planting occurs up to the edge of the watercourse, this too will increase the risk of acidification, and cause shading of the waters at the mature forest stage, which leads to reduced growth rates of fish. The resulting more even temperature of the water may however be beneficial to fish.

Over 40 per cent of existing plantations in Ireland are on acid-sensitive peatland and there is some uncertainty as to whether the carbon sequestration by the forest compensates for the carbon losses resulting from oxidation of the peat during the development phase (Farrell, 1996).

Mature forests also absorb water, potentially reducing water availability in an area. This occurs because the interception of water passing overhead is more than offset by the high rate of evapotranspiration through the large leaf-surface area. Forested catchments can yield between 10 and 30 per cent less water than unafforested counterparts. Decreased water yield can be of concern generally, and especially in catchments that are used for public water supply.

Other negative effects of afforestation include the increase in sediment exports from the area at the development stage, causing habitat destruction to invertebrates, plant life and salmonid fish. Suspended sediment in water can also have harmful effects (Whelan, 1996). There are of course several courses of action which can restrain the damage, such as careful timing of ploughing and draining, the manner of ground preparation, et cetera. The impact declines as the terrain settles though even after several years, sediment yield can be several-fold higher than pre-drainage

[16] A map showing the locations of acid-sensitive areas in Ireland is given on page 3 of Bowman (1991).

levels.

Finally the effects on wildlife and species diversity can be quite marked, though it depends on what was there before afforestation and again on how the forestry is managed and its type. Afforestation of wetlands, or replacement of broadleaved trees by conifers, would have a negative effect on species diversity, as would fast maturing crops which are then clear-felled, that is, felled in one go. Bio-diversity grows with time in forests, so that longer rotations are more benign than short rotations. Also staggered felling is more benign though more costly than clear-felling. Wildlife populations need habitats with continuity. In addition to destroying habitat, clear felling can cause soil erosion and run-off and leave an unattractive scenery.

In sum, most concern about forestry would centre on acidification of water, on the effect on scenery and on wildlife, possibly in that order. No value has been put on these external costs though work is in train (Clinch and Convery, 1996). Some of these problems can be avoided if precautions are taken and the new guidelines discussed below adhered to (Forest Service 1995/6). The major environmental benefits probably lie in carbon sequestration, and provision of habitat in some instances.

4.B.2 Existing fiscal treatment and environmental effects

An enhanced programme of planting is now underway, for farmers to counter the declines in support for traditional farming, and for the non-farming private sector. Private afforestation, of which farmers account for some two-thirds, is now nearly three quarters of all afforestation. Conditions for forestry in Ireland are ideal with high growth rates at 12 m^3/hectare per year, compared to 4.3 m^3/hectare per year in the rest of Europe (McLoughlin 1996). It is expected that the Irish timber industry will become a net exporter of wood products.

The EU has supported forestry development in Ireland since 1981 through the Western package Scheme and the Operational Programme for Forestry 1989-93. Meanwhile the CAP gives higher returns to agriculture, such that mainly non-agricultural land tended to be used under these forestry schemes. The trend in CAP reform to move away from agricultural output support to direct income support is tilting the balance somewhat towards forestry. The present programme

of support introduced in 1994 comes under the Operational Programme 1994-1999 and under the CAP Forestry Accompanying Measure (part of the McSharry CAP reforms). The grant differentials favour the afforestation of diversified species and broadleaves in particular. An additional premium is payable to farmers to help reduce agricultural output. A slightly lower premium is paid to non-farmers. Private afforestation has grown rapidly since 1985. Present subsidisation comes under two schemes: (1) the Afforestation Grant Scheme at a total cost of £87 million over the five years and (2) the Forest Premium Scheme at a total cost of £125 million, also over the five years (Department of Agriculture, Food and Forestry, 1994). In addition, (3) there are tax incentives applying to forestry development in the areas of income tax et cetera, and subsidies to the timber industry. These are now described in more detail.

(1) The Afforestation Grant Scheme awards an afforestation grant in two stages. At the development stage three quarters is awarded, subject to approval conditions, and four years later as a maintenance grant the remaining quarter is awarded. The total amount per hectare ranges from £1500 for non-diverse species to £3000 per hectare for afforestation which consists of over 75 per cent oak or beech.

(2) The Forest Premium Scheme applies to farmers and others who suffer a loss of income resulting from the afforestation of their land. It is payable only in relation to plantations which qualify for the Afforestation grant above. Premiums are payable annually for 20 years and the levels for farmers range from £130 per hectare for unenclosed land to £300 per hectare for oak or beech on non-disadvantaged enclosed land.

(3) Profits accruing to an individual or a company from the occupation of woodlands managed on a commercial basis and with a view to the realisation of profits are exempt from both income tax and corporation tax. Gains arising on growing trees and on the disposal of felled timber are not chargeable to capital gains tax. Forestry is regarded for VAT purposes as an agricultural activity: there is no VAT chargeable on timber. A person exclusively engaged in forestry is not required to register and account for VAT, though may elect to do so. It is not known what is the cost to the public purse of this tax subsidy. Other subsidies are given to promote the wood-based furniture sector, to aid the construction of forest roads, to courses for forest product marketing,

and the like.

The annual real rate of return to forestry under the 1989-93 scheme has been calculated by several authors. On mineral soil, Farrell and Boyle (1990) estimate the rate of return to the forester to be 5.5 to 6.5 per cent, and 4.5 per cent on low-level blanket peats. Clinch and Convery looked at ten per cent of all forest investments grant aided in 1991. Assuming average historical prices, the expected real rate of return was just under 6 per cent in the presence of existing subsidies. However when afforestation subsidies are removed from the calculation, the real rate of return is decreased to 4.1 per cent. A rate of 5 to 6 per cent would be required for public investment. Under the more generous grants and annual payments introduced in 1994 the rate of return becomes 10.5 per cent, though in reality some of this return will be absorbed by higher land prices. An important question would be: what is the rate of return to public money, in terms of both private and public net benefits, and how does this compare with the cost of raising public funds to provide the subsidy?

Compliance with the guidelines concerning protection of fisheries, landscape and archaeology is a condition for grant aid. The extent to which this affects environmental behaviour is unclear as there are no reports, at least as yet. Afforestation over 70 hectare (reduced from over 200 hectare on 1 October 1996) requires planning permission from the relevant local authority, with submission of a formal Environmental Impact Assessment. If the afforestation is over 40 hectares and includes an aquatic zone the developer must consult the Regional Fisheries Board at least 6 weeks before start of operations - in a Designated Sensitive Area the threshold is 5 hectares. Grant approvals preclude the planting of archaeological sites, and forestry operations must cease on discovery of an archaeological object which must be reported to the Gardai or National Museum. Whether there are adequate resources to monitor and investigate these environmental issues is questionable, as there appears to be no automatic mechanism for their funding, apart from a 5 per cent administration charge on the value of grant payments, which might yield £10 million over the five years. The extra activity will put pressure on existing monitoring resources.

The guidelines for afforestation are published by the Forest Service (1995/6), outlining

requirements for protection of fish, archaeology and landscape. A concern is the absence as yet of guidelines regarding wildlife, except that grants are not available for areas which are protected or qualify for protection under EU Directives 79/409 EEC and 92/43 EEC on the Protection of Birds and Natural Habitats. There are currently 75 protected areas under the Birds Directive and none as yet under the Habitats Directive. There is a marked disincentive to the retention of areas of natural and semi-natural vegetation, such as hedgerows and broadleaved groves in properties under development according to Farrell and Kelly-Quinn (1991). These areas are sometimes deducted from the grant-assisted area. This is an example of the distorting effects of grants.

There are as yet no guidelines on procedures for harvesting and transport of timber. However, the Department's recent *Strategic Plan* (1996) heralds new procedures on notification to local authorities of proposals for over 25 hectares, new conditions on distance from dwellings, buildings and roads, and new guidelines on harvesting, wildlife, and use of chemicals. Also, premiums may be subject to attendance at training courses. With the present heavy planting programme, thought will need to be given to the staggering of felling.

A common theme running through the comment on forestry, as with agriculture, is the need for resources, that is, suitably qualified personnel and equipment, to ensure that the environmental conditions are adhered to. In the case of the requirement, for example, that development of forestry above 70 hectares have an Environmental Impact Study prepared by the developer, the procedure can only operate effectively if the County Councils, which have to assess these studies, have the expertise and the capacity to assess the projects. At the present time, few councils are suitably staffed for this work according to Farrell and Kelly-Quinn. If this is the case then the attachment of environmental conditions might have little meaning in practice. Another reason for concern is the absence of legal protection of Natural Heritage Areas, though amending legislation is currently in preparation by the Department of Arts, Culture and the Gaeltacht.

4.B.3 Suggested use of economic instruments

As with agriculture, forestry receives considerable subsidies from the state, but for development mainly. There is a further need for funds for checking and monitoring the environmental impact. In theory the forestry industry should probably provide these funds.

The underlying aim of the forestry programme is to enhance rural development and provide rural employment, especially in the context of reduced support to agricultural output. An informed outside observer might in fact suggest that these aims could be just as well served by a rural employment subsidy, or reduction in employment taxes, such as PRSI payments and income tax. At present the developer on the afforestation scheme enjoys a higher rate of return than if the grants were absent, but no change in employment costs per se. Hence the developer will want to continue to economise on labour.

However there is an area where subsidisation to forestry is strictly justified in economic terms for environmental reasons, and that is in relation to the external benefits bestowed on society, from carbon sequestration described at the outset. A figure for carbon fixation is quoted by Cannell and Cape. One hectare of new forest on good sites (in the Pacific Northwest and southern US) will sequester 6 tonnes of carbon per year. One could apply, in reverse, the EU's proposed carbon tax by subsidising trees. In the proposed tax of $10 per barrel of oil, $5 is that part relating to carbon (see the chapter on Energy for more details). This is equivalent to $36.70 or £22.90 per tonne of oil, which contains 0.854 tonnes of carbon, and amounts to a subsidy of about £27 per tonne of carbon sequestered. The reasoning here is that oil users would be taxed £27 per tonne of carbon emitted and, in so far as this represents the marginal damage, the forester should be offered this sum for removing carbon. If a hectare of forest sequesters 6 tonnes per year, then the subsidy per hectare should be in the region of £150 per hectare per year. This would apply only during a certain phase of the trees' lives, though to overcome the aversion to risk some upfront phasing of the subsidy may be necessary. It ought not to be awarded to forest planted on peat soil where the net sequestration value may be zero or negative. If, say, half of the 474 000 hectares of forest in the state qualified, the total subsidy would amount to £38 million per year. The figures used here are for illustration.

This may be an upper limit, because there are other, cheaper, ways of reducing given amounts of carbon emissions[17] and Ireland may choose these rather than forestry, in order to achieve its emissions target. On the other hand, given that forest area will grow and it appears that "the EU

is committed to meeting contingent liabilities created pre-1997 in respect of premium payments of up to 20 years duration" (Department of Agriculture, Food and Forestry 1996 op. cit. para. 4.16.3), the funds may be forthcoming anyway. There should however be an obligation to use them optimally. An over-riding consideration is that the future of the CAP is uncertain and its price support aspects will be further phased out. The consequence will be a reduction in land prices, which should help to raise the internal rate of return on forestry and reduce the rationale for such widespread grants.

To the extent that mature forests, and broadleaved forests in particular, provide habitats for wildlife, these should receive a habitats subsidy also. No evaluations of the habitat function of Irish forests been undertaken, to put a figure on the desired subsidy. Such a habitats subsidy plus the £38 million carbon sequestration subsidy combined could amount to something over £40 million per year. Coincidentally, this rough estimate for environmental subsidies is similar to the existing subsidies, which amount to a total of £212 million over the five years 1994 to 1999, and should replace them. In other words, the existing pattern of subsidies for forests should give way to one that is based on subsidising their benign environmental external effects.

We have just dealt with the external benefits. The external damages, namely acidification, intrusion on scenery and detriment to some wildlife, are not generally amenable to pollution taxes and have to be regulated and monitored. Funds will be required to provide the resources for mapping, testing and analysis along with sufficient qualified personnel, including archaeologists, chemists, fisheries specialists et cetera. The existing administrative charge, which yields perhaps an average £2 million per year, possibly needs to be doubled.

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Appendix 4.1 *Grant schemes to agriculture which have environmental impacts*

Control of Farm Pollution Scheme
The smaller farmer can receive grant aid for certain farm buildings, farmyards, storage facilities for fodder and agricultural wastes and slurry disposal equipment. (The scheme is currently suspended).

Two schemes which have had some adverse environmental effects should be included for completeness, as reforms have recently been introduced to modify their effects:

(i) Livestock Headage Schemes in Disadvantaged Areas (for cattle, equines, sheep and goats in Disadvantaged Areas)
Applicants must undertake to keep the animals for a minimum of two calendar months.
Some main schemes with annual payments are:

Cattle headage payments in handicapped areas range from £40 to £84.

Sheep or goat headage payments in disadvantaged areas are £10 up to a limit of £2000.

This scheme has in fact had some adverse effects on the environment by causing over-grazing by sheep (discussed above) on commonage on hill areas designated as disadvantaged. In October 1995 new measures provided cash payments to farmers who agreed to reduce sheep numbers on hills, amounting to a payment of £31 per ewe for each ewe removed from the flock and an area-based top-up ranging from £60 to over £100 per hectare up to a maximum of 40 hectares. In addition there are incentives where two or more farmers owning at least 50 per cent of the sheep in a designated area agree to join REPS (see below).

(ii) Livestock Premium Schemes
Some main schemes are:

A suckler cow premium applying to the whole country amounts to £136.70.

A special beef premium of £87.88 per head, payable twice in the life of the animal, up to a maximum total of £15 818.

A ewe premium of £17.37 per ewe is paid, plus £5.37 in Disadvantaged Areas.

This scheme also has had some adverse environmental effects.

Nutrient Management Planning via the Advisory Service
This scheme is a subsidised service to help the environment. Nutrient Management Planning (NMP) has been developed by Teagasc, the State's agriculture and food advisory body, and is being applied at farm level through the Advisory Service, facilitated by the EU LIFE initiative. It is of relevance to the large farmer. Lee notes that recommendations not to apply nutrients at high soil test levels were frequently ignored, especially for high value crops and products such as sugar beet and milk. This may be an indication of wrong incentives facing farmers.

Rural Environment Protection Scheme (REPS)
As mentioned, REPS is the agri-environment component of the CAP reforms. Operated by the Department of Agriculture, Food and Forestry, funding is available from the EU for 75 per cent of the cost to farmers wishing to implement environmental measures. This is the most radical environmental scheme to date, aiming to influence farming practice in its totality rather than just

dealing with the "end of pipe" problems. Farmers have to implement plans, drawn up by Teagasc or other approved agencies, for waste storage, management, liming and fertilisation plans for the farm and a grassland management plan which avoids over-grazing and poaching. Farmers in REPS will be paid annually a premium of 125 ECUs (£100) per hectare for five years up to a maximum of 40 hectares.

Extra payments are available for farmers who undertake additional environmentally friendly farming practices such as preserving Natural Heritage Areas (NHAs), organic farming (discussed below) and rearing animals of local breeds in danger of extinction. The Environmentally Sensitive Areas (ESAs) pilot scheme has been subsumed into the REPS.

The REPS in Ireland has an indicative allocation of £230 million for the period 1994 to 1999. While it might be claimed that the environment features rather modestly in the direct spending of the reformed CAP, Ireland in fact receives a significant amount under this.

Early Retirement from Farming

Farmers between the ages 55 and 66 can avail of an annual pension for 10 years (but not past the age of 70) provided at least five hectares are transferred and the transferee meets certain conditions, or the land is transferred to a non-farm use, including forestry and ecological reserves. Qualifying farmers receive a base payment of 4000 ECUs together with £244 per hectare up to a maximum of 24 hectares. Convery (1994) shows that the terms amount to a doubling of the value of poor quality land on farms of 24 hectares. The pension option will be favoured by farmers on small holdings or on poor land, but its environmental effects will depend in part on the uses to which the land is likely to be put.

Organic Farming

Organic farming is a system of farming which co-exists with, rather than dominates, other systems, sustains soil fertility and protects the environment, wildlife and non-renewable resources. Payments will be available to farmers who are already in or wish to convert to organic farming under the REPS. Payments per hectare subject to a 40 hectare maximum are:

	Holdings < 3 hectares	Holdings > 3 hectares
Land in conversion	£195	£146
Land of organic status	£98	£73

An additional 125 ECU (£100) per hectare per year for 5 years is already payable under REPS. Farmers will be paid £100 on completion of a 20 hour training course (Lampkin and Measures 1994).

Development of the organic farming sector is supported by grant aid to operators for packing and distribution etc and to recognised bodies (eg An Bord Bia) for marketing and promotion. 50 per cent capital grants and 70 per cent marketing/promotion grants are available, co-funded by the EU. A minute proportion, some 0.015 per cent of agricultural output in Ireland is organically grown.