

SUSTAINABLE AGRICULTURE IN THE UK

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Abstract. Most agricultural assessments of global environmental change made to date have not focused explicitly on sustainability issues, and have neglected the considerable impacts of shifting agricultural zones, alterations in commercial fertiliser and pesticide use, and changes in the demand for water resources. The current crisis in agriculture, with its economic, political, social and ecological dimensions, has arisen because of the pursuit of a productivity technology/policy model. This broad policy of agricultural ‘modernisation’ and development through the application of agricultural science and technology has shaped the direction of technological change in agriculture and the evolution of a complex agro-industrial food system.¹ This paper focuses on England’s Rural Development Programme² as it contributes to sustainable agriculture alongside the control of pollution.

Key words: agri-environment schemes, pollution, rural development programme, sustainable agriculture.

Abbreviations: CAP – Common Agricultural Policy; CSS – Countryside Stewardship Scheme; DEFRA – Department of Environment, Food and Rural Affairs; EAGGF – European Agricultural Guidance and Guarantee Fund; EC – European Commission; EPA – Environmental Protection Agency; ERDP – England’s Rural Development Programme; ERDR – England’s Rural Development Regulation; ESA – Environmentally Sensitive Area; EU – European Union; FAO – Food and Agriculture Organisation of United Nations; MAC – Maximum Admissible Concentration; MAFF – Ministry of Agriculture, Food and Fisheries; NRA – National Rivers Authority; NVZ – Nitrate Vulnerable Zones; OECD – Organisation for Economic Cooperation and Development; RDR – Rural Development Regulation; SD – Sustainable Development; UK – United Kingdom; UNCED – United Nations Conference on Environment and Development; US – United States.

1. Introduction: A critique of the agricultural programme in the UK

The increasing linkages between the agricultural sector and industrial sectors in the modern food system are such that agriculture now obtains inputs from ever more isolated sources, both spatially and sectorally, derives a large proportion of its energy supplies from non-renewable sources, depends upon a narrow genetic base, and has a detrimental impact on the environment. Although these processes all contribute to an erosion of the ‘sustain-

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ability' of agriculture, the crisis of overproduction ought to provide the opportunity for a re-appraisal of the direction of agricultural development and the introduction of more sustainable practices. Agricultural support policies, which have sought to stimulate production have accelerated the damage to wildlife habitats and valued landscapes in rural areas. Reduction in the diversity of wildlife habitats results from a range of farming practices adopted in the 1950s, 1960s and 1970s. The most damaging practices have been the removal of hedgerows and the ploughing up of un-cultivated field margins, together with the reclamation of scrub and woodlands; the reduction in rotations and fallows; the replacement of permanent pasture by leys and arable cropping; land drainage and the elimination of standing water and farm ponds; and the treatment of grassland and arable land with selective herbicides and insecticides. In the UK, for example, the Countryside Commission (1977) estimated that the rate of hedgerow removal rose to a peak in the 1960s of about 10,000 miles of hedgerow removed each year. Although the rate of loss has decreased since then, the landscape of large tracts of eastern and lowland Britain has been significantly altered. Agriculture and forestry rely on the availability of natural resources and, in making use of them, can bring pressure to bear on the environment. Differentiated landscapes and the associated biodiversity shaped by farming over the centuries may also be seriously affected by the abandonment of land-use. Field boundaries alone provide important wildlife habitats for at least 20 species of mammals, 37 species of birds and 17 species of butterflies (Nature Conservancy Council, 1977). The combined impact of the removal of hedgerows with other aspects of the intensification of agricultural production has been the loss of many habitats and the increasing threat to some species.

Another pertinent issue is agricultural water pollution. It is a well-known fact that agriculture is the single largest user of freshwater resources, using a global average of 70% of all surface water supplies. However, agriculture is both cause and victim of water pollution. It is a cause through its discharge of pollutants and sediment to surface and/or groundwater, through net loss of soil by poor agricultural practices, and through salinisation and water logging of irrigated land. It is a victim through use of wastewater and polluted surface and groundwater, which contaminate crops and transmit disease to consumers and farm workers. Agriculture exists within a symbiosis of land and water and, as FAO³ makes quite clear, "... appropriate steps must be taken to ensure that agricultural activities do not adversely affect water quality so that subsequent uses of water for different purposes are not impaired".

The impact of agricultural production on the water environment has only begun to become apparent during the 1970s and 1980s. The main pollutants are agrochemicals, nitrates from fertilisers and farm livestock wastes. If we again take the case of the UK experience, the number of reported farm pollution incidents more than doubled during the 1980s, with the most impor-

tant pollutants being cow slurry (55%) and silage effluent (20%) (National Rivers Authority, 1992). Such pollution incidents occur when organic wastes are allowed to enter watercourses, usually because of inadequate storage facilities or poor management, and have arisen primarily because the cost-price squeeze has forced a diminishing number of farms to carry ever-larger cattle herds, making safe disposal of wastes more difficult. The switch from straw-based has exacerbated the problem to slurry-based livestock housing systems. In addition, the increasing use of manufactured nitrogen fertilisers in farming is partly responsible for the increasing levels of nitrates detected in ground and surface water levels to the extent that the EC's limit of 50 mg/l NO₃ is repeatedly exceeded in numerous water catchments (Croll and Hayes, 1988; National Rivers Authority (NRA), 1992).

Similarly, evidence has been produced to show that 298 water sources or supplies in Britain exceed the EC Drinking Water Directive Maximum Admissible Concentration for single pesticides (0.1 g/l) and 76 breached the MAC for total pesticides (0.5 g/l). The most commonly detected agricultural pesticides were general and pre-emergent cereal herbicides (British Medical Association, 1990; NRA, 1992). Pesticides can also be one of the most important sources of air pollution from agriculture, particularly in the form of spray drift. Agriculture's contribution to air pollution is repeatedly seen as increasingly global in scale. It contributes between 40% and 60% of methane and 10–25% of nitrous oxide, both 'Greenhouse' gases, and 80–90% of ammonia, which contributes to acid rain (Pretty and Conway, 1989).

The third sets of issues which render contemporary agriculture unsustainable involve the social and economic costs which have been borne by the farming community itself. Most notably, there has been a marked decline in agricultural employment. While the shedding of labour from farms has been going on for over a hundred years in Britain, between 1950 and 1990, the numbers employed in agriculture fell from almost 1 million to under 300,000 (Body, 1991). At the same time, agriculture's contribution to rural employment and regional economies more generally has steadily diminished. Alongside these trends, farming receives a decreasing share of value added in the food chain, with the increasing relative costs of farm inputs, and the trend towards the greater processing of foodstuffs by downstream food companies. Harvey (1987) estimates the proportion of total value added that goes to farmers to be less than 15%. Another important indicator of farming's declining social and economic fortunes has been the level of indebtedness. In Britain, for example, total liabilities have risen from 3.8 billion in 1979 to 10.7 billion in 1991, and total liabilities as a proportion of total assets have risen from 8.5–18.5% over the same period (Johnson, 1986; Ministry of Agriculture, Fisheries and Food, 1992).

As more investment is coming from borrowed finance capital rather than re-invested profits, the volatility of investment in agriculture has also

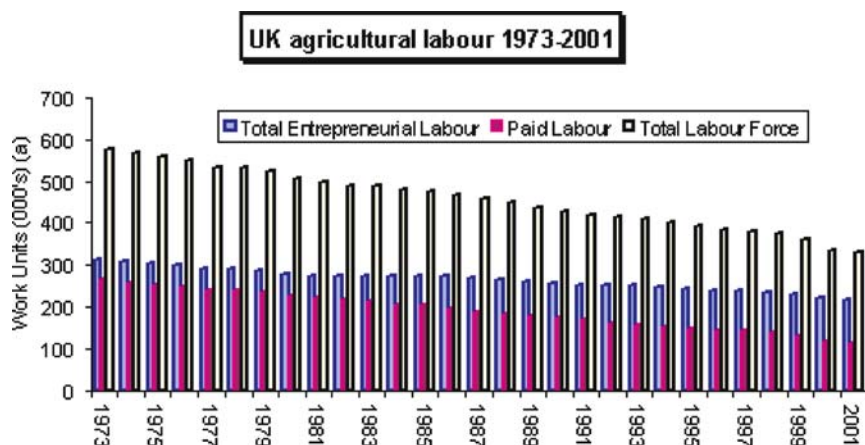


Figure 1. UK agricultural labour 1973–2001. Source: DEFRA (2002) a = full-time equivalent.

increased. It is quite possible that the economic squeeze on agriculture will influence upon the intentions of farm children to succeed to their parents' farm businesses. Evidence is beginning to emerge in the UK, which seems to be reflecting a decline in the proportion of farms currently being managed with a succession to the next generation planned. Whilst this proportion was around 75% in the late 1960s (Harrison, 1975), a national survey of 26,000 farm businesses in 1991 found that only 52% had a nominated successor for their farm (National Westminster Bank, 1992). Alongside the social and economic costs of these problems for farmers is that of the distribution of agricultural incomes and farm support payments.

In the EC under the Common Agricultural Policy, for example, 80% of support goes to 20% of farmers, usually on the largest and most productive farms (House of Lords, 1991). The employed agricultural labour force in the UK is 493,000 persons representing 1.9% of the total labour force (Eurostat, 1999).⁴ This figure does not, however, take into account working farmers, their spouses or family. Errington and Nolan (1997)⁵ claimed an 11% decline in the agricultural labour force between 1984 and 1994 and 'the farm workforce was levelling out to a minimum required to operate farms efficiently and maintain a viable countryside'.

Figure 1 illustrates the changes between 1985 and 1997 of the employed agricultural workforce. The data does not include salaried managers, or the spouses of farmers, partners or directors, who nevertheless contribute significantly to work on farms.

It is clear from the above graph that the number of people working on farms has been declining for a long period. There has moreover, been a move from full-time working to part-time working within the industry.

Whilst the number of full-time workers has declined since 1985, there has been a corresponding increase in the number of part-time workers from 21% of the total in 1984 to 29% in 1997. The proportion of seasonal and casual workers has remained relatively stable over this period.

Agriculture in the advanced industrial economies has also been criticised as unsustainable in terms of its energy use. Post-war agriculture has depended on cheap supplies of non-renewable energy sources, with a major factor being the substitution of machines for manual labour. Total energy consumption per agricultural land unit increased by 39% between 1970 and 1988 in the OECD countries, with the trend being most pronounced in Japan (167%) and European countries (54%) (Rae, 1991). However, it is worth considering energy consumption in the wider context of the modern agro-food system as a whole. In producing a 1 kg loaf of bread in a country like the UK, growing the wheat takes 19.4% of the energy used, whilst milling, baking and distribution account for the other 80%. In the UK, farm-based production uses about 2% of the *primary* energy from oil, gas and electricity. However, the FAO estimated in 1972, that if every country in the world had a food system like that of the UK, then the quantity of primary energy used in producing food would amount to 40% of global consumption (quoted in Barber, 1991: 12–13). This level of energy consumption is, therefore, no longer viable in the long run, chiefly due to the pollution caused, and the likely increased scarcity (and costs) of energy.

Each of these four sets of problems is currently being challenged, and these challenges arise as a result of social, economic and political processes of change that go far beyond the agricultural or rural spheres. Four broad shifts can be identified which intensify the questioning of agriculture's sustainability. These are: (a) as people come to value the countryside as a consumption space; (b) the greater concern for global pollution and the role of rural areas as reservoirs of natural resources; (c) as collapse of post-war economic growth models no longer provides an increasing number of urban jobs to mop up rural decline; and (d) the end of the cheap energy era.

It implies that agriculture not only secures a sustained food supply, but that its environmental, socio-economic and human health impacts are recognised and accounted for within national development plans.⁶ According to the FOA definition,⁷ sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, and is environmentally non-degrading, technically appropriate, economically viable and socially acceptable. Beyond availability of drinking water and access to food supply, agriculture is the greatest priority. Agriculture,

therefore, is a dominant component of the global economy. While mechanisation of farming in many countries has resulted in a dramatic fall in the proportion of population working in agriculture, the pressure to produce enough food has had a worldwide impact on agricultural practices. In many countries, this pressure has resulted in expansion into marginal lands and is usually associated with subsistence farming. In other countries, food requirements have required expansion of irrigation and steady increase in the use of fertilisers and pesticides to achieve and sustain higher yields.⁸

2. Sustainable agriculture and its significance

From the above critique, it is clear that rural sustainability is being undermined by agriculture, particularly as agriculture is the dominant user of rural land. However, in discussing sustainable agriculture, the ecological dimension has tended to be privileged while the social dimension has been neglected. This is despite the fact that one of the central objectives of agricultural policy in the EC and much of the advanced industrial world has been to maintain farm incomes and keep farmers on the land (i.e. a socially sustainable agriculture). The current economic and ecological crisis for agriculture has therefore, opened up the space for a discussion of what sustainable agriculture might be, and how it might be operationalised.

Social sustainability in much of rural Europe is still to be sought through productivity agriculture. Thus, there continues to be a trade-off between ecological priority areas and the productivity pressures of the agricultural treadmill. In the UK, for example, rural areas are designated as Less Favoured Areas, Environmentally Sensitive Areas, Nitrate Sensitive Areas, National Parks or Sites of Special Scientific Interest, reflecting a geographical differentiation in agro-environmental relations as well as a differentiation in regulatory mechanisms. In this emerging mosaic of ecological priority areas, agriculture's relations with the local natural environment become critical.

This increasing differentiation of land uses within the agricultural sphere is leading to a renewed concern with local contexts. Indeed, one response to the growing globalisation of the food system has been to stress the need for a local focus to any discussion of sustainability. As Van der Ploeg puts it:

"The re-linking of agriculture to natural (instead of artificial) growth factors requires a re-localisation.... Hence, sustainability in agriculture will require again 'art de la localité'; the 'art of farming' will, as it were, be re-invented and re-assessed"

(Van der Ploeg, 1992: 37).

According to Van der Ploeg (1992) heterogeneity and "localness" are continuing features of contemporary agriculture but must be assessed in relation to the dominant tendencies towards "standardisation".

Agriculture, he argues, is becoming disconnected from local features such as nature, labour skills (through appropriation from external agencies), the labour process (now increasingly governed by external technologies) and products (now often merely the raw material for processed foods). This “disconnection” is leading to new forms of local knowledge. These not only concern, in different situations, the application of general rules, procedures and artefacts, they also entail specific responses on how to resolve the particular problems that emerge from such an application’ (Van der Ploeg, 1992). Van der Ploeg focuses on the labour process as the arena in which the different ‘domains’ of farming, such as economic and technological linkages, family reproduction and so on, are coordinated. In this formulation, farming is seen as a ‘social construction’ with culture centrally placed between ‘internal and external relations, between experience and perspective, between past, present and future’. It is culture, which ultimately reproduces the heterogeneous pattern of farming and the meaning and shape of locality. There is a tendency to assume that as long as the proposed systems benefit the environment and are profitable, sustainability will be achieved and the whole of society will benefit. However, what is produced, how, and for whom, are important questions that must also be considered if a socially sustainable agriculture is to emerge.

Altieri (1989) defines sustainable agriculture as a system which should aim to maintain production in the long run without degrading the resources base, by using low-input technologies that improve soil fertility, by maximising recycling, enhancing biological pest control, diversifying production, and so on.

According to Riley (1992), the level of analysis chosen can be a significant influence on the diagnosis of sustainability. At the field level, particular soil management, grazing and cropping practices will be the most important determinants of sustainability. At the farm level, sustainable resource use practices need to support a sustainable farm business and family household. At the national level, there may be broader pressures on the use of agricultural land from non-farming sectors, and at the global level, climatic stability, international terms of trade and distribution of resources also become important determinants.

Sustainability is the key concept of the fifth Environmental Action Programme,⁹ in which sustainable development is defined as ‘development, which meets the needs of the present without compromising the ability of future generations to meet their own needs’. This entails preserving the overall balance and value of the natural capital stock and a re-definition of short-, medium- and long-term considerations to reflect the real socio-economic costs and benefits of consumption and conservation.¹⁰

Since the mid 1980s,¹¹ there have been major reforms in both agriculture and the environmental policies in the European Union. The 1992

MacSharry reforms of CAP weakened the objectives of CAP as contained in Article 39 of the Treaty of Rome by introducing a system of direct payments to farmers and a move away from market support as a means of securing farm incomes. To qualify for these payments, farmers had to comply with a range of specific controls intended to restrain production. Arable production was restrained by set-aside and livestock production by quotas and headage payments. Incentives were put in place for farmers to comply with new practices, and so reduce food production,¹² thereby introducing environmentally friendly farming.

The CAP reforms greened agriculture policy to a limited extent by including for the first time policy measures designed to fulfil environmental objectives through Regulation 2078/92, which required member states to implement an agri-environmental programme. The Regulation states in the preamble that the requirements of environmental protection are an integral part of the CAP, and that measures to reduce agricultural production in the EU must have a beneficial impact on the environment.

Article one set out the aims of the scheme:

- To reduce the polluting effect of agriculture;
- To encourage environmentally favourable extensification of crops and livestock;
- To protect the countryside; to recover abandoned land;
- To set up environmentally beneficial long-term set aside; to facilitate public access to land, etc.

For the first time, the Regulation made environmental incentive schemes a mandatory legal obligation on member states rather than making them optional. This obliged governments to offer farmers voluntary incentive schemes for adopting environmentally friendly forms of land management. The amount of farmland designated under these agri-environmental measures varies across member states.

Sustainable Agriculture however, may entail more than just ecological and demographic concerns. Wendell Berry¹³ describes sustainable agriculture as one that 'does not deplete soils or people'. Similarly, John E. Ikerd¹⁴ argues that sustainability touches on social, even spiritual, concerns; the three corner stones of sustainable agriculture – ecological soundness, economic viability, and social responsibility rest upon a foundation of inter-generational equity which in turn has its foundation in human spirituality.

In the Food, Agriculture, Conservation, and U.S Trade Act of 1990, Congress established that sustainable agriculture will over the long term, 'satisfy human food and fibre needs; enhance environmental quality and the natural resource based upon which the agricultural economy depends; make the most efficient use of non-renewable resources and on-farm

resources and integrate where appropriate natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and society as a whole'.

Researchers at Canada's International Institute for Sustainable Development¹⁵ agree with the foregoing description of sustainable agriculture and further assert that these goals can be arrived at in a variety of ways, that sustainability isn't 'the exclusive domain of organic farming' nor is it tied to any one technological practice. 'Rather, sustainable agriculture is thought of in terms of its adaptability and flexibility over time to respond to the demands for food and fibre (both high and low), its demands on natural resources for production, and its ability to protect the soil and the resources. This goal requires an efficient use of technology in a manner conducive to sustainability. Finally, because agriculture is affected by changes in market and resource decisions in other sectors and regions, it is important that these changes do not provide a rationale for depleting the agricultural resource base locally'.¹⁶

3. The success of the England rural development programme

The application of agri-environment contracts delivering environmental services over 20% of European farmland marks a very significant step towards sustainability. The target set in the fifth Environmental Action Programme of 15% coverage by 2000 has thus already been exceeded. The requirement on Member States to apply the regulation throughout their territories according to their needs has stimulated a very rapid expansion of initiatives and measures, which otherwise may have taken many years to be launched and developed. The evidence presented from programmes¹⁷ is on the whole positive and shows that substantial environmental benefits accrue from agri-environment programmes: reductions in the use of N-fertiliser; better application techniques; positive activities for nature protection; and conservation of landscape features. An increase in employment is recorded in some cases, for example where labour-intensive environmental management replaces a low-labour intensive activity. Evaluation reports¹⁸ show that programmes provide value in terms of environmental benefits for a relatively modest cost to the Community budget: 4% of EAGGF guarantee section. Agriculture has changed dramatically, especially since the end of World War II.¹⁹ Modern agriculture in the 20th century was highly successful at increasing food production with per hectare cereal yields increasing 2–3-fold in Europe.

Commission Regulation 1750/1999²⁰ sets out detailed rules for the application of the Rural Development Regulation. The England Rural Development Programme²¹ describes how the government is implementing the

‘second pillar’ of the Common Agricultural Policy – the Rural Development Regulation in England. The RDR provides a set of measures and CAP funds, which countries in the European Union can use, alongside their own funds, to benefit the rural environment, economy and communities. Between 2001 and 2006 £1.6 billion, including £300 million new Exchequer funding will be allocated via the England Rural Development Programme.

The total expenditure under the programme is provided through co-financing based on the EU allocation to the UK. The expenditure from co-financing is 1496.7 million euros, which includes an EU contribution of 615.2 million euros from the Guarantee Section of the European Agricultural Guidance and Guarantee Fund (EAGGF). The appropriations from modulation²² provide a further 757.3 million euros, including 381.6 million euros from the EAGGF.

In addition, the UK has committed a further 404.1 million euros of national state aids associated with measures under the programme, which increases the full financial effort for the rural development programme for England to an overall total of 2658.1 million euros, with an EU contribution of 996.8 million euros from the EAGGF. The programme aims to increase significantly the area covered by schemes to conserve and improve the environment and maintain the sustainable management of the uplands through a substantial expansion in funds for the land-based schemes. It also aims at assisting the creation of more diverse and competitive agricultural and forestry sectors and jobs in the countryside, encouraging the development of new products and markets and greater collaboration and to provide training to support these new activities through launching of the four new project based schemes outlined below. The two main priority areas for funding under the ERDP are:

Land-based schemes (to conserve and improve the environment):

- Countryside Stewardship
- ESA areas
- Organic Aid Scheme
- Woodland Grant Scheme
- Farm Woodland Premium Scheme
- Hill Farm Allowance Scheme

Project-based schemes (to enable farming, forestry and other rural businesses and communities to adapt to changing circumstances and to develop):

- Rural Enterprise Scheme
- Processing and Marketing Grant Scheme
- Targeted Skills Training Activity
- Energy Crops Scheme

Recently, the rural programme has portrayed some glimpse of success through the reviews held in 2003; some of the decisions in the reviews are as follows;

- England will be split into two regions – land in the severely disadvantaged areas of the less favoured areas and all other land in England. Different flat rates will apply in these regions.
- England will decouple fully in 2005 and move towards a flat rate Single Farm Payment to farmers.
- England will use the opportunities from these reforms to put their farming industry onto a profitable and sustainable path.
- No use of ‘national envelopes’ in England.
- Only farmers active in 2005 will qualify for payment.
- Payments will depend on farmers meeting ‘cross-compliance’ conditions – government will consult on these standards soon and work to ensure they are implemented effectively with minimum bureaucracy.
- There will be an 8-year transition period to the flat rate.

The implication is that the June CAP reform agreement decouples the bulk of subsidy from production, enabling farmers to realign their businesses to meet market demands, not what subsidy regimes dictate – DEFRA economists have estimated that on average farm incomes could rise by about 5% compared to 2003 Total Income from Farming as a result of the efficiencies and market freedom that result. The ‘second pillar’ of the CAP, Rural Development Policy, is a key element in providing the conditions in which agricultural sustainability can flourish. Rural areas should provide attractive location for living and working and comprise a widespread of population in terms of age structure so that schools and other essential services can be guaranteed. Also, there are many environmental goals to be met if sustainability is to be taken seriously. There has been series of reforms on the CAP. The reform agreement was a major breakthrough

- It achieved far more than many expected, freeing farmers to produce what the market and consumers want rather than what the subsidy regimes dictate.
- The reforms provide the opportunity to reduce the bureaucracy farmer’s face, by rolling a plethora of subsidies into a new single payment which is not linked to what they produce.
- It will reduce the environmental impact of farming by removing an incentive to intensify production and by linking subsidy to compliance with environmental and other standards.
- It is right that farmers should comply with environmental, food safety and animal welfare standards if they are to enjoy taxpayer subsidy. Nevertheless, we intend to introduce these requirements in a proportionate way.

The deal also means more resources for wider rural development goals.

There are however, some differences between the agri-environmental schemes introduced to curb the excesses of CAP and the newly introduced Rural Development Programme.

4. Dissimilarity between agri-environment schemes and the rural development programme

- The ERDP unlike the agri-environmental schemes focuses on two major schemes: land-based and project based.²³ This in essence shows that the agri-environment schemes have been integrated into the Rural Development Programme.
- The ERDP is an integrated funding package for environment and rural development measures.
- It reflects pressure to move away from direct support for agricultural production and towards more general support for sustainable development in rural areas affected by CAP reform.
- The ERDP underpins the government's new direction for agriculture by helping farmers and foresters to respond better to consumer requirements and become more competitive, diverse, flexible and environmentally responsible.
- It also provides help to rural businesses and communities, which need to adapt and develop. It offers a more integrated set of schemes.
- It places much stronger emphasis on addressing regional and local issues and on encouraging and developing ideas at grass roots level.
- It is intended that the ERDP will play a major role in helping rural communities recover from foot and mouth disease.
- The RDP for England is aimed at diversifying farming and forestry businesses and increasing competitiveness, developing new food and non-food products, ensuring the sustainable management of Less Favoured Areas and significantly increasing the areas covered by environmental schemes.

5. Control of agricultural pollution

The Ministry of Agriculture, Food and Fisheries–MAFF (now called the Department of Environment, Food and Rural Affairs–DEFRA) produced in 1991 a 'Code of Good Agricultural Practice' for farmers giving detailed advice on the treating, storing and applying of animal livestock waste, the disposal of dirty water, fertilisers, fuel oil, sheep dip, pesticides, nitrates, disposal of animal carcasses, etc. With Environment Agency advice also,

local farmers all must produce a Farm Waste Management Plan to comply with pollution control regulations.²⁴ Some examples of good practice are:

- Delaying the ploughing in of crop residues.
- Reducing the amount of fertilisers, manure and sewage sludge applied.
- Sowing autumn crops early.
- Careful management of disposal of farm waste.

Set-aside regulations will also have the beneficial effect of reducing intensity of farming in the local area, and thus lowering nitrate levels. Environmental policies at both the European Union and national levels will increasingly address agricultural water pollution problems by imposing mandatory 'codes of good agricultural practices'. The Groundwater Regulations 1998 provide a significant example. It represents an attempt to comply with the Groundwater Directive.²⁵

Monitoring and enforcement will be facilitated by more sophisticated administration and information systems to register land uses and other activities of a shrinking population of full-time farmers. Still, there is much to be learned concerning agricultural pollution control and the effectiveness of various mixes of measures. Empirical work on alternative control policies currently is too limited to devise informed 'packages of good control measures'. It is therefore important for many control approaches to be pursued in greater detail and to be more closely evaluated. Sagardoy²⁶ summarised the action items for agriculture in the field of water quality as:

- Establishment and operation of cost-effective water quality monitoring systems for agricultural water uses.
- Prevention of adverse effects of agricultural activities on water quality for other social and economic activities and on wetlands, *inter alia* through optimal use of on-farm inputs and the minimisation of the use of external inputs in agricultural activities.
- Establishment of biological, physical and chemical water quality criteria for agricultural water users and for marine and riverine ecosystems.
- Prevention of soil runoff and sedimentation.
- Proper disposal of sewage from human settlements and of manure produced by intensive livestock breeding.
- Minimisation of adverse effects from agricultural chemicals by use of integrated pest management.
- Education of communities about the pollution impacts of the use of fertilisers and chemicals on water quality and food safety.

Controlling water pollution from agriculture is made difficult by its particular nature. In most circumstances, agricultural pollution occurs over a wide area, and its sources are diffuse and difficult to identify. It also varies unpredictably over time and space, and depends not only on

rainfall patterns and the land–slopes and soil characteristics – but also on farmers' land use and crop choices, production techniques, and fertiliser and pesticide use. There is currently a lively debate about the future sustainability of agriculture, fuelled by proposed changes to funding through the Common Agriculture Policy, and concerns over food safety, animal welfare and the environment. One of the significant benefits of attaining a sustainable agricultural system would be a reduction in diffuse water pollution.

A reduction in diffuse pollution can only be achieved by appropriate land management techniques. The EPA realises that while it has a regulatory role to play here, farmers themselves can make the greatest improvements by adopting good land management practices. Good soil husbandry is central to many of these practices. To enable this to happen we need to work with others to provide good quality advice so that farmers are aware of the issues and are able to deal with them.

6. Conclusions

Conceivably the only constant in the diverse agricultural system is change. Many of today's farmers and ranchers practise a type of agriculture that is far different from how their grandparents, or even their parents, worked the land. Change can be a positive force to improve the world's sources of food and fibre if those changes are made while balancing profitability, stewardship of natural resources and the health of rural communities.

For generations, American farmers have worked to protect and improve the land and the quality of rural life. Early farmers such as George Washington and Thomas Jefferson, seeing a need to change some standard agricultural practices, became leaders in adopting new farming methods. Washington was among the first of his generation to practice crop rotation, compost livestock waste and help pioneer the use of new planting methods.

Sustainable agriculture does not refer to a prescribed set of practices. Instead, it challenges producers to think about the long-term implications of practices and the broad interactions and dynamics of agricultural systems. It also invites consumers to get more involved in agriculture by learning more about and becoming active participants in their food systems.

A key goal is to understand agriculture from an ecological perspective – in terms of nutrient and energy dynamics, and interactions among plants, animals, insects and other organisms in agro-ecosystems – then balance it with profit, community and consumer needs. Farming methods that improve the sustainability of one farm may not be appropriate to a differ-

ent farm or region. Each practice must be evaluated in a given farming system for its ability to achieve a set of economic, environmental and social goals. During the last decade, the EU countries have made efforts to reconcile their policies for agriculture and the environment. At the Union level, agricultural policy is expanding subsidies for less intensive and less polluting methods of production, and environmental policy has begun to directly target agricultural pollution of water.

In recent years, it has become obvious that the current state of affairs is no longer sustainable. The new Agreement on Agriculture resulting from the conclusion of the Uruguay Round of multilateral trade negotiations and the planned enlargement of the EU to include countries of Central and Eastern Europe make additional reforms of the Union's agricultural policy very likely. In particular, direct income support is expected to increasingly replace agricultural price supports, which should provide efficient incentives for agricultural pollution abatement.

Stewardship of the natural resources on which agriculture is based is a fundamental requirement for sustainable development, underpinning the need to synchronise actions with nature. This includes responsible water management, measures to address desertification and shrinking biological diversity. Rural areas are increasingly home to broader economic activities such as e-commerce. New technology is opening the countryside up to the general business public and we must ensure that this wider population can be integrated in a way, which is economically motivating and harmonious with existing rural populations.

Responsible stewardship of the natural resources on which agriculture is based is a fundamental requirement for sustainable development, underpinning the need to synchronise actions with nature. This includes responsible water management, measures to address desertification and shrinking biological diversity. Rural areas are increasingly home to broader economic activities such as e-commerce. New technology is opening the countryside up to the general business public and we must ensure that this wider population can be integrated in a way, which is economically motivating and harmonious with existing rural populations. The rural programme portrays some glimpse of success although reviews are still underway till 2003; but, looking at the aims of the programme there is going to be some remarkable change in the arena of the environment as a whole in England in particular.

With reference to the outcomes of the current reforms, as highlighted in the body of this paper, the implication is that the June CAP reform agreement decouples the bulk of subsidy from production, enabling farmers to realign their businesses to meet market demands, not what subsidy regimes dictate – DEFRA economists have estimated that on average farm incomes could rise by about 5% compared to 2003.

Breaking the link between subsidy and production also removes an incentive for farmers to maximise production and so reduces environmental damage from intensive farming such as overuse of pesticides and fertilisers. The agreement also makes subsidy dependent on farmers meeting certain EU environmental, food safety, plant and animal health and animal welfare standards as well as maintaining their land in good agricultural and environmental condition. More subsidies will also be diverted from production to wider rural development and environmental initiatives, which farmers undertake.

Notes

¹ Goodman and Redclift, 1991.

² 2000–2006.

³ Food and Agriculture Organisation of the United Nations (FAO, 1990a).

⁴ Eurostat Yearbook 2001: A Statistical Eye on Europe. Author: Ec ISBN: 9289404647.

⁵ Errington, A. and Nolan, J. 1997. Meeting farmers' training and development needs: new solutions to an old problem? *Farm Management*, 9 (12) 634–645.

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