

Agricultural policy changes needed

As well as identifying needs for further research and other action by the Environment Agency, this report has highlighted that no one policy option will necessarily result in a reversal of natural resource and environmental protection problems. Each problem may have to be considered individually. Alongside the need for a 'whole farm approach' targeting all farms, specific actions are required to tackle certain agriculture approaches. Emphasis must be given to preventative approaches, as they are the most effective and efficient. In addition to targeting resources towards environmental problems, potential changes to Government policy that would help to improve environmental quality include:

1. ***Establish guidelines for 'good farming practice'***: A clear, unambiguous definition of good agricultural practice must be agreed and established. Many environmental problems can be attributed, at least in part, to the lack of such an agreed definition. A cost-effective way to identify and demonstrate good farming practice may be for farmers to adopt the Agency's proposed Environmental Management Standard (see recommendation 7). When established, the standards should be both comprehensive and high, but take into consideration financial costs to be borne by farmers. It may not be realistic or fair to expect farmers to meet these standards in the short term; therefore there may be benefits in a "phase in" period until standards are enforced. In the first phase, farmers could be supported with taxation incentives, capital grants and technical advice. A review date should be set, with further regulation and 'polluter pays' approaches applied to encourage improvements in under-performing farms.
2. ***Update regulatory framework***: Regulation must be improved to ensure farmers are penalised for 'bad farming practice'. Existing legislation covers only a limited number of issues. What is required is a comprehensive regulatory framework that is simpler to operate and more transparent. 'On the spot fines' could be introduced for minor offences of bad agricultural practice. Targeting farmers with small fines for less serious offences could help to contain overall enforcement costs, contribute funds for further environmental improvements, increase farmer compliance and help establish and reinforce good farming practice.
3. ***Review current prosecution policy***: In England and Wales in 2000, the probability of incurring a fine for an *identified* environmental farm offence was 0.4%, the lowest it has been in years. From 1991 to 2000 there was a large decrease (79%) in the most serious (Category 1) incidents but a significant increase (more than 50%) in less serious farm substantiated incidents. On the other hand, prosecutions of both Category 1 and less serious farm incidents fell considerably over this period (by 54% and 89% respectively). A reversal of the recent decline in farm prosecutions may be needed. More efforts to publicise the successful prosecution of offenders should increase farm compliance. One suggestion includes initiating a regular column or advertisement in a popular farmer journal, featuring both farmers following 'good farming practices' and those who need to improve.
4. ***Support CAP reform and increased modulation (movement of funds from Pillar I to Pillar II)***: Reform of Government policies that cause environmental degradation is needed. This includes more effective integration and co-ordination between CAP and environmental policies (such as increasing cross compliance measures and applying 'good farming practice' standards to Pillar I payments). The benefits of agri-environmental schemes would justify an increase in modulation from its planned rate of 4.5% to its potential maximum rate of 20%.
5. ***Target agricultural problems***: Action to remedy agricultural problems must focus on ways to reduce the greatest environmental risks. An effective targeted action must consider the type of environmental damage, relevant regional and industrial factors and the effectiveness of potential policies. However, such targeted action through 'deep and narrow' schemes needs to

be underpinned by a broad and shallow, whole farm scheme for all farmers (as discussed below).

6. ***Change existing agri-environmental schemes:*** This report highlights many problems that need addressing in the existing RDR scheme. These include the need to achieve a better balance between wildlife habitat and landscape quality, with natural resource use and environmental protection. Inflexibility of existing schemes, monitoring, administration, enforcement, training; and end of contract issues have also attracted criticism. Changes proposed include developing new natural resource and environmental protection schemes (or modifying existing schemes). One need is to create a larger unified scheme. New schemes must encourage a 'whole-farm' approach and promote good soil management practice.
7. ***Promote an environmental management system for farms:*** As part of the 'whole-farm' approach, there is a need for an industry led, but Government endorsed, farm management system, to protect soil, water and air. The system should consist of auditing environmental performance in the farm business context and planning to manage land use, nutrients, pesticides, water and wastes. The system should be supported by advice, training and technical development. It would improve environmental performance and help farmers to meet regulatory requirements with the minimum of bureaucracy.
8. ***Integrate environmental education with agricultural training :*** The need for improvements in the public provision of farm training is paramount. The existing system is barely adequate, and there is a strong case for a new public body to provide technical assistance for farmers in place of private bodies. The programme should be targeted, use existing advice networks, combine financial and environmental advice and be designed to overcome barriers to uptake by farmers. A 'whole-farm' training approach must be at the heart of the system in order to integrate environmental priorities with other farm concerns.
9. ***Implement taxation reform:*** Various taxation reforms could be introduced to promote environmentally sustainable agriculture. Environmental expenditure incurred on the farm must be considered as part of normal business undertakings. Taxes and any tax reliefs must help promote a healthy, clean environment, not just food production. Potential natural resource taxes have been proposed. These include a pesticide tax and diffuse pollution phosphorus taxes (with the potential of a tradeable rebate scheme). There is also a strong possibility of using a nutrient tradeable permit scheme in specified areas.
10. ***Promote co-operation between water companies and farmers:*** Co-operative agreements between farmers and water companies in suitable catchments should be supported to improve environmental performance and encourage greener trading practice.
11. ***Consider land acquisition for environmental purposes:*** Investment in land acquisition by Government (or other bodies) may be socially and environmentally beneficial in the long term. Lower agricultural land prices, the rising cost of farm subsidies, increasing recreational and environmental benefits of land and tighter future controls on farming practices may strengthen the economic case for such purchases.
12. ***Research the bargaining power of supermarkets and support consumer education:*** There is widespread anecdotal evidence that supermarkets do exercise considerable bargaining power over farmers, that may result in some negative environmental consequences. Further research is needed. Also, educating the public to accept higher priced local agricultural products for increased environmental quality may help farmers to charge higher prices to offset increased farm expenditure. Such consumer education could include promoting more consistent and unified product labelling schemes.

Payments to farmers should represent the social benefits that agriculture provides. It is unfair and unrealistic to expect farmers to shoulder all costs associated with their provision. Governments must play their role by setting the right policy, providing advice, determining the regulatory

framework, ensuring appropriate signals and incentives for farmers and recognising the benefits and costs of any decision they impose. In the end however, responsibility for achieving any goals in agriculture must lie with farmers. That is why it is essential to get the policies and incentives right.

REFERENCES

- Acreman M. (ed) (2000) *The Hydrology of the UK: A Study of Change*, Routledge, London and New York.
- Agra Europe (2000) 'Auditors attack EU agri-environment policy', *Agra Europe*, Vol. 17, November.
- Agra Europe (1996) 'Common Agricultural Policy Seminar', 22nd May 1996, Churchill Inter-Continental Hotel, London.
- Baldock D., Bishop K., Mitchell K. and Phillips A. (1996) *Growing Greener: Sustainable Agriculture in the UK*, report prepared for Council for the Protection of Rural England (CPRE) and World Wide Fund for Nature (WWF-UK).
- Binning C. (2000) "Conserving Biodiversity – Institutions, Policies and Incentives", *New Zealand Treasury Working Paper 00/26*.
- Boardman J. (1995) 'Damage to Property by runoff from agricultural land, South Downs, southern England, 1973-93', *The Geographical Journal*, Vol. 161 (2) pp. 177-191.
- Boardman J., Ligneau L., Roo Ad de and Vandaele K. (1994) 'Flooding of property by runoff from agricultural land in Northwestern Europe', *Geomorphology* Vol. 10 pp. 183-196.
- Boardman J., Foster I., and Deering J. (1990) *Soil Erosion on Agricultural Land*, John Wiley & Sons, Chichester.
- Bowers J. (1998) *Sustainability and Environmental Economics: An Alternative Text*, Addison Wesley Longman China Ltd, Singapore.
- Burney J. and Reid C. (2001) 'Discussion on agri-environment payment mechanisms', English Nature, discussion paper.
- Campbell L.H. and Cooke A.S. (1997), *The Indirect Effects of Pesticides on Birds*. Joint Nature Conservation Committee, Peterborough, UK.
- Centre for Rural Economics Research (2001) *Economic Evaluation of Set-Aside*, report prepared for DEFRA, October.
- Chadwick D., Sneath R., Phillips V. and Pain B. (1999) A UK Inventory of nitrous oxide emissions from farmed livestock, *Atmospheric Environment*, Vol. 33, pp 3345-3354.
- Chartered Institution of Water and Environment Management (2000) *Diffuse pollution impacts – The environmental and economic impacts of diffuse pollution in the UK*, edited by Arcy B., Ellis J., Ferrier R., Jenkins A. and Dils R., Terence Dalton Publishers, Suffolk.
- Clarkson R. & Deyes K. (2001) 'Estimating the Social Cost of Carbon Emissions', Environment Protection Economics Division, Department of Environment, Food and Rural Affairs: London, August.
- CIRIA (1996) *Design of Sewers to Control Sediment Problems*, Report 141, London.
- CIRIA (1996a) *Report on the Implications of the Landfill Tax for Dredging*, Project Report 26, February.
- Cobb D., Feber R., Hopkins A. and Stockdale L. (1998) *Organic Farming Study*, Global Environmental Change Programme Briefing 17, University of Sussex, Falmer.
- Competition Commission (2000) 'Supermarkets: A report on the supply of groceries from multiple stores in the United Kingdom', Cm 4842, October.
- The Countryside Agency (1999) *The State of the Countryside 1999*.
- The Countryside Agency (2000) *The State of the Countryside 2000*, Countryside Agency Publications, April.
- The Countryside Agency (2001) 'Local Products Key for Rural Local Economies', 6/8/01
- Crop Protection Association (2001) 'Minimising The Environmental Impacts Of Crop Protection Chemicals', February, Peterborough.
- The Daily Telegraph (2001) 'Flood Warning', article published on 20/10/01.

- DEFRA (2001) England Rural Development Programme 2000-2006: Annual Report 2000, June.
- DEFRA (2001a) Agricultural Statistics, from website.
- DEFRA (2001b) 'Developing A Knowledge Transfer Strategy To Improve Resource Protection From Agriculture - A Discussion Document', Draft.
- DEFRA (2001c) 'To what degree can the October/November 2000 flood events be attributed to Climate Change?', FD2304 Final Report, June, prepared by CEH Wallingford and the Met office.
- DEFRA (2001d) 'Shifting Support from the 1st to the 2nd Pillar of the Common Agricultural Policy: Background Policy Paper to Inform Workshop Discussions', available at www.defra.gov.uk/farm/policypaper.pdf.
- DEFRA (2002) 'The Potential Cost and Effectiveness of Voluntary Measures in Reducing the Environmental Impact of Pesticides', report prepared by EFTEC, CSERGE and ENTEC.
- Department of the Environment (1995) 'The Occurrence & Significance of Erosion, Deposition & Flooding in Great Britain', London: HMSO.
- Rigby D., Woodhouse P., Young T. and Burton M. (2001) 'Constructing a farm level indicator of sustainable agricultural practice', *Ecological Economics*, Vol. 39, pp. 463-478.
- Dobbs T. and Pretty J. (2001) 'Future Directions for Joint Agricultural-Environmental Policies: Implications for the United Kingdom Experience for Europe and the United States', South Dakota State University Economics Research Report 2001-1 and University of Essex Centre for Environment and Society Occasional Paper 2001-5, August.
- Dosi C. ed. (2001) *Agricultural Use of Groundwater: Towards Integration Between Agricultural Policy and Water Resources Management*, Kluwer Academic Publishers, Dordrecht/Boston/London.
- ECOTEC (1998) 'Economic Instruments for Pesticide Minimisation', report prepared for Department of the Environment.
- ECOTEC (1999) 'Design of a Tax or Charge Scheme for Pesticides', report prepared for DETR, March.
- ECOTEC (2001) 'Economic Evaluation of Free Advice Programmes', report prepared for MAFF/DEFRA.
- English Nature and Environment Agency (2001) 'Tackling diffuse agricultural pollution - current thoughts on a general strategy', discussion paper prepared by Chris Mainstone and Helen Richardson, January.
- English Nature (2001) *Sustainable Flood Defence: The Case for Washlands*, No. 406 Research Report, report prepared for EN by Risk Policy Analysts, Peterborough.
- English Nature (1999) 'Sector Analysis: Agriculture', notes prepared by Jim Dixon.
- English Nature and Environment Agency (2002) Policy mechanisms for the control of diffuse agricultural pollution, with particular reference to grant aid. Number 455 Research Report, prepared by IEEP, ADAS and GFA-RACE
- Entec (1997) Valuing Landscape Improvements in British Forests.
- Entec (1998) 'Economic Valuation of the Nitrate Sensitive Areas Scheme', report for MAFF, July, London.
- Environment Agency (1996) *Best Management Practices to Reduce Diffuse Pollution from Agriculture*, R & D Publication P2/i615, Bristol.
- Environment Agency (1996a) *Water Pollution Incidents in England and Wales 1995*, HMSO London, April, Bristol.
- Environment Agency (1996b) *National Farm Visit Programme 1995-97*, RLUG, October.
- Environment Agency (1997) *Water Pollution Incidents in England and Wales 1996*, HMSO London, April, Bristol.
- Environment Agency (1998) *A strategic Review of Sheep Dipping*, report prepared by ADAS, R&D Technical Report P170.

- Environment Agency (1998) *Water Pollution Incidents in England and Wales 1997*, HMSO London, April, Bristol.
- Environment Agency (1999a) *Water Pollution Incidents in England and Wales 1998*, HMSO London, April, Bristol.
- Environment Agency (1999) "Historical flood event database", Report no. 26, in preparation draft D, by Chris Fayers and Ian Meadowcroft.
- Environment Agency (2000) *Aquatic Eutrophication in England and Wales: A Management Strategy*, August 2000.
- Environment Agency (2000a) *Agriculture and the Environment: An impact statement prepared by the Environment Agency*, Consultation draft, October, Bristol.
- Environment Agency (2000b) 'Developing and Piloting of an Integrated Best Farming Practices Manual', Research and Development Technical Report P433.
- Environment Agency (2001) *Best Farming Practices: Profiting from a good environment*, January, R & D Publication 23, Bristol.
- Environment Agency (2001a) *Incident Report 2000*, August draft.
- Environment Agency (2001b) 'A Framework for Change: Restored, protected land with healthier soils', July.
- Environment Agency (2001c) 'Submission to the Policy Commission On The Future Of Farming And Food', November.
- Environment Agency (2001d) GQA Statistics and reports from internet site.
- Environment Agency (2001e) 'Impact of Agricultural Soil Conditions on floods – Autumn 2000', R&D Project W5C (00) 04, by Soil Survey and Land Research Centre, Cranfield University, Bristol.
- Environment Agency (2001f) 'The environmental impact of the foot and mouth disease outbreak: an interim assessment', December, Bristol.
- ERM (2002) 'Taxation Issues in Rural Areas', initial draft report for The Countryside Agency, January.
- European Commission (1998) 'State of Application of Regulation (EEC) No. 2078/92: Evaluation of Agri-environmental Programmes', DGVI Commission Working Document (VI/7655/98).
- European Commission (2001) *Integrated Pollution Prevention and Control (IPPC): Reference Document on Best Available Techniques for Intensive Rearing of Poultry and Pigs*, Draft report by Institute for Prospective Technological Studies, Technologies for Sustainable Development, European IPPC Bureau, July.
- Evans R., (1996) *Soil Erosion and its Impact in England and Wales*. Friends of the Earth Trust, London.
- Faeth P. (2000) *Fertile Ground: Nutrient Trading's Potential to Cost-Effectively Improve Water Quality*, World Resources Institute, Washington DC.
- Falconer K., Dupraz P. and Whitby M. (2001) "An Investigation of Policy Administrative Costs Using Panel Data for the English Environmentally Sensitive Areas", *Journal of Agricultural Economics*, Vol. 52 (1), January, pp 83-103.
- Fisher J. and Goodwin A. (2001) *Appraisal of Nature Conservation and Recreational Improvement Options for Integrated Estate Management at the Environment Agency*, Report No. 40, March.
- Forum for the Future (2001) *Green Futures*, Vol. 29, July/August.
- Foster V., S. Mourato, R. Tinch, E. Ozdemiroglu and D. Pearce (1998). 'Incorporating External Impacts in Pest Management Choices', in Vorley, W. and D. Keeney, (eds.) *Bugs in the System-Redesigning the Pesticide Industry for Sustainable Agriculture* London: Earthscan Publications Ltd.
- Garrod and Willis (1995) 'Valuing the Benefits of the South Downs Environmentally Sensitive Area', *Journal of Agricultural Economics*, 46 (2) pp. 160-173.

- Garrod G. and Willis K. (1996) 'Estimating the Benefits of Environmental Enhancement: A Case Study of the River Darent'. *Journal of Environmental Planning and Management* (39) pp. 189-203
- Guardian (2001) 'Foot and mouth costs charity £11m', 1/5/01.
- Hanley N., Whitby M. and Simpson I. (1999) Assessing the success of agri-environmental policy in the UK, *Land Use Policy* Vol. 16, pp. 67-80.
- Hanley N., Anderson M., Wright R. and Alvarez-Farizo B. (2002) 'Valuation of benefits of improvements in water quality: pilot study using the choice experiment approach', Final Report to DEFRA, January.
- Hartridge O. and Pearce D. (2001) 'Is UK Agriculture Sustainable? Environmentally Adjusted Economic Accounts for UK Agriculture', CSERGE-Economics paper, September.
- Harvey D. (2001) 'What Lessons from Foot and Mouth? A Preliminary Economic Assessment of the 2001 Epidemic', *Centre for Rural Economy Working Paper Series*, Working Paper 63, March, University of Newcastle upon Tyne.
- Hicklin A. (2001) 'Changes To Agriculture' Environment Agency memo, 5 October 2001.
- Hodge I. (2000) 'Agri-environmental relationships and the choice of policy mechanism', *World Economy*, Vol. 23 (2), February, p. 257-269.
- Horseman C. (1996) 'The CAP: Institutional Framework and Development', in AGRA Europe (1996).
- HR Wallingford (2000) *National Appraisal of Assets at Risk from Flooding and Coastal Erosion: Final Report*, Report SR 573, May.
- ICTSD (2001) *Agriculture Negotiations at the WTO: Update Report*, report prepared for English Nature, October.
- IEEP (2001) *Identification and evaluation of supplementary measures to control diffuse pollution to support Implementation of the EU water framework directive*, draft report prepared for the Environment Agency, August.
- IEEP (2001a) 'Diffuse Pollution from Agriculture', progress note of project prepared for English Nature and the Environment Agency, November.
- INFU, LEI and WRc (2001) 'Co-Operative Agreements In Agriculture As An Instrument To Improve The Economic Efficiency And Environmental Effectiveness Of The European Union Water Policy' draft prepared for the European Union, Contract No.: ENV4-CT98-0782, December.
- Institute of Ecology and Resource Management and Scottish Agricultural College (1999) 'Estimating the Value of Environmental Features', report prepared for MAFF, January.
- Jacobs Gibb (2002) 'River Mimram Low Flow Public Preference Study', Final Draft, prepared for the Environment Agency, January.
- MAFF, SOAEFD, NIDOA, Welsh Office (1996) *Agriculture in the United Kingdom 1995*, London.
- MAFF (1999) Towards Sustainable Agriculture: A Pilot set of Indicators.
- MAFF (1999a) AGENDA 2000 CAP Reform: A New Direction for Agriculture, December 1999.
- MAFF (1999b) Restructuring of Agricultural Industry, August 1999.
- MAFF (2000) Strategy for Agriculture: Current and Prospective Economic Situation.
- MAFF (2000a) Agenda 2000 CAP Reform: A New Direction for Agriculture - An Economic Note.
- MAFF (2000b) Economic Appraisal of Proposed Expenditure under the Rural Development Regulation.
- MAFF et al (2000c) Agriculture in the United Kingdom 1999.
- MAFF (2000d) Agenda 2000 CAP Reform: A New Direction for Agriculture: A Consultation Document.
- MAFF (2000e) England Rural Development Programme 2000-2006, October.
- MAFF (2000f) England Rural Development Programme, set of information leaflets.
- MAFF (2000g) The Rural Enterprise Scheme: A Consultation Document, June 2000.

- MAFF (2000h) *The Processing and Marketing Grant: A Consultation Document*, June 2000.
- MAFF (2000i) *Current and Prospective Economic Situation in Agriculture: Working paper – A Discussion Document*, prepared by Economic and Statistics Group, March.
- MAFF et al (2001) *Agriculture in the United Kingdom 2000*, London, The Stationary Office.
- McCann L. and William Easter K. (1999) “Transaction costs of policies to reduce agricultural phosphorous pollution in the Minnesota River”, *Land Economics*, Vol. 75 (3), pp 402-414.
- Misselbrook T., Van Der Weerden T., Pain B., Jarvis S., Chambers B., Smith K., Phillips V. and Demmers T. (2000) Ammonia emission factors for UK agriculture, *Atmospheric Emissions*, Vol, 34, pp. 871-880.
- Morse G., Lester J. and Perry R., (1993) *The Economic and Environmental Impact on Phosphorus Removal from Wastewater in the European Community*. Selper publications, London.
- National Audit Office (1995) *National Rivers Authority: River Pollution from Farms in England*, March, Report by the Comptroller and Auditor General.
- National Audit Office (1998) *BSE: The Cost of a Crisis*, July, Report by the Comptroller and Auditor General.
- National River Authority (1992a) *Water Pollution Incidents in England and Wales - 1990*, Bristol.
- National River Authority (1992) *The Influence of Agriculture on the Quality of Natural Waters in England and Wales*, Water Quality Series No. 6, Bristol, January.
- National River Authority (1992b) *Water Pollution Incidents in England and Wales - 1991*, Bristol.
- National River Authority (1993) *Water Pollution Incidents in England and Wales - 1992*, Bristol.
- National River Authority (1994) *Water Pollution Incidents in England and Wales - 1993*, Bristol.
- National River Authority (1995) *Water Pollution Incidents in England and Wales - 1994*, Bristol.
- Nix J. and Hill P. (2001) *Farm Management Pocketbook*, Imperial College at Wye, 31st edition, September 2000.
- OECD (1999) *Voluntary Approaches for Environmental Policy: An Assessment*. Organisation for Economic Cooperation and Development, Paris.
- Pannell, D.J. (2000). Market-Based Mechanisms, Financial Incentives and Other Institutional Innovations: Assessing Their Potential for Addressing Dryland Salinity (SEA Working Paper 00/09).
- Pannell, D.J. (2001). Explaining non-adoption of practices to prevent dryland salinity in Western Australia: Implications for policy. In: Conacher A. (ed.), *Land Degradation*, Kluwer, Dordrecht, pp. 335-346.
- Parris K. (2001) ‘Environmental Prospects For Agriculture – An OECD Perspective’, paper presented to the Farming and Wildlife Advisory Group Ltd 4th International Conference: National Agricultural Centre Stoneleigh, Warwickshire, United Kingdom, 29 November 2001.
- Petchey A., D’Arcy B. and Frost C. (1997) *Diffuse Pollution and Agriculture II*, Proceedings of a Conference held in Edinburgh, 9-11 April 1997.
- PIRSA Rural Solutions (2000) ‘Evaluating the Impact of Property Management Planning’, report prepared for PIRSA, South Australia, July.
- Policy Commission on the Future of Farming and Food (2002) ‘Farming and Food: A Sustainable Future’, report prepared by the Cabinet Office, January.
- Potter C. (1998) *Against the Grain: Agri-Environmental Reform in the United States and the European Union*. Wallingford, Oxen, UK and New York. CAB International.
- Potter C. and Lobley M. (1996) “Unbroken Threads? Succession and its effects on family farms in Britain”, *Sociologia Ruralis*, Vol. 36, pp. 286-306.

- Pretty J, Brett C, Gee D, Hine R, Mason C F, Morison J I L, Raven H, Rayment M and van der Bijl G. (2000) 'An Assessment of the Total External Costs of UK Agriculture', *Agricultural Systems* Vol. 65 pp. 113-136.
- Pretty J. *et al* (2001) 'An Assessment of the Environmental Damage Costs of Eutrophication in England and Wales', November, final draft prepared for the Environment Agency, publication pending.
- Pretty J., Brett C., Gee D., Hine R., Mason C., Morison J., Rayment M., van der Bijl G., and Dobbs T. (2001) 'Policy Challenges and Priorities for Internalising the Externalities of Modern Agriculture', in *Journal of Environmental Planning and Management*, Vol. 44 (2) pp 263-383.
- Pretty J. (2001) Notes on agriculture on internet: <http://www2.essex.ac.uk/ces/ResearchProgrammes/>.
- OECD (1997) 'Eco-labelling: Actual Effects of Selected Programmes', OECD/GD(97)105, Paris.
- Richardson H. (2001a) "Managing Diffuse pollution from agricultural land", Draft Discussion paper for the Environment Agency, May.
- Richardson H. (2001b) "Water Framework Directive: Scope for implementation of basic and supplementary measures to manage Diffuse pollution from agricultural land", Draft Discussion paper for the Environment Agency, August.
- RIRDC (2001) 'VEMAs: Designing voluntary environmental management arrangements to improve natural resource management in agriculture and allied rural industries', report prepared by CSIRO Land and Water Unit, RIRDC Project No. CSL-15A, October, Kingston, ACT.
- RPA (2002) 'Nutrient Pollution Incentives', draft report prepared for English Nature and Environment Agency by Risk and Policy Analysts, March.
- RSPB (1995) 'Taxation and Nature Conservation: A Review of the Current Taxation System and an Identification of the Potential for Reform', by Land Management Research Unit, University of Portsmouth, September.
- Ryan M. (2000) Appendixes to Impact of NVZs, report prepared for DEFRA.
- Ryan M. (2000a) Integrated Pollution Prevention and Control: Unit Cost of Measures for Agriculture, report prepared for DEFRA.
- SDC (2001) 'Principles of Sustainable Farming', Draft report by the Sustainable Development Commission, September.
- SDC (2001a) 'A Vision for Sustainable Agriculture', October, available online at <http://www.sd-commission.gov.uk/pubs/food2001/index.htm>
- Taylor D., Mohamed Z., Shamsudin M., Mohayidin M., Chiew E. (1993) 'Creating a farmer Sustainability Index: A Malaysian case study', *American Journal of Alternative Agriculture*, Vol. 8, pp 175-184
- Turner K, Lorenzoni I., Beaumont N., Bateman I., Langford I and McDonald A. (1998) 'Coastal management for sustainable development: analysing environmental and socio-economic changes on the UK coast', *The Geographical Journal*, Nov. 1998, vol. 164 i3, pp 269-284.
- Van der Ploeg R., Ehlers W. and Sieker F. (1999) 'Floods and Other Possible Adverse Environmental Effects of Meadowland Area Decline in Former West Germany', *Naturwissenschaften* Vol. (86) pp. 313-319.
- Van der Ploeg R., Hermsmeyer D. and Bachmann J. (2000) 'Postwar Changes in Land Use in Former West Germany and the Increased Number of Inland Floods', in J. Marsalek *et al* (eds), *Flood Issues in Contemporary Water Management* pp. 115-123.
- Waters T. (1995) *Sediment in Streams: Sources, Biological Effects and Control*, American Fisheries Society Monograph 7, Bethesda, Maryland.
- Wildlife and Countryside Link (2001) *Paying for the Stewardship of the Countryside: A Greenprint for the Future of Agri-environment Schemes in England*, IEEP, July 2001.
- Whitby M. (2000) 'Challenges and Options for the UK Agri-Environment: Presidential Address', *Journal of Agricultural Economics*, Vol. 51, No. 3, September, pp 317-332.

-
- The Wildlife Trusts & RSPB (2000) Countryside Stewardship and Regional Targeting, position paper to MAFF.
- Wilson G. and Hart K. (2000) Financial Imperative or Conservation Concern? EU farmers' motivations for participation in voluntary agri-environmental schemes, *Environment and Planning A*, Volume 32, pp 2161-2185.
- WRc (1999) *Potential costs and benefits of implementing the proposed water resources framework directive*, report for the Department of the Environment, Transport and the Regions.
- WRc (2001) '*Economic Evaluation of Inland Fisheries: Module A: Economic Evaluation of Fishing Rights*', Project Record W2-039/PR/1, report prepared for the Environment Agency by A F Radford, G Riddington and D Tingley.
- WRc (2001a) '*Indirect Economic Values Associated with Fisheries*' of the Environment Agency's '*Economic Evaluation of Inland Fisheries*', R&D Project W2-039, report prepared by GIBB Ltd, Division of Economics and Enterprise and MacAlister Elliott & Partners
- UK Round Table on Sustainable Development (1998) *Aspects of Sustainable Agriculture and Rural Policy*, July.
- Young (2001) "Opportunities to improve resource and environmental management", CSIRO discussion paper.

Appendix 1. Agriculture in the UK

The following details are from MAFF (2001 and 2000i), DEFRA statistics and DEFRA (2001). Unfortunately, because of the way that data is presented by DEFRA, not all tables can be directly compared.

Agricultural output and land

Table A1.1 illustrates the gross output, number of holdings and agricultural land in the UK and by region in England. In 1998 England represented 54% of the agricultural land in the UK, it had 61% of farm holdings and 82% of the total income from farming. Average farm size was highest in Scotland (158 ha), followed by England, Wales and Northern Ireland.

The South West region in England had the largest share of agricultural holdings and land (20% and 25% respectively), and the second largest share of total income from farming (the Eastern region had 20% of the total share of income).

Table A1.1 Output, income and distribution of agricultural holdings & land by region: 1998

Government office region	Gross output ¹	Intermediate consumption ¹	Net value added at factor cost	Total income from farming	Number of holdings ²	Total agricultural land ^{2,3}	Ave. holding
	<i>£ million</i>	<i>£ million</i>	<i>£ million</i>	<i>£ million</i>	<i>('000)</i>	<i>('000 ha)</i>	<i>ha</i>
United Kingdom	16,571	8,952	5,208	2,330	238	16,963	71
England	12,495	6,609	4,121	1,915	145	9,188	63
Wales	1,091	676	252	91	28	1,473	53
Scotland	1,984	1,118	599	234	33	5,199	158
Northern Ireland	1,107	655	236	90	32	1,068	33
English regions⁴							
North East	360	254	71	16	5	574	115
North West & Merseyside	1,345	761	418	195	17	890	52
Yorkshire and Humberside	1,523	805	506	236	16	1,088	68
East Midlands	1,740	879	600	285	16	1,229	77
West Midlands	1,442	783	464	213	19	950	50
Eastern	2,189	1,034	803	393	17	1,467	86
South East & London	1,547	760	539	258	19	1,198	63
South West	2,437	1,418	720	317	36	1,791	50

Notes: 1. In this table, at each level of aggregation, gross output includes the sale of store stock out of the region and gross input includes purchases of such stock from another 'region'. Thus the sum of the country figures exceeds the United Kingdom total and the sum of the English regional figures exceeds the England total.

2. Excludes minor holdings in Great Britain, includes all farms in Northern Ireland.

3. Excludes common rough grazing.

4. Provisional estimates of output, intermediate consumption & income for regions within England only.

Source: DEFRA statistics

Agricultural land use

The table below illustrates the land use in the UK. In 2000 agriculture utilised 18.3 million hectares of land in the UK (around 75% of the UK's total land use). Grassland was the predominant agricultural holding (37%), followed by crops (25%), sole right rough grazing (24%), all other land (11%) and set-aside (3%).

Table A1.2 UK Agricultural land use ('000 ha)

	Average of 1989-95	1996	1997	1998	1999	2000
Total agricultural area (total area on agricultural holdings plus common rough grazing)	18 887	18 750	18 653	18 606	18 579	18 306
Crops	5 037	4 722	4 990	4 971	4 709	4 665
Bare fallow	68	37	29	34	33	37
Total tillage	5 105	4 759	5 020	5 004	4 742	4 702
All grass under five years old	1 592	1 395	1 405	1 302	1 226	1 226
Total arable land	6 697	6 154	6 425	6 306	5 968	5 928
All grass five years old and over (excluding rough grazing)	5 315	5 354	5 282	5 365	5 449	5 364
Total tillage and grass (b)	12 012	11 507	11 706	11 671	11 417	11 292
Sole right rough grazing	4 970	4 760	4 657	4 621	4 575	4 437
Set-aside		509	306	313	572	567
All other land (c) and woodland	615	751	763	773	789	779
Total area on agricultural holdings	17 654	17 527	17 432	17 379	17 352	17 074
Common rough grazing (estimated)	1 233	1 223	1 221	1 227	1 227	1 232

Source: DEFRA statistics

Table A1.3 Holdings & average areas of crop and livestock enterprises (1995 & 2000) in the UK ('000)

		1995	2000 ¹
		Number of holdings	Number of holdings
		Hectares	Hectares
Cereals (excluding maize)	Total	73	65
	Average area (hectares) ²	3 176	3 344
Oilseed rape	Total	15	13
	Average area (hectares) ²	44	332
Sugar beet	Total	10	9
	Average area (hectares) ²	24	173
Potatoes	Total	20	14
	Average area (hectares) ²	169	166
Dairy cows	Total	39	32
	Average size of herd	9	12
Beef cows	Total	71	65
	Average size of herd	2 600	2 335
Sheep breeding flock	Total	71	78
	Average size of flock	25	28
Pig breeding herd	Total	84	78
	Average size of flock	19 369	19 432
Fattening pigs	Total	10	8
	Average size of herd	77	85
Broilers	Total	2	2
	Average size of flock	76 577	105 303
Laying fowls	Total	29	25
	Average size of flock	33 869	53 508
TOTAL	Total	361	318
		149 243	174 110

Notes: 1. Figures for 2000 are not directly comparable with those for 1995 because improvements were introduced in 1997 to census methodology

2. Average area refers to the average area of the specified crop on holdings that grow that crop. Holdings that do not grow the crop are excluded from the calculation.

Source: DEFRA Statistics

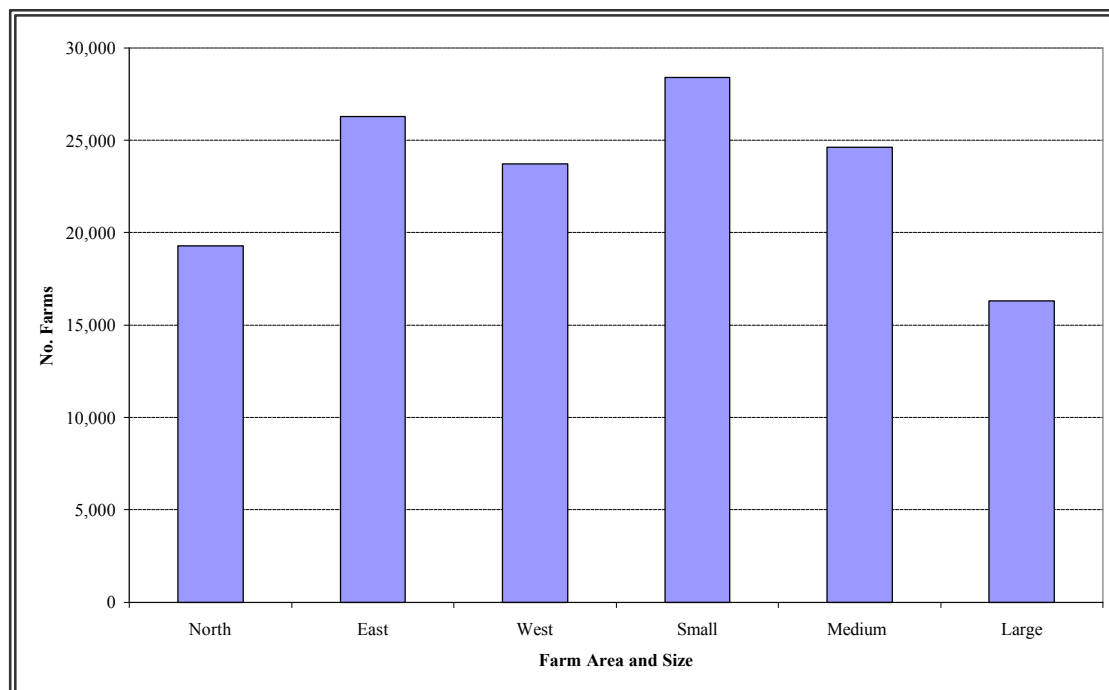
Agricultural holdings

Table A1.3 illustrates the number of holdings and average area of crop enterprises and the number of holdings and livestock numbers of livestock enterprises in the UK in 1995 and 2000. There are three times more livestock than crop enterprises. The largest number of holdings in the UK in 2000 were sheep farms (25%), followed by beef cows (21%) and cereals (20%). An average crop enterprise used 40 hectares in production in 2000, a 19% increase in the average

size from 1995. The number of sheep and beef remained steady, with average herd sizes increasing by 8 and 11% respectively. Falls were experienced in the total number of dairy cows, pigs and laying fowls.

In 2000 there were 146,347 European Size Unit farms (minimum size farms needed for full-time holdings) in England. Figure A1.1 illustrates MAFF's Farm Business Survey data of England farms in 1999-2000. 41% of English farms are classified as small, followed by 35% classified as medium. Most English farms are in the East region (38%), followed closely by the West region (34%).

Figure A1.1 Area and size of English farms in 1999-2000



Source: MAFF

Agricultural income

Total income from farming in 2000 is estimated to fall by 25 per cent from its 1999 level. Prices have fallen for agricultural outputs due to rises in sterling against the euro and a reduction in the volume of output. Some savings were made in inputs (namely labour, animal feed and pesticides) but fuel, fertilisers and interest payments were higher.

Improvements in world commodity prices are expected over the medium term, although CAP reforms will put downward pressure on incomes.

The fall in farm incomes was accompanied with an increase in the proportion of farms which have diversified their businesses (around 35% of farms have diversified).

Labour force

Labour productivity increased by almost 5% in 2000, reflecting a drop in annual work units. Total factor productivity increased by 2.6% in 2000.

The agricultural labour force fell to 556,000 in 2000. Most of the falls was due to farm workers leaving.

Appendix 2. Additional information on eutrophication and flooding issues

Eutrophication

Table A2.1 provides a breakdown of the estimated costs of freshwater eutrophication in the UK.

Table A2.1 Summary of the annual costs of freshwater eutrophication in the UK

Cost categories	Range of annual costs (£ thousands)	
A. Damage costs – the reduced value of clean or non nutrient-enriched water		
<i>A1. Social damage costs</i>	<i>Ranges</i>	<i>Midpoint</i>
i. reduced value of waterside properties;	£1320 to £6505	£3912.5
ii. reduced value of water bodies for commercial uses (abstraction, navigation, livestock watering, irrigation and industry);	£500 to £1000	£750
iii. drinking water treatment costs (treatment and action to remove algal toxins and algal decomposition products);	£19,000	£19,000
iv. drinking water and sewage treatment costs (to remove nitrogen)	£20,100	£20,100
v. clean-up costs of waterways (dredging, weed-cutting);	£500 to £1000	£750
vi. reduced value of non-polluted atmosphere (via greenhouse and acidifying gas emissions);	£12,900	£12,900
vii. reduced recreational and amenity value of water bodies for water sports (bathing, boating, windsurfing, canoeing), angling, and general amenity (picnics, walking, aesthetics);	£9650 to £33,540	£21,595
viii. revenue losses for formal tourist industry;	£2940 to £11,660	£7,300
ix. revenue losses for commercial aquaculture, fisheries, and shell-fisheries;	£29 to £118	£74
x. health costs to humans, livestock and pets.	unknown	
<i>A2. Ecological damage costs</i>		
i. negative ecological effects on biota (arising from changed nutrients, pH, oxygen), resulting in changed species composition (biodiversity) and loss of key or sensitive species.	£7340 to £10,120	£8,730
Sub total	£74,279 to £115,943	£95,111
B. Policy response costs – costs of addressing and responding to eutrophication		
<i>B1. Compliance control costs arising from adverse effects of nutrient enrichment</i>		
i. sewage treatment costs to remove phosphorus arising from large point sources;	£56,500 to £58,500	£57,500
ii. costs of treatment of algal blooms and in-water preventative measures (biomanipulation, stratification, straw bale deployment);	£500	
iii. costs of adopting new farm practices that emit fewer nutrients.	£3,390	
<i>B2. Direct costs incurred by statutory agencies for monitoring, investigating and enforcing solutions to eutrophication</i>		
i. monitoring costs for water and air;	£440	
ii. cost of developing eutrophication control policies and strategies.	£200	
Subtotal	£61,030 to £63,030	£62,030

Source: Pretty *et al* (2001)

Flooding and agriculture

Following on from the discussion in Section 3.2.6, this section analyses the link between agriculture and flooding. Box A2.1 provides more detail on the costs of floods linked to agriculture.

Given the recent interest in the link between climate change and increased flooding, DEFRA (2001c) attempted to assess the degree to which the October/November 2000 flood events were unusual and if they could be attributed to climate change. No assessment was made of other causes of flooding. The report concluded that there was no specific link *per se* with climate change, though strong evidence was found for:

- Increasing rainfall and river flow extremes in Britain over the last 30-40 years, especially for longer duration (30-60 days running);
- Increases in winter season heavy rainfall events; and

- The evidence is consistent with predictions of human induced climate change, but does not show that observed changes in precipitation can be attributed to human activity.

Box A2.1 Case study of flooding costs in eastern South Downs in 1987

The land use of the upper reaches of the valleys around Brighton and Hove is predominantly agriculture. Autumn sowing has increased substantially in the area. In October 1987 the worst erosion ever occurred following heavy rainfall and homes, gardens, roads and drains were flooded. Most of the floodwater originated as erosive runoff (due to recently sown winter cereals) from three large farms on the urban periphery.

More than 5000 m³ of soil was lost from the farms. A survey was undertaken to estimate the costs incurred by the community.

Household costs of damage

Households incurred the largest damage costs from the flooding events. In 1987 £527,000 damage costs were incurred, which represented a proximate average cost of £5,380 per home. Insurers paid out around 70% of the damage costs.

Householders had to pay for reinstatement of their gardens. Other damages not costed included the stress and disruption caused; the loss of no-claims bonuses and the labour incurred to rectify damage.

Some householders considered trying to claim their uninsured losses against the farmers concerned.

Local Authority costs

Local authorities incurred £133,000 worth of damage costs, which represented an average cost of £66,500 per authority. Costs were incurred for emergency flood alleviation work and longer-term protective measures.

Although the council were aware of the agricultural contribution to flooding, they adopted predominantly protective rather than preventative works. For example, they built dams and improved drainage rather than demanding land use changes on farms. The expense of such measures was recovered through a levy on households.

Farm costs

Two of the three farms suffered only very small losses (£700 and £350), while the third farm experienced very high costs (£13,000 in total). On average, farms incurred an average cost of £4,680 per farm.

All farmers blamed the intensity of the early October rainfall as the reason for the October floods. They acknowledged that their cultivation of the land was also a factor. Some farmers intended to change their management practices somewhat to lesson the probability of future flooding.

Source: Robinson and Blackman in Boardman *et al* (1990)

Much research is currently being undertaken that is attempting to link the impact of land use and catchment behaviour. The Environment Agency and DEFRA have currently commissioned a large project assessing procedures on producing development scenarios for the Modelling and Decision Support Framework (MDSF) for Catchment Flood Management Plans (CFMPs). Part of the project will consider agricultural/rural land use and climate change. Another major five-year project is being undertaken by the Water Resource Systems Research Laboratory at the University of Newcastle on Tyne, researching the link between catchment hydrology and sustainable management (CHASM). The objective is to gain a better understanding of catchment behaviour under future climatic conditions, taking into account the range and intensity of anthropogenic influences and the current hydrological and ecological regimes.⁵⁴

Boardman (1995) refutes the argument that rainfall intensity is responsible for flooding events, citing a case study on the South Downs area that illustrates:

⁵⁴ Further details can be found at www.ncl.ac.uk/chasm.

- The worst flooding and erosion did not occur in the wettest winters since 1950;
- Very modest rainfall amounts can result in erosion and flooding; and
- Flooding most often occurs when agricultural lands are bare.

Department of the Environment (1995) details areas in the UK where significant flooding events have been attributed to agriculture and land management practices. These areas include South Downs, Isle of Wight, parts of Devon, Kent, Norfolk, Nottinghamshire, Shropshire, Somerset and Suffolk. The report stated that there seems to be an increase in the frequency of floods in the mid 1980s, at the same time as changes in land management occurred.

Van der Ploeg *et al* (1999 and 2000) attempt to assess the implications of land use change on flooding runoff and events. They illustrate the relationship between different types of land use, management practice, hydrological soil group and rainfall runoff, as shown in Table A2.2. The higher the number, the greater the run-off (with a maximum possible runoff of 100).

Table A2.2 Runoff curve numbers for hydrological soil-cover complexes for medium antecedent rainfall and good hydrological conditions

Land use	Practice	Hydrological soil group			
		<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Fallow	Straight row	77	86	91	94
Row crops	Straight row ¹	67	78	85	89
	Contoured ²	65	75	82	86
Small grain	Straight row	63	75	83	87
	Contoured	61	73	81	84
Meadow, rotation	Contoured	55	69	78	83
Pasture	-	39	61	74	80
Meadow, permanent	-	30	58	71	78
Woods	-	25	55	70	77

Notes: A = sandy B= silty C = loamy D = clayey

1. Rows parallel to land slope
2. Rows perpendicular to the slope

Source: van der Ploeg *et al* (1999) (from USDA)

Land use types that are associated with increased rainfall runoff respectively include urban; fallow; row crops; small grains; and meadows (rotation). A change in land use can have a huge impact on runoff. For example, take an agricultural watershed where the land cover is permanent meadow and its soil group is the second poorest (a runoff curve number of 71). In a rainfall event of 50mm the expected runoff volume is 6mm. However, if the land cover was fallow, with the same soil condition of C, the expected runoff volume is 27mm – 350% more than meadowland use.

The Environment Agency (2001e) investigated the soil conditions of a number of catchments in England (Severn, Yorkshire Ouse, Uck and Bourne) in late 2000 and early 2001. Particular land use types that were examined included: Autumn sown crops, late autumn harvested crops, field vegetables, orchards, grassland (permanent and ley). The study found:

- Enhanced soil degradation was present in all four catchments. It occurred on 27 and 19% of the land in the Severn and Yorkshire Ouse catchments respectively, while the Bourne and Uck had 33 and 49% of its soil severely degraded;
- Severe degradation is associated mainly with late harvested crops (such as maize, sugar beet and potatoes) with extensive degradation occurring over 55% of the sites, followed by autumn sown crops, grass and field vegetables (25%) and orchards (10%); and

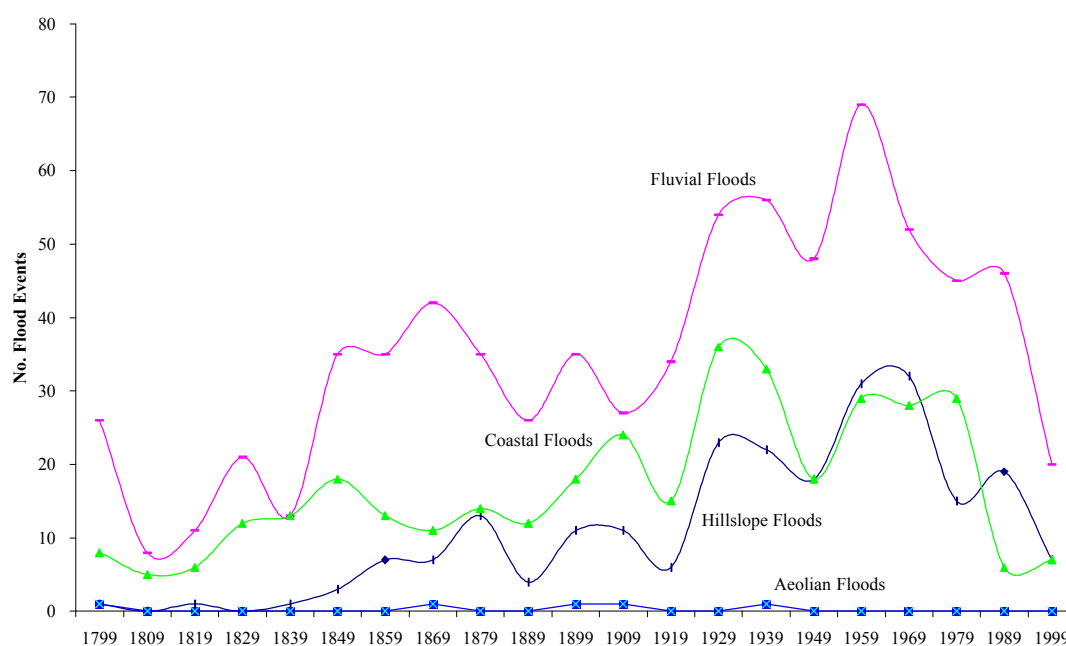
- It is suggested that the observed soil degradation may have led to an increased runoff of between 1.5 to 20% during storm events.

Hence – agriculture does contribute to a number of flood events in England, as well as contributing significantly to fluvial floods. But exactly how much does agriculture contribute? Identification of the number of agricultural surface water flood events and *total* flood events would allow a conservative estimate of agriculture's contribution to total events.

A flooding database held by the Environment Agency identifies flood events by a variety of characteristics. In particular, the year, severity of flood, location, damage, source and process are noted, with records starting in 1000. The most detailed records are from 1790 onwards. The database was put together from a collection of contemporary reports, mainly particular national and local newspapers. See Environment Agency (1999) for more detail.

The flooding database indicates that flooding appears to be on the increase (as illustrated in Figure A2.1), with all scales of flood increasingly cited.

Figure A2.1 Flood Events by System from 1790 to 1990s



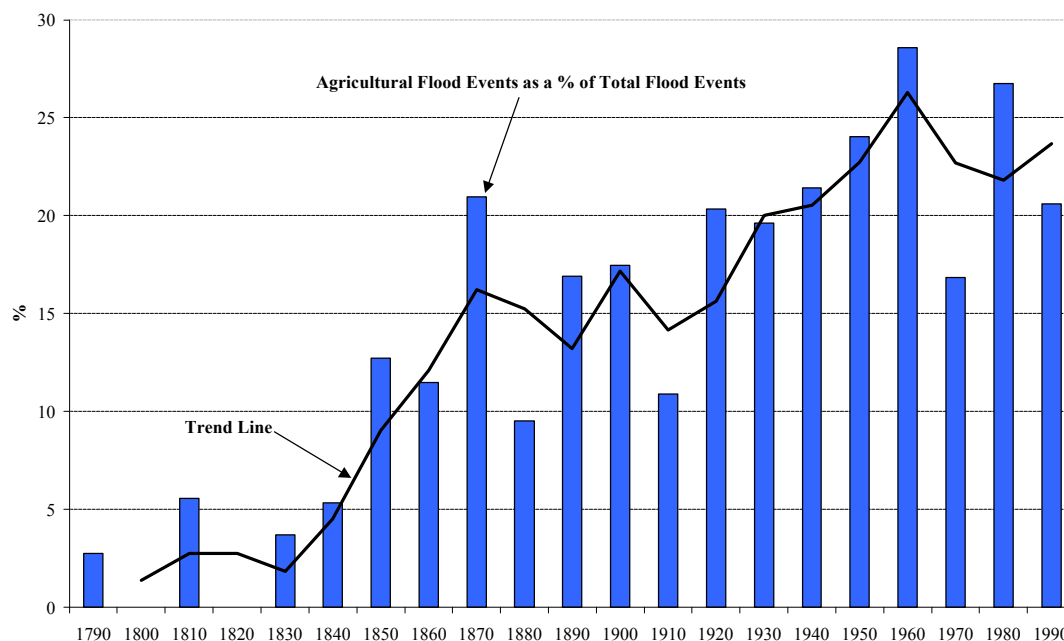
Source: Environment Agency

Possible reasons suggested by the Environment Agency (1999) for the increase in floods include:

- Improved and more effective reporting over the years;
- Changes in factors which cause and influence flooding (e.g. climate, catchment, drainage, flood defences);
- Changes in vulnerability (e.g. more development in flood-prone areas, buildings and contents more vulnerable to damage); and
- Changes in expectations about flooding. As society has increased expectations that flooding can be controlled, flooding events have perhaps become more newsworthy. Society as a whole is becoming more risk-aware and risk-averse.

One interesting detail of the flooding database is that it allows an identification of agricultural related flooding events. A conservative approach has been utilised here, using events that were classified as a system of hillslope flooding via an erosion and deposition process.⁵⁵ As a percentage of total flood events, hillslope flooding has increased from 3% in the 1790s to 25% in the 1980s and 90s.⁵⁶ Figure A2.2 illustrates the increase from the early 1800s to the 1990s.

Figure A.2.2 Hillslope flood events as a percentage of total flood events



Source: Environment Agency

In the 1980s and 90s, 57% of hillslope events were caused by erosion and deposition events. Therefore, it is assumed that at the *very least* 14% of total flood events can be attributed to agriculture.

This estimate is believed to be conservative due to the following:

- No allowance has been made towards agriculture's contribution to fluvial flooding, which it surely does;
- It is highly likely that regional disparities did result in the newspaper reporting and that agricultural flooding events were most likely underreported (due to them not being noteworthy enough);
- 24% of England and Wales is at moderate to very high risk of erosion due to agriculture (with at least 38% at small risk), hence it could be assumed that agriculture contributes to flooding by 24% (Department of Environment 1995); and
- It is known that 12% of agricultural land in England lies at risk from flooding (HR Wallingford 2001).

⁵⁵ Flood events were classified by system (Hillslope, fluvial, coastal and aeolian) and by process (erosion, deposition, flooding and unspecified).

⁵⁶ The original database records ended in 1993, with some less detailed records added afterwards. As such, the decade of the 1990s may not be as representative as earlier decades.

Appendix 3. Definitions of agricultural management responses

1 **Soil management** - Determine soil texture, monitor each season for compaction and smearing, monitor regularly for capping, use rough ploughing/cultivation to reduce runoff after late harvested crops, avoid cultivation and trafficking when too wet, use rougher finishes to seed beds and use rotations and grass breaks to maintain structure.

2 **Nutrient management** - Produce and implement a nutrient management plan which takes into account both organic manure and chemical fertilisers, take account of both nitrogen and phosphorus, apply to meet crop requirements only (RB209), observe N and P rules in COGAP (including Index 3 rule for P), observe COGAP rules re timing of applications.

3 **Pesticide management** - Produce and implement a crop protection plan, implement Integrated Crop Management (i.e. use appropriate rotations, select varieties for disease resistance, encourage beneficial predators, walk crops to monitor weeds and diseases, use traps, baits and diagnostic kits, use predictive advice, use reduced pesticide doses when appropriate.) Maintain and calibrate sprayers, use low drift nozzles, observe good spraying practice, observe LERAPs and buffer zones. Mix pesticides only on contained, covered yard area or on soil (i.e. not uncovered yard), meticulously avoid spills and drips of concentrate, be prepared to deal with accidental spillages, use closed rinsing or returnable containers where possible. Store pesticides in properly designed store and rinse and dispose of all containers via approved routes. Collect and dispose of washings in compliance with Groundwater Regulations.

4 **Buffer zones** - Retain permanent vegetated buffer strips of at least 2 meters width along all ditches and water courses, observe buffer zone requirements of pesticides, undertake and implement LERAPs, use set-aside to provide additional buffer zones where possible.

5 **Water management** - Undertake water use audit, apply irrigation scheduling, use low loss irrigation systems (e.g. trickle irrigation), regularly check for and eliminate leaks, separate roof and clean yard drainage from slurry collection systems, cover stock gathering and feeding areas wherever possible.

6 **Simple management change** - Examples - Keeping winter feeding areas away from ditches and streams and other rapid drainage routes; moving gateways; exclusion of stock from riparian strip (fencing off watercourse).

7 **Energy management** - Undertake energy audit and act on results; Horticulture - optimise glasshouse management; Intensive Livestock - ensure effective insulation; Arable - optimise and match tractor power and machines, reduce number of passes; Dairy - optimise cooling.

8 **Integrated farm management** - Undertake LEAF (or equivalent) audit; on arable farms adopt ICM, produce and implement Nutrient Management Plan and Crop Protection Plan, consider reduced tillage on appropriate soils; on mixed and livestock farms adopt BEAM project principles.

9 **Waste management ('non-natural' wastes)** - Do not burn or bury waste on the farm, minimise waste, recycle black plastic (where scheme available), arrange for other waste to be collected by registered waste contractor and disposed of at licensed sites, comply with Groundwater Regulations for disposal of pesticide washings and spent sheep dip.

10 **Landuse management** - Conservation and reduced tillage, hedgerow management, strategic hedgerow creation (to minimise risks of runoff), ditch management, grass waterways, access tracks.

11 **Washlands** - Creation of an area which can be flooded and used to store a sufficient volume of flood water to relieve flooding in another target area. Washlands are not synonymous with wetlands.

12 **Capital investment in emission control** - Poultry - new buildings or retrofitted ventilation systems which ensure dry litter; Pigs - new buildings with part slatted floors and low surface systems area dung channels, covers for slurry stores, low emission spreading equipment (trailing shoe and band spreaders and soil injection systems), Dairy - low surface area slurry channels, covers for slurry stores, covered manure stores (also for composting), and spreading equipment as for pigs.

Appendix 4. Rural development regulation schemes

Box A4.1 provides detail on the various schemes under the Rural Development Regulation Programme. Appendix Six illustrates the expenditure on various schemes from 2000 to 2006.

Box A4.1 Rural development regulation schemes

Investment in agricultural holdings

Rural Enterprise Scheme: Provides targeted assistance to support development of more sustainable, diversified and enterprising rural economies and communities.

Energy Crops Scheme: establishment grants for short rotation coppice and miscanthus.

Training

Vocational Training Scheme: for those involved in farming and forestry: provides training that contributes to an improvement in the occupational skill and competence in various areas (information and communications, business skills, marketing, conservation and environmental skills, diversification, resource management, technical skills, personal development and on farm food production and processing).

Less favoured areas

Hill farm allowance Scheme (2001-2006): Payments are made for moorland and common land, severely disadvantaged areas and disadvantaged areas.

Agri-environment

Countryside Stewardship Scheme (CSS): Payments are made for chalk and limestone grassland, uplands, historic features, old meadows and pastures, field boundaries, arable land and new access. Specific upland options include managing grassland and moorland.

Environmentally Sensitive Areas (ESAs): Payments for protection and management of existing features, stockproof walls, hedges, high water levels in wetland habitats, banks, ditches, old meadows, pastures and field margins. Each ESA has one or more tiers of entry under which farmers can enter into voluntary 10 year management agreements to maintain and enhance the environmental features of their land.

Organic Aid Scheme (OAS): Aid payable for 5 years for conversion to organic status based on income foregone.

Nitrate Sensitive Areas (NSA): Payments for converting arable land to grassland and other agri-environment and forestry schemes in designated areas.

Improving processing & marketing of agricultural products

Processing and Marketing Grant: Payments are made for activities that: guide agricultural production towards new markets/products, improve existing marketing, improve presentation of products or minimise waste, apply new technology, improve quality and health conditions and protect the environment.

Afforestation of agricultural land

Farm Woodland Premium Scheme and Woodland Grant scheme: Payments are made over 10-15 years for planting woodlands and natural regeneration.

Energy Crops Scheme: Short rotation coppice.

Adaptation and development of rural areas

Rural Enterprise Scheme. It provides assistance for projects that help to develop more sustainable, diversified and enterprising rural economies and communities.

Sources: DEFRA (2001), MAFF (1996, 2000b, 2000f), Baldock *et al* (1996), Task Force for the Hills (2001)

Appendix 5. Participation and non-participation in agri-environmental schemes

Wilson *et al* (2000) conducted a survey of approximately 1,000 EU farmers participating (and not participating) in agri-environmental schemes. Farmers were identified into the following categories:

- Scheme enthusiasts: 65% of participants;
- Neutral adopters: 35% of participants;
- Uninterested nonadopters (54% of nonparticipants); and
- Profit-maximising nonadopters (46% of nonparticipants).

Participation reasons

Wilson *et al* (2000) identified the following key factors as reasons for farmers' participation:

1. Financial reasons (79%)
2. Provides a secure source of income (64%)
3. Wish to promote environmental conservation (53%)
4. Fitted in with farm-management plans (50%)
5. No changes in farm management needed (48%)
6. To improve the image of the farm (20%)
7. Already participated in previous scheme (18%)
8. Encouraged to join by officials (16%).

In some areas the goodness of fit (such as fitting in with farm management plans) was the most important reason for participation. The more deep and narrow schemes are, the more likely it is that goodness of fit will play a major role in farmers' decisions to participate. Among farmers whom did not enter all land into the scheme, the main reasons given were 'lack of scheme flexibility' and that the scheme 'did not fit into farm-management plans'. This reinforces the view that many farmers see agri-environmental schemes as only marginally suited to the specific situation on their farms, and that they often adopt a pragmatic approach by entering only 'suitable' land into schemes (Wilson *et al* 2000).

Many UK studies have suggested that financial considerations are paramount in farmers decisions not to participate in agri-environment schemes, although Wilson *et al* (2000) suggests that this is generally not the case for the rest of EU (because of its higher payments generally). It is also noticed that the more contact and information provision by officials with farmers the higher the participation rates.

The more targeted and narrow a scheme the larger the number of scheme enthusiasts in it. Similarly neutral adopters were influenced by extension services. Information sources that played an important role in farmers decision to participate in AEP schemes include agricultural extension services, local or regional officials, agricultural publications and information meetings. Other information sources such as local farmers unions, leaflets and NGOs had little significant impact on the decision to participate.

Characteristics of participating farms

Wilson *et al* (2000) found the following in their survey of 1,000 EU farms:

- Agri-environment schemes tend to be more suitable to relatively larger farms (in terms of participation). It is suggested that larger farms have more flexibility in decision making, are

usually better off financially and may have larger ecologically important habitats on their farm. These factors are dependent upon the type of scheme investigated.

- Extensive farms generally participate in AEP schemes more than intensively managed or arable farms, probably because of the 'goodness of fit' factor. Most participating arable farmers are in the schemes for either neutral or profit-maximising reasons.
- Farmers owning more than half of their holding as freehold property were more likely to enter into AEP schemes than those owning less than 50%. Tenant farmers did not enter schemes due to uncertainty about long-term tenancy agreements with landlords and that landlords often did not share agri-environmental benefits with tenants.
- Farmers who had completed schooling and had higher education levels were far more likely to enter into schemes than those with lower education levels.
- Farmers who have a high dependence (50 to 99%) on the farm for income tend to be more likely to participate in schemes. However, those depending on the farm for 100% of income are less likely to participate because the opportunity cost of foregone income is higher. Farmers with a low dependence on the farm for income (less than 50%) also tend not to participate because of the relatively meagre financial benefits of the scheme.
- The effect on participation in AEP schemes of whether farmers had a successor or not proved to be inconclusive. Potter and Lobley (1996) suggested that older UK farmers without a successor were interested in 'winding down' their farms and enter AEP because they are rewarded for extensification measures. Wilson *et al* (2000) suggest that there has been a recent shift in farmers' thinking towards the benefits of incorporating environmental factors into farm decision making.
- The higher the payments offered by AEPs the higher the participation rate.
- Farmers who had participated in earlier schemes were more likely to continue with subsequent schemes rather than pull out altogether.
- A quarter of all non-participants identified lack of information about schemes as their key reason for non-participation.

Dobbs and Pretty (2001) reviewed the UK literature and commented on the following characteristics of participating ESA and CSS farms:

- CSS farms were larger on average than the general population of English farms (20% of CSS farms were over 300 ha in size, compared to 3% of the general population);
- CSS agreements included a disproportionately high number of cattle and sheep farms and a disproportionately low number of crop and dairy farms, compared to the general population;
- Little difference was found in land tenure agreements between scheme participants and the general population;
- Analysis suggests that the likelihood of decreases in stewardship following the end of CSS agreements is greatest where CSS investment was the highest.
- Farmers enrolled in the CSS cited conservation reasons for participation more highly than farmers enrolled in the ESA.

Ducros in Petchey *et al* (1998) commented on some barriers to uptake by farmers of buffer zone schemes. She found that reasons for non-adoption included:

- Lack of adequate compensation and the fear of production losses were the two greatest barriers; and
- Other main barriers included the fear that farming practices would be negatively affected, that land could not be sacrificed to conservation schemes and that enough evidence was not available of the effects of the scheme.

Pannell (2001) explores the reasons for low-adoption of salinity management practices in Australia. Non-adoption occurred because of the following three main factors:

1. *Difficulties of trialing*: For any farming innovation, a farmer's uncertainty about its performance is initially high. Off-farm information may help to reduce the uncertainty, but the key to reducing uncertainty is on-farm trialing, preferably on the farmer's own property. Key difficulties of trialing some environmental strategies include: (a) Observability is low or observations are costly; (b) Long time scales; (c) Externalities – belief that the cause of the degradation is predominantly other farmers; (d) Necessary scale of implementation; (e) Quality of implementation; (f) Resources required for trialing; and (g) Risks of trial failure.
2. *Economic costs and benefits of current treatment options*: Once farmers have personal experience with the benefits of the system, more weight will be put on this than other factors. Thus, successful trials or successful adoption are necessary for favourable perceptions in the medium to long term. Problems arise in the following: (a) Establishment, Maintenance and Opportunity Costs; (b) Long time scales and discounting of benefits; and (c) Off-site Externalities.
3. *Social factors*: Some social processes do not act in favour of adoption of environmental practices. These include: (a) Concern about the social fabric (effects on rural populations and services); (b) High transaction costs of negotiation; (c) Fairness of the distribution of benefits and costs.

Appendix 6. Rural development programme expenditure and funding sources

Table A6.1 illustrates the planned expenditure on the rural development programme, while Table A6.2 and A6.3 illustrate the sources for the funds and expenditure on the CAP.

Table A6.1 Planned expenditure on RDP from 2000 to 2006 in £ million

	2000	2001	2002	2003	2004	2005	2006	Total
Investment in agricultural holdings	0	1	1.5	2.3	3.3	3.7	4.9	16.6
Energy crops (Miscanthus)	0	0.7	0.8	0.9	0.9	0.9	0.9	4.9
Diversification (RES)	0	0.3	0.7	1.4	2.4	2.8	4	11.6
Training	0	2.1	2.5	3.6	4	4	5.7	22
Vocational training scheme	0	2.1	2.5	3.6	4	4	5.7	22
Less favoured areas	42.4	43.8	40.9	37.4	34.8	27.2	27.2	253.8
Hill livestock compensatory Allowances (2000)/Hill Farm Allowance (2001-2006)	42.4	43.8	40.9	37.4	34.8	27.2	27.2	253.8
Agri-environment	83.6	111.3	122.1	137.6	153.5	169.2	183.8	961.1
Countryside stewardship	27.5	37.9	53	68	83	98	113	480.4
Environmentally sensitive areas	39.1	50.1	48.3	48.2	48.2	48.2	48.2	330.4
Organic farming	13.4	20.6	19	19.9	22.3	22.9	22.6	140.7
Nitrate sensitive areas	3.7	2.7	1.8	1.4	0	0	0	9.6
Improving processing & marketing of agricultural products	0	2.2	6.3	8	8	8	11.4	44
Processing & marketing grant	0	2.2	6.3	8	8	8	11.4	44
Afforestation of agricultural land	15.5	20.3	23.9	26.1	27.1	29.1	30.1	172
Farm woodland premium scheme	7.5	8	9	10	11	12	13	70.8
Woodland grant scheme	8	9	11	12	12	13	13	78
Energy crops (short rotation Coppice - agric. land)	0	3.3	3.9	4	4	4	4	23.2
Other forestry measures	7.8	8.5	9.7	9.7	9.7	9.7	9.7	64.9
Energy crops (short rotation Coppice -non agric. land)	0	0.5	0.7	0.7	0.7	0.7	0.7	4.1
Woodland grant scheme	7.8	8	9	9	9	9	9	60.8
Adaption and development of rural areas	0	4.3	9.5	17.5	28.6	33.2	47.2	140.3
Rural enterprise scheme	0	4.3	9.5	17.5	28.6	33.2	47.2	140.3
Total expenditure	149.3	193.5	216.6	242.1	269.1	284	320	1675

Source: Taskforce for the Hills (2001)

Table A6.2 Current RDP funding sources from 2000/01 to 2006/07 (£ m)

	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	Total
Farmers modulated payments		-	20	40	48	55	70	70	303
New Exchequer match funding		-	20	40	48	55	70	70	303
Baseline exchequer funding	90	90	90	90	90	90	90	90	630
EU receipts	40	50	50	50	50	50	50	50	350
TOTAL	130	140	180	220	235	250	280	280	1,585

Source: MAFF (1999a, 2000c, 2000)

Consequences of exchequer matching funding

Increased modulation from 4.5 to 20% will have implications for Treasury expenditure. When the Government sets fiscal policy, it has to ensure that its policy decisions will provide stable public finances in the short and medium term. Decisions also have to be sustainable in a long-term framework, due to the Code for Fiscal Stability. Long-term projections covering a period of at least ten years have to be provided.

Table A6.3 Public expenditure under the CAP and on national grants and subsidies (£ m)

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01
I Market regulation and other agricultural support measures under the CAP											
A. Expenditure funded via the Intervention Board											
(i) Expenditure by the Intervention Board	1 262.3	1 182.8	1 049.8	1 076.2	454.0	457.2	1 621.0	1 281.1	1 012.6	710.4	761.3
(ii) Expenditure by Agriculture and other Departments:											
Agricultural measures:	360.5	441.1	649.8	1 515.7	1 751.0	2 165.8	2 424.9	1 998.1	2 130.2	2 039.0	2 006.1
Rural development measures											22.4
'Agri-environment & other measures	..	..	..	18.8	29.6	33.4	35.5	41.3	50.3	66.6	79.6
B. UK expenditure by Agriculture & other dpts	..	57.7	73.6	75.0	69.6	84.1	75.3	91.0	105.1	138.9	143.8
II Price guarantees (national)	18.3	40.8	27.4	12.5	0.1	..	..	..	..	..	..
III Support for conservation and other improvements	..	63.4	58.5	60.6	72.8	41.1	26.0	22.0	13.3	13.2	16.9
IV Support for agriculture in special areas	159.1	184.2	161.7	139.5	128.2	111.6	132.9	145.4	169.0	192.0	148.9
V Other payments	..	..	..	..	..	3.6	2.2	3.9	1.3	1.3	3.3
TOTAL	1800.2	1970.0	2020.8	2898.3	2505.3	2896.8	4317.8	3582.8	3481.8	3161.4	3182.3

Source: DEFRA statistics (2001a)

Budgets for 1999 and 2000 forecast that the UK's long-term fiscal position was relatively favourable and that current consumption could grow at a faster rate than GDP without compromising fiscal stability. A level of 40 per cent of GDP has been defined as the maximum debt level possible for achieving the sustainable investment rule. Public sector net debt is currently at around 33 per cent of GDP in 2000-01. The UK's favourable position is a result of a sound fiscal starting point, less pressing demographic developments and price indexation of universal state pension benefits (HM Treasury 1 2001).

It is possible that the Treasury may have to provide *additional* funds up to £90 million annually for the RDR by 2006-07. For example, in 2003-04 it is forecast that RDR expenditure will increase from £47.5 to £70 million by MAFF with modulation at 4.5%. If arguments for increased funding to 20% succeed, new exchequer funding may rise to £159 million (an additional increase of £89 million).⁵⁷

HM Treasury has three main options:

1. Fund part or all of the expenditure through a tax/levy on the agricultural sector;
2. Debt Finance; or
3. Fund by changing expenditure priorities.

It is unlikely that a tax or levy would provide the majority of funds sought, though its existence may help provide the case for other Treasury expenditure. The current financial position suggests

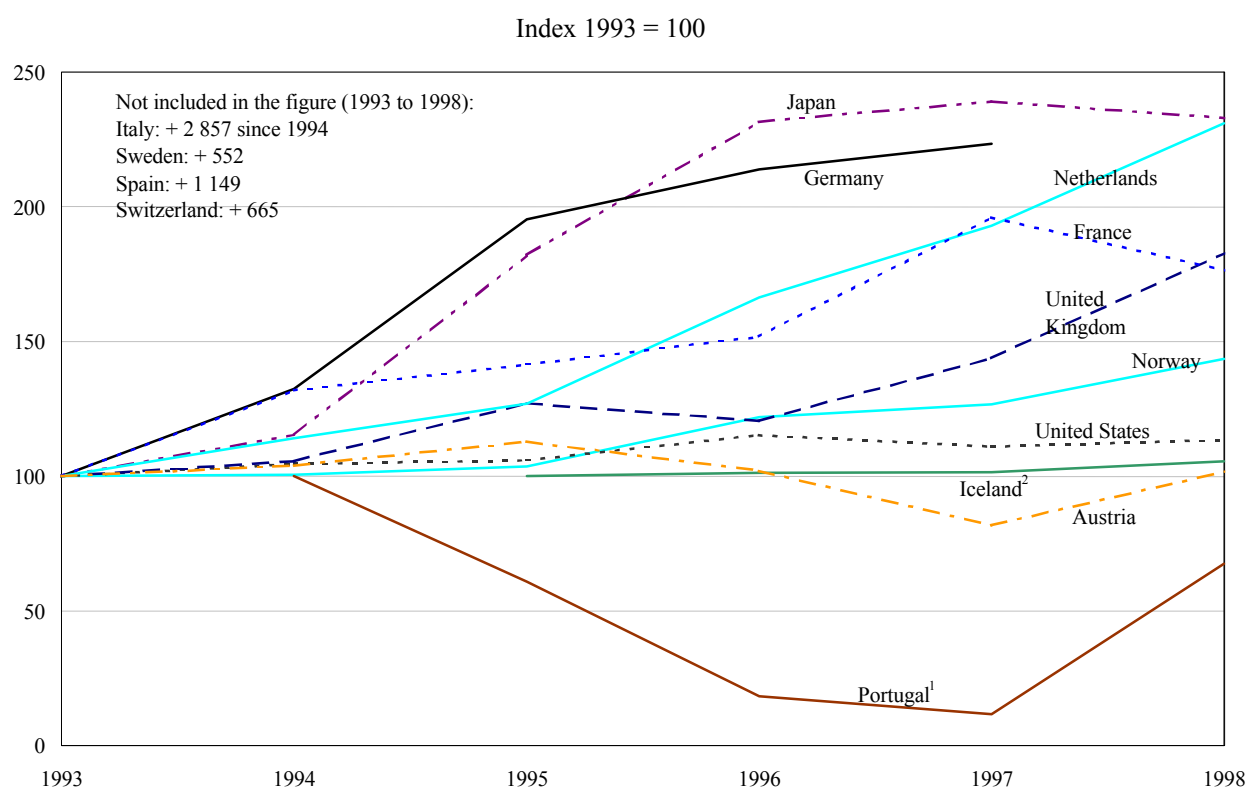
⁵⁷ 2003-04 was the latest available information. MAFF forecast that new exchequer funding will represent 25% of agri-environmental funds in 2006-07, and 20% of total CAP is £636 million. The assumption was made that new exchequer funding may be £159 million.

that if the Treasury chose to debt finance it might not place the UK into an unstable position. but may have the effect of reducing expenditure in other areas.

OECD expenditure on agri-environmental measures

Many OECD countries introduced agri-environmental measures in agriculture, beginning around the late 1980s. Figure A6.1 illustrates public expenditure on agri-environmental measures by countries in the OECD. The nature of measures vary greatly across countries, but most have mainly focused on altering inappropriate farm management practices. Some measures have also included the provision of payments if certain practices are adopted, such as area payments for adoption of low-input or organic farming systems (Parris 2001).

Figure A6.1 Public expenditure on agri-environmental goods, services and conservation in OECD countries: 1993 to 1998



Notes:

1. 1994 = 100.

2. 1995 = 100.

Source: Parris (2001)