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Rural Economy and
Land Use Programme

Informing the Reform and Implementation of the Common Agricultural Policy

Informing the Reform and Implementation of the Common Agricultural Policy

Findings from the UK Research Councils' Rural Economy and Land Use Programme

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Executive summary

E1 This Paper presents lessons from recent research for the reform and implementation of the Common Agricultural Policy (CAP) of the European Union (EU). It focuses on findings from over 20 projects funded by the UK 'Rural Economy and Land Use' programme (Relu).

E2 The CAP influences the use and management of some 180 million hectares of land across 27 EU Member States. It comprises a complex range of regimes, funding mechanisms, policies and institutions. The total annual CAP budget at EU level is now over €50 billion, 40% of the total EU budget, or 0.4% of EU Gross Domestic Product. The CAP has evolved over the last 50 years in response to political, economic, social, technological, legal and environmental drivers. The expansion of the EU has itself brought major changes in the size of the farm labour force, in farm structures, and in the challenges facing rural areas.

E3 The EU Commissioner for Agriculture and Rural Development initiated a further phase of reform in April 2010, aiming for approval of new legislation by the end of 2013. This will be framed within the context of the EU budget review, EU aspirations for jobs and growth, climate change, the global downturn, and questions about the coherence, legitimacy and sustainability of the CAP. Many interests are promoting diverse policy objectives: fostering world trade; managing market risks; contributing to global food security; ensuring food safety; providing renewable feedstocks; and safeguarding water quality and biodiversity.

E4 Relu projects offer findings of particular relevance to the further development of 'agri-environment schemes'. These support land managers in delivering a range of ecosystem services which would not otherwise be provided through the market ('environmental public goods'). The schemes are generally open to all farmers and are delivered through voluntary agreements co-financed by Member States and the EU under Pillar II of the CAP. The agreements, which typically last for five or 10 years, provide annual payments to farmers who agree to implement a range of specified management practices on their land.

E5 The scientific evidence provided by Relu projects will help policy-makers tackle a range of questions about the further development and implementation of agri-environment schemes:

- What ecosystem services should be supported by the schemes?
- What spatial scales are appropriate for planning and management?
- How should stakeholders be involved in designing and delivering the schemes?
- How can co-ordinated, collaborative action be obtained across farms?
- How can long-term environmental benefits be secured?
- Could providing formal training help to deliver the schemes?
- How should the benefits of ecosystem services be valued?
- How should successful land management be measured?
- Should agri-environment payments change if other support is reduced?

E6 On the basis of the research findings reported here, and taking account of the wider policy context, the following recommendations are offered for consideration by policy-makers:

1. An ecosystem services framework: Agri-environment schemes should be retained as a critical delivery mechanism within the CAP. They should be explicitly designed and implemented within the framework provided by the 'ecosystem services approach'. This embraces services rewarded by the market (e.g. producing food and fibre) and the provision of environmental public goods. The framework will assist in managing the varied demands on land, setting priorities, and identifying and tackling conflicts.

2. Funding: The resources made available at EU level to support the schemes should be increased radically, to recognise their critical role in delivering environmental commitments. The schemes should receive a higher proportion of the EU CAP budget and/or be supported at a higher rate of EU co-financing. Payments for scheme options should be increased as necessary to ensure that desired environmental public goods can continue to be delivered following any reductions in the Single Farm Payment.

3. Developing scheme options: The menu of scheme options, in any one area, should be based on a systematic assessment of all the environmental public goods which could be provided by farms. Management options should be developed at the most appropriate scale e.g. 'catchment' for water quality, or 'landscape' for farmland birds). Management prescriptions should be tailored, as far as possible, to local conditions.

4. New priorities: The schemes should include actions to: promote carbon storage, and integrated pest management; reduce risks to public health from livestock waste in water; and respond to new pest and disease threats. The use of the schemes to convert conventional farms in highly-productive EU regions to organic farming systems should be reviewed. An alternative might be to use the schemes to create networks of areas managed primarily for biodiversity around intensively-managed fields on conventional farms, enhancing the benefits by using 'no-till' or 'low-input' approaches.

5. Promoting collaborative approaches: The scale at which scheme agreements are planned, negotiated, funded and delivered should shift, over time, from the individual farm to the local community of farms. This will help to ensure that: farmers are fairly rewarded for the added benefits of co-ordinated action; farmers outside agreements cannot negate the work of those within agreements; and different environmental public goods are delivered at the most appropriate scale.

6. Involving stakeholders: Advice from local farmers and other stakeholders on scheme options, their delivery, and how to co-ordinate action between farmers, should become far more important in designing and delivering the schemes. More use should be made of tools to support deliberation on objectives and priorities, and to help resolve conflicts. Participatory Geographical Information Systems offer one useful approach.

7. Securing long-term benefits: The schemes should incorporate, or be supplemented by, new contractual mechanisms which will secure the long-term public interest in land management, over periods of decades rather than years. This will be particularly important in managing carbon, and in restoring, re-creating or linking wildlife habitats.

8.Calculating payments: The payments offered under the schemes to secure changes in land management reflect income foregone and additional costs incurred. World trade rules preclude the inclusion of any incentive element. There are some differences between Member States in the approach taken to calculating income foregone. This experience should be shared with the aim of establishing consistent practices which provide appropriate rewards for the provision of environmental public goods.

9.Payment by results: Where scheme outcomes are easy to measure, some element of the payment should be based on results, rather than on mere participation. Prescribing the desired outputs rather than the inputs (e.g. 'a sward of a certain composition and height' rather than 'the timing and density of grazing') would enable farmers to measure outcomes themselves, and to check and adjust management practices accordingly.

10.Supporting farmers with training: Investment in formal training, targeted on novel or technically-difficult options, should become an integral part of all schemes, to help improve their effectiveness. This will help farmers to understand scheme objectives, and to support them in exercising their skills to deliver appropriate management.

Introduction

0.1 This Paper presents lessons from recent research for the reform and implementation of the Common Agricultural Policy (CAP) of the European Union (EU). It focuses on findings from over 20 projects funded by the UK 'Rural Economy and Land Use' programme (Relu). These projects represent only a small sample of recent research and consultancy work relevant to the CAP, but offer some important and even startling findings. While most of the projects focus on the UK, several have examined experience in other countries, and all offer findings relevant to the policy community responsible for developing and implementing the CAP.

0.2 The first section of the Paper summarises current challenges facing the CAP. How to respond to these is the focus of a lively policy debate at both UK and EU levels. The following sections set out relevant research findings. The focus, which reflects the scope and nature of the projects, is mainly on how the CAP could support land managers in delivering a range of 'environmental public goods' alongside the marketable farm outputs of food and fibre. Drawing on the research findings, and taking account of the wider policy context, the final section offers ten concise recommendations for consideration by policy-makers.

The 'Rural Economy and Land Use' (Relu) Research Programme

- Promotes interdisciplinary research between social and natural sciences.
- Focuses on the challenges facing agriculture and rural areas.
- Supported by the UK Research Councils (Economic and Social, Biotechnology and Biological Sciences, and Natural Environment), Defra and the Scottish Government.
- Budget of £25 million, with projects running between 2004 and 2011.
- Comprises 74 projects, involving 500 researchers, from over 40 disciplines.
- Emphasises the importance of actively engaging diverse stakeholders in research.
- Provides rounded economic, social, and environmental perspectives on land management.
- Offers new evidence, tools and approaches for policy development and implementation.

1. Current challenges facing the CAP

What is the Common Agricultural Policy?

1.1 The CAP influences, to a varying extent, the use and management of some 180 million hectares of land across 27 EU Member States. It affects the livelihoods of several million farmers, the prosperity of thousands of rural communities, and, through the diverse services provided by farming, the well-being of us all.

1.2 The CAP comprises a complex range of regimes, funding mechanisms, policies and institutions. The total annual CAP budget at EU level is now over €50 billion, 40% of the total EU budget, or 0.4% of EU Gross Domestic Product (Graph 1). There are two separate EU Funds, or 'Pillars'. The specific funding arrangements vary considerably between Member States. 'Pillar I' provides direct payments to farmers, and other forms of market support, and accounts for most of the budget. 'Pillar II' supports rural development. Spending under Pillar II is 'co-financed' (the EU budget funds a proportion of the cost of eligible measures, and Member States provide the balance from national budgets) (Table 1).

1.3 The CAP has evolved through several phases over the last 50 years (Graph 2). Initially, the focus was on improving productivity, securing food supplies, stabilising markets and supporting incomes. Success in raising production led to food surpluses, burgeoning expenditure, and trade and environmental concerns. Policy responses in the 1980s included introducing 'supply management' (e.g. milk quotas and 'set-aside'), and providing some limited support for environmentally-sensitive farming within specially-designated areas.

1.4 Reforms in 1992 started a shift away from supporting prices towards making direct payments to farmers instead. The 'Agenda 2000' package formalised the current 'two-Pillar' structure and strengthened support for farm diversification and environmental management. Further reforms in 2003 decoupled subsidy payments from production, to ensure compatibility with world trade rules, and strengthened environmental protection requirements.

1.5 The EU itself has also changed substantially. The expansion of the EU from 15 Member States in 1995 to 27 by 2007 brought a doubling in the size of the farm labour force, greater diversity in farm structures, and new challenges for rural areas. There are now some 7.3 million 'commercial' farm holdings in the EU-27, and an additional 6.4 million 'small' holdings. Almost half of the 'small' holdings are found in Romania alone. Of the total farm labour force of 11.7 million, some nine million work on 'commercial' holdings (Eurostat 2009). The CAP needs to be able to respond to the territorial diversity of an expanded EU.

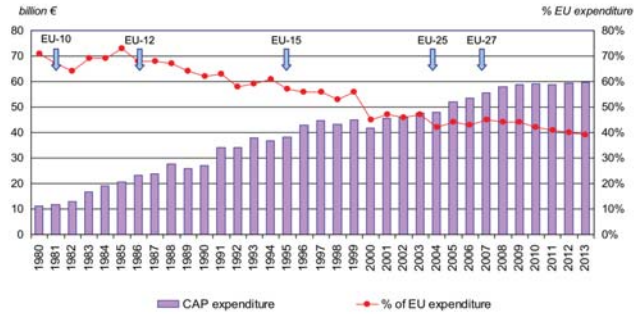
What is the scope of the next stage of reform?

1.6 The EU Commissioner for Agriculture and Rural Development launched an online debate on the future of the CAP in April 2010. He posed four questions:

— Why do we need a European Common Agricultural Policy?
— What do citizens expect from agriculture?
— Why reform the CAP?
— What tools do we need for the CAP of tomorrow?

The debate generated some 5,700 contributions (see http://ec.europa.eu/agriculture/cap-post-2013/debate/index_en.htm). The Commission plans to issue a Communication towards the end of 2010 setting out policy options. The aim is to approve new legislative proposals by the end of 2013, in advance of the start of the 2014-2020 financial perspective.

Graph 1: CAP expenditure 1980-2013 (current prices)



This graph shows the **development of CAP expenditure over the years as share of the EU budget**. **This share has decreased very sharply over the past 20 years**, from almost 75% to 44% and is forecasted to be around 39% in 2013. This decrease has taken place despite the successive EU enlargements. This downward path of CAP cost in the EU is due mainly to the CAP reforms and to the increase of other EU policies.

Sources: From 1980 to 2006: CAP expenditure – European Commission, DG Agriculture and Rural Development (Financial Reports); EU expenditure – European Commission, DG Budget (2008 Financial report). From 2007 to 2013: EU Financial framework 2007-2013.

Annual expenditure, in current prices.

Updated: 20.1.2010

Source: European Commission web site:
http://ec.europa.eu/agriculture/cap-post-2013/graphs/index_en.htm

1. Current challenges facing the CAP

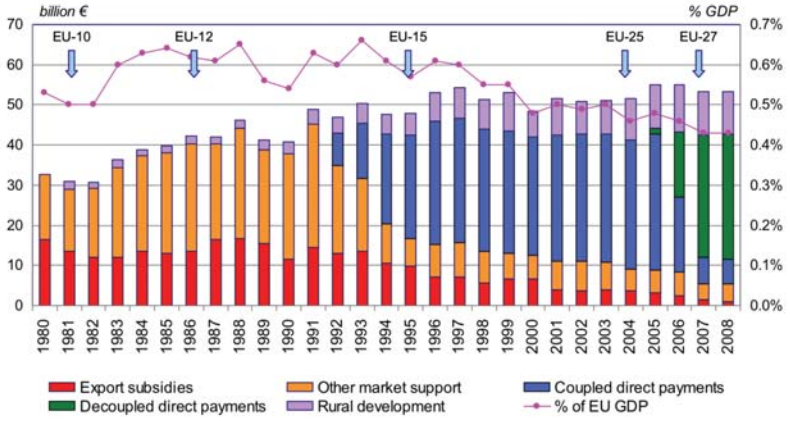
Table 1: The main CAP funding streams

Stream	Element	Purpose
'Pillar I'. European Agricultural Guarantee Fund (EAGF). Compulsory across all EU Member States.	Single Payment Scheme ('Single Farm Payment').	Direct payments to farmers to support farm incomes. Recipients must: — Maintain land in 'Good Agricultural and Environmental Condition' (GAEC) by meeting standards relating to the protection of soils, habitats and landscape features. — Comply with 'Statutory Management Requirements' (SMRs) covering the environment, public and plant health, animal health and welfare, and livestock identification and tracing.
	Other forms of market support.	— Refunds for exporting farm produce to non-EU countries (export subsidies). — Intervention measures to regulate agricultural markets. — Promoting farm produce, within and outside the internal EU market. — Restructuring measures in the sugar industry. — Promoting the consumption of fruit in schools. — Contributing to veterinary measures, inspections of foodstuffs and animal feed, animal disease eradication and control, and plant-health measures. — Conserving, characterising, collecting and using genetic resources in farming. — Setting up and running farm accounting information systems. — Supporting farm survey systems. — Expenditure relating to fisheries markets.

Table 1: The main CAP funding streams (continued)

Stream	Element	Purpose
'Pillar II'. European Agricultural Fund for Rural Development (EAFRD). Member States may set their own priorities for funding both between and within Axes, subject to minimum spending limits, in line with the principle of subsidiarity.	Axis 1: Improving the competitiveness of the agricultural and forestry sector	1. Promoting knowledge and improving human potential: — Providing vocational training and information. — Establishing young farmers. — Enabling early retirement for farmers. — Providing advisory services to improve performance. 2. Restructuring and developing physical potential: — Modernising holdings and using new technology. — Adding value to production through investments in efficiency and marketing. — Improving and developing infrastructure. — Restoring and seeking to prevent damage caused by natural disasters. 3. Improving the quality of production and products: — Assisting farmers in adapting to EU quality standards. — Encouraging participation in quality assurance schemes. — Supporting producer groups in promotional activities for products. 4. Supporting the new Member States: — Restructuring semi-subsistence holdings. — Establishing producer groups. — Supporting restructuring and diversification into non-agricultural activities.
	Axis 2: Improving the environment and the countryside	Encouraging management actions to preserve the environment and landscape, and protect and improve natural resources (managing biodiversity, including Natura 2000 sites, protecting water and soil, and mitigating climate change). Includes: — Supporting farming in hill and upland areas with natural handicaps and other disadvantaged areas (defined by the Member States as 'Less Favoured Areas'). — Supporting agri-environment or forest-environment schemes which encourage sensitive land management, going beyond cross-compliance requirements, including non-productive capital investments for this purpose. — Encouraging environmentally-led afforestation of farmland and agroforestry systems, the restoration of forestry potential, and prevention of natural disasters. All recipients of support must observe the cross compliance conditions (GAEC and SMRs) which apply to direct payments to farmers.
	Axis 3: Quality of life in rural areas and diversification of the rural economy	— Supporting non-agricultural diversification, establishing micro-businesses, promoting tourism and protecting, developing and managing the natural heritage. — Improving the quality of life in rural areas, with particular focus on renovating and developing villages and preserving and making the best use of the rural heritage. — Acquiring skills and running activities in order to prepare and implement the local development strategy.
	Axis 4: LEADER	— Implementing local development strategies through public-private partnerships ('local action groups'). — The strategies, applied to clearly designated rural areas, must achieve the objectives of at least one of the three preceding axes. — Implementing, through the local action groups, inter-territorial or transnational co-operation projects.

Graph 2: The evolution of CAP expenditure 1980-2008 (2007 constant prices)



This graph shows **how the CAP has evolved through the evolution of the CAP expenditure**:

- **In the 80s the expenditure was mainly due to price support through market mechanisms** (intervention and export subsidies) which raised by the end of this decade due to the agricultural surpluses.
- **In 1992** there is the first big shift, due to the 1992 reform. **The market mechanisms** (in red and yellow) **were reduced and replaced by direct payments** (in blue). Thus price support is replaced by producer support. Finally, **spending on rural development measures also increased** (in purple).
- **In 2003**, one can see the impacts of the 2003 reform, with **direct payments shifting to decoupled payments** (green). Payments are no longer paid per ha or per animal but paid in function of what the farmer received in a reference period. **Spending in rural development is again reinforced** in this reform.
- **Spending has been stabilized** and despite the successive enlargements, **the overall spending as a share of the GDP has actually decreased**: 0.5% of GDP in the 80s to 0.4% now (graphic line).

Sources: CAP expenditure – European Commission, DG Agriculture and Rural Development (Financial Reports); GDP – Eurostat.

Annual expenditure, in 2007 constant prices. **Updated: 20.1.2010**

Source: European Commission web site:
http://ec.europa.eu/agriculture/cap-post-2013/graphs/index_en.htm

1.7 There are many drivers for this next stage in the evolution of the CAP. The context is set by a parallel review of the size of the total EU budget, and how it is allocated. The European Commission also wants to ensure that a sustainable, productive and competitive agricultural sector contributes to achieving the goals of the 'Europe 2020' strategy for jobs and growth, and to reducing greenhouse gas emissions by perhaps 30%, compared to 1990 levels, by 2020. The Commission has also highlighted a need to examine the possible contribution of the CAP to adaptation to climate change in rural areas, in addition to its mitigation.

1.8 There are also calls for changes to the CAP to meet diverse policy objectives: fostering world trade; managing market risks; contributing to global food security; ensuring food safety; providing renewable feedstocks for industry, and energy; and supporting the implementation of EU legislation to safeguard water quality and biodiversity. Many observers are questioning whether the current CAP is coherent, legitimate or sustainable, and demanding much greater transparency and better targeting of policies. Some are stressing the need to agree the purposes of the future CAP before deciding the size of the budget and how it should be distributed between Member States, rather than the other way round.

1.9 Specific areas of concern, which will need to be resolved in the policy debate, include:

— Should the CAP budget be reduced so as to release funds for other policy areas? If so, by how much?

— Should the CAP budget be redistributed among Member States? Some possible criteria for redistribution include: the area of farmland, permanent grassland, or land designated as Less Favoured Areas; agricultural output; or the size of the farm labour force.

— Should the two 'Pillars' be retained? Should the current balance of spending between them change? If so, how far, and how fast?

— Should future direct payments to farmers be made only where they support the delivery of 'environmental public goods' which would not otherwise be rewarded by the market?

— What elements of the CAP, if any, should continue to be funded wholly by the EU budget? A significant shift towards co-financing by Member States would raise concerns about the 'renationalisation' of the CAP, and possible infringements of competition law.

— Should Member States, taking account of the principle of subsidiarity, have more or less flexibility to determine their own funding priorities under Pillar II?

— Should direct payments to farmers continue indefinitely or be treated as 'transitional adjustment payments', and reduced or removed (perhaps with a one-off lump sum or 'bond' being paid to compensate farmers for the loss of annual payments)?

— Should support for the provision of environmental public goods be extended beyond 'farmers' to include other land managers (e.g. those managing forests or peatlands)?

— Should the CAP seek to hasten or to slow the restructuring of agriculture? Substantial differences in farm structure, both between and within different Member States, have important implications for the efficiency and competitiveness of EU agriculture.

— Should the CAP seek to give farmers more control over the prices they can charge for their produce? Traditionally farmers have been 'price-takers' rather than 'price-setters'. Any action to strengthen their 'negotiating position' is likely to meet stiff resistance.

1.10 There is also uncertainty about the impact on the negotiations of the granting of co-decision rights to the EU Parliament, as required under the Lisbon Treaty, and whether this will make it more difficult to alter the status quo. Some observers see the CAP as having created 'programme dependency', which will be hard to change. Further uncertainty surrounds the impact of the global economic downturn, and of the high levels of indebtedness, and budgetary problems, in several EU Member States.

1.11 In the UK, the new Coalition Government is reviewing and developing its negotiating position. The Secretary of State has expressed optimism about 'the opportunities for meaningful CAP reform', noting that 'all Member States are facing up to tough economic choices and this has focused their minds on reform', and stating that 'we have the opportunity to shape the negotiations to deliver a CAP which reflects our four-pronged approach to good value for farmers, taxpayers, consumers and the environment alike' (Spelman 2010).

How can Relu projects contribute to the current debate?

1.12 Relu projects are relevant to many aspects of the CAP. Their scope embraces diverse subjects, which include: modelling the implications of a nutrition-driven food policy for the countryside; establishing the merits of consuming vegetables produced in the UK, Spain, or Africa; assessing the impacts of increasing the area of land under energy crops; and investigating energy production on farms through anaerobic digestion.

1.13 There is one area of policy concern, however, where a dozen projects or so have all produced important findings. This relates to how the CAP should support land managers in delivering a range of ecosystem services which would not otherwise be provided through the market ('environmental public goods'), in particular through the use of 'agri-environment schemes'. Several Relu projects have studied farms being managed under these schemes. Others have tackled land management issues across a range of landscape types. It is accordingly in this area that Relu projects can contribute most strongly to the current debate.

1.14 Agri-environment schemes are a key mechanism for influencing land management across the EU. They have been used more extensively, and over longer periods, in some Member States than others (e.g. in the UK, the first schemes commenced in 1987). The schemes are generally open to all farmers and are delivered through voluntary agreements co-financed by Member States and the EU under Axis 2 of Pillar II of the CAP. The agreements, which typically last for five or 10 years, basically provide annual payments to farmers who agree to implement a range of specified management practices which are appropriate to their land. Farmers participating in the schemes must also observe the cross compliance requirements attached to Single Farm Payments, whether or not they are claiming them (see Table 1).

1.15 The content of the schemes differs, both within and between Member States. They reward land management practices which protect soils and water, and maintain or enhance biodiversity, traditional farmed landscapes, and historic features. One example, selected purely for illustrative purposes from the many different schemes across the EU, is provided by the national agri-environment scheme in England, 'Environmental Stewardship' (Table 2). This has three basic 'Levels' ('Entry', 'Organic Entry' and 'Higher'). Further 'Upland' options are available within the Severely Disadvantaged Areas of designated 'Less Favoured Areas'. The payments made in these Areas reflect the loss of the former 'Hill Farm Allowance'.

1.16 All Member States are required to implement agri-environment schemes. They have been substantially tried and tested (e.g. in January 2010 the schemes in England covered some 67% of the utilisable agricultural area). As a model for rewarding the provision of ecosystem services which might otherwise not be provided, they seem likely to survive the next phase of CAP reform. However, as the findings reviewed in this section demonstrate, there are substantial opportunities, if not also imperatives, to develop agri-environment schemes further to enhance their efficiency, and effectiveness, in delivering benefits to the EU public.

Table 2: The structure of one example of an agri-environment scheme

Element	Entry Level Stewardship (ELS) and Uplands ELS	Organic Entry Level Stewardship (OELS) and Uplands OELS	Higher Level Stewardship (HLS)
Level	The simplest level in Environmental Stewardship.	The organic version of Entry Level Stewardship.	A more demanding level or Environmental Stewardship that asks a farmer to achieve more.
Availability	Separate schemes in the lowlands and uplands.	Separate schemes in the lowlands and uplands.	One scheme available throughout England.
Eligibility	Open to all farmers.	Open to farmers with organic land, land entering conversion or farms that combine conventional and organic enterprises.	Negotiated with farmers in target areas or, outside of those areas, using target themes.
Duration	5 years.	5 years.	10 years, though some options can run longer.
Payment	For ELS, the standard payment is £30 per hectare per year (£8/ha/yr on land parcels of 15 hectares or more above the Moorland Line).	The standard OELS payment is £60 per hectare per year. Organic conversion aid payments are £175/ha/yr (improved land for the first two years) and £600/ha/yr (top fruit orchards for the first three years). For Uplands OELS the standard payment is £92/ha/yr.	Requires a greater input in management terms, and so attracts higher payments. The actual payment varies according to the management required under the specific agreement.

Source: Natural England (2010)

2. Agri-environment schemes and 'ecosystem services'

2.1 The 'ecosystem services approach' provides a framework for integrating ecosystem services into policy decisions (Defra 2007). It distinguishes four main types of 'services' or benefits which healthy ecosystems can provide for people: 'provisioning' (e.g. producing food), 'regulating' (e.g. controlling flooding), 'cultural' (e.g. creating landscape beauty), and 'supporting' (e.g. cycling nutrients). The ecosystem services approach is related to, but distinct from, the 'ecosystem approach' (without the word 'services'). The latter provides a strategy for the integrated management of land, water and biodiversity to secure the objectives of the Convention on Biological Diversity (see www.cbd.int/ecosystem).

2.2 The ecosystem services approach provided the basis for the international Millennium Ecosystem Assessment (see www.maweb.org). It encourages an integrated approach to policy-making which recognises that land provides economic, social and environmental services alike. All ecosystem services are legitimate and should be fully reflected in decision-making. Hence we should consider managing land not simply 'to provide food' or 'to safeguard biodiversity' but to secure the optimum mix of diverse services. The ecosystem services approach provides not only a framework for holistic analysis, but also a challenge to established, 'silo'-based, ways of thinking about how we use and manage land.

What are the benefits of adopting the ecosystem services approach?

2.3 The ecosystem services approach has provided a framework for several Relu projects. This is not surprising, given their general emphasis on interdisciplinary and integrated approaches to the environment. Several Relu projects underline the value of adopting this approach in developing agricultural policy in general, and agri-environment policy in particular. For example, the Floodplains project suggests that developing policies for managing floodplains using an ecosystem services approach can help policy-makers to:

— Identify and quantify the range of services provided by floodplains under different management options.

— Understand the synergies and trade-offs between different types of benefits and costs associated with land and water management options.

— Appreciate how benefits and costs are distributed among different stakeholder groups, facilitate dialogue among them, and show what can and cannot be achieved through collaborative working.

— Design and promote new forms of land and water management that can deliver intended outcomes more cost-effectively.

— Design targeted policies that reward land managers for providing the desired range of beneficial services.

— Support the 'joining-up' of hitherto fragmented policy objectives and funding mechanisms in floodplains.

2.4 The Floodplains project revealed a range of trade-offs between different ecosystem services. For example, floodplains can store water, but if flooded at the wrong time, this can destroy the eggs or chicks of ground-nesting birds and set back conservation work. Equally, maintaining high water levels in the soil and in ditches can reduce flood-storage capacity and in turn affect the extent to which flood managers can control the retention and release of water to avoid flooding downstream settlements. Once such conflicts are made clear, it may be possible to develop solutions. The project concluded that 'locally relevant and targeted agri-environment options can help to balance production and environmental protection, and may be able to offer the greatest combined output of ecosystem goods and services' (Morris, 2010).

2.5 The Sustainable Uplands project also identified several further advantages of adopting an ecosystem services approach in developing and implementing land management policies:

— Competing objectives could be reconciled by ensuring that farmers are rewarded not only by the market for producing food and fibre but also, through the CAP, for providing environmental public goods (e.g. safeguarding water quality and farmland birds).

— The diverse mechanisms used to pay farmers for providing different services could be reorganised within a single ecosystem services framework. This could encourage farmers to provide a wider range of environmental public goods than hitherto.

— The use of public funds could be improved by using capability assessments to target funds on those locations which can most effectively deliver the required public goods.

— Diverse sources of information (e.g. on water quality, ecology, soils, and landscape) could be brought together and evaluated alongside each other, within a single framework, when determining how support should be targeted spatially, rather than relying on designations which tend to focus on one service at a time, such as Nitrate Vulnerable Zones (water quality) and EU Natura 2000 sites (biodiversity).

2.6 The Sustainable Uplands and Community Catchment Management projects questioned the long-standing use of the 'Less Favoured Areas' designation to compensate farmers for physical disadvantages in the uplands, rather than rewarding them for the provision of public goods. Basing public support on the natural handicaps which prevent a farmer earning more from the market is a narrow approach. An alternative would be to assess what support is needed to encourage delivery of the full range of ecosystem services on upland farms (i.e. including regulating, cultural and supporting services, alongside provisioning services).

2.7 Agri-environment schemes have been recognised as having an important role to play in delivering a range of EU environmental commitments (Table 1). These include safeguarding biodiversity (UN Conventions on Biodiversity and Wetlands), protecting Natura 2000 sites (designated under the EU Birds and Habitats Directives), protecting soil and water (EU Water Framework Directive and Nitrate Directive), and mitigating climate change (UN Convention on Climate Change). They should also help to meet EU aspirations to adapt to climate change and to respond to the innovation and growth agenda of the Europe 2020 Strategy.

Should agri-environment schemes support a wider range of ecosystem services?

2.8 Building the ecosystem services approach into the design of agri-environment schemes would entail checking whether and to what extent all relevant services were being recognised and specifically rewarded, and adjusting scheme prescriptions as necessary. One aim would be to release more value by rewarding the delivery of a wider range of ecosystem services than hitherto from any one area of land. The need to promote multi-functional land use was emphasised by the recent UK Foresight Land Use Futures Project (2010). Relu research has identified four areas where agri-environment schemes could play a stronger role, and also raised questions over the emphasis placed on promoting organic farming approaches.

Rewarding the provision of carbon stores

2.9 The Sustainable Uplands project highlighted the role of organic (peat) soils in storing carbon, and how this could be enhanced through agri-environment schemes (and potentially other policy mechanisms). In the UK alone, peat soils store over three billion tonnes of carbon, (equivalent to total UK carbon dioxide emissions over 20 years). Peat soils are now most widely distributed in the uplands, contributing to livestock production, supporting habitats for wildlife and game, providing gathering grounds for drinking water supplies, and sustaining recreational landscapes. However, land management practices and historical atmospheric deposition of pollutants have damaged significant areas. Efforts are now being made to restore these peatland areas so that they can more effectively provide a range of services.

2.10 The project suggested that agri-environment schemes in the UK uplands could be extended to support actions which prevent loss of carbon and increase the rate at which it is taken up from the atmosphere (e.g. blocking drainage ditches and gullies, and re-vegetating bare and eroding peat). Such actions could also help manage fire risk, protect downstream fisheries, safeguard drinking water quality, alleviate downstream flooding, and enhance habitats for a range of rare species. However, the mix of benefits depends critically on local conditions; it may not be possible to deliver them everywhere, all the time. It is also important to ensure that actions such as blocking drains do not exacerbate methane emissions from peatlands, and thereby offset the benefit of mitigating climate change through carbon storage.

2.11 Such an approach would contrast significantly with the traditional focus on livestock farming in these areas. Farming would still be important, but it would also need to be compatible with the delivery of other ecosystem services. It is conceivable that payments for delivering a wider range of services would exceed those received historically from farm support systems based on livestock numbers and/or land area alone. Farmers would, as now, remain free to pursue other sources of income through diversification or off-farm employment.

2.12 The project also investigated the scope to develop new mechanisms outside the CAP to reward farmers for storing carbon. This could include accessing funds to manage and restore peatlands from carbon offsetting schemes, or from other sources linked to the markets for managing and trading carbon emissions (see CREDIT 2010).

Promoting Integrated Pest Management

2.13 Concern about pesticide residues in water, adverse impacts on biodiversity, and increasing resistance among target species, has prompted the development of 'Integrated Pest Management' approaches which seek to reduce pesticide use, and its associated problems, while maintaining food production. While most conventional farmers rely on pesticides for weed, disease and pest control, many are also adopting management practices and land use patterns which can help to protect their crops.

2.14 Effective 'biocontrol' of pests can be improved by providing new habitats such as hedgerows, grass field margins, beetle banks and floral strips. These provide food and shelter for natural enemies of pests such as cereal aphids. As some invertebrate predators are relatively immobile, the spatial arrangement of these new habitats is important. For example, control by flying predators is best within 250 metres of a grass margin. Biocontrol will be achievable if suitable habitats are present in every arable field, and larger fields are divided by beetle banks. More diverse landscapes, with varied hedge and vegetation types, promote more diverse, and effective, natural predator populations.

2.15 The Pest Management project suggested that securing biocontrol should become an explicit aim of agri-environment schemes. They should reward farmers for diversifying farmland habitats and creating new habitats to harbour predators. The schemes could also promote complementary actions: controlling nutrient inputs to avoid oversupply (which encourages weeds, pests and diseases); and the use of organic manures, and reduced tillage, to encourage beneficial soil organisms. While these approaches, and related crop monitoring and management practices, would not rule out the use of pesticides completely, they would provide complementary pest control. This could also be assisted by the development of new 'biopesticides' (naturally-occurring substances, micro-organisms, and substances produced by plants containing added genetic material, which all control pests).

Reducing risks to public health from livestock waste in water

2.16 Ensuring that livestock farming does not compromise water quality is an important objective for environmental protection. This is reflected in agri-environment schemes which support farmers in creating buffer strips alongside watercourses and fencing-off watercourses to exclude livestock. These options are justified in terms of reducing faecal contamination and damage to stream banks, thereby protecting water quality and wildlife habitats. Additional potential benefits to human health and shell fisheries are not always made explicit; these come from a reduction in the risk that pathogenic micro-organisms present in livestock waste will end up in coastal bathing waters, or in food or drinking water for human consumption.

2.17 The Livestock Waste project focused on how the risks to human health from pathogenic micro-organisms in watercourses could be mitigated. It found that important risk factors include: stocking density and manure management; topography; manure storage infrastructure; and the inclination and ability of farmers to manage the risks. The project developed a tool to help land managers determine which risks are most significant and how to mitigate them effectively and efficiently. An important conclusion was that 'agri-environment measures should be strengthened to include actions that mitigate the risks'. This suggestion is reinforced by recent concern about risks to public health on beaches from pathogens in watercourses, whether from sewage outfalls or natural watercourses.

Responding to new disease threats linked to climate change

2.18 Climate change is expected to create warmer and wetter conditions in the UK, which are likely to favour the spread of pests and infectious diseases of plants and animals. This risk will be exacerbated by continuing globalisation of trade and movement of people between continents. The two Animal and Plant Diseases projects found that these risks could have implications not only for food production but also for the delivery of other environmental services. For example, landscapes could be damaged as a result of diseases of trees and shrubs (e.g. Phytophthora ramorum), and there could be increased risks to biodiversity, and to people using the countryside, from tick-borne diseases (e.g. Lyme Disease).

2.19 The projects suggested that the implications of these risks for the design and management of agri-environment schemes could include:

— Developing new management options to support the re-establishment of landscape features damaged by diseases and pests (e.g. by new planting of trees or shrubs).

— Avoiding the creation of habitats favoured by ticks and other pests, and thereby bringing risks for people using these areas, or for the biosecurity of crops and livestock on djacent land.

— Making provision for the suspension of public access to land managed under agri-environment schemes, where access could exacerbate disease outbreaks.

Reviewing support for organic conversion in intensively-farmed regions

2.20 The SCALE project undertook a 'like for like' comparison of biodiversity on mixed organic and conventional farms, set in similar landscapes, in the UK. The project measured the effects of adopting organic systems alone: it was designed so as to control effects related to field size, or to farm size, type or location. Biodiversity was assessed in terms of 'density of species' for plants and birds and 'abundance' (density of individuals) for earthworms, arthropods, butterflies and insect pollinators. The positive benefits for biodiversity from organic farming varied between the groups studied, and overall were not as strong as suggested by other comparisons of 'organic' and 'conventional' farms (an increase in biodiversity of 12% on the organic farms in this study, compared with 30-40% in others). The researchers also compared yields at field scale on the two types of farm. They questioned whether an increase of 12% in biodiversity compensated for a reduction of 55% in yield.

2.21 The research recognised that organic systems may be a useful part of the land management mix in less productive regions, where environmental factors limit productivity. For example, supporting organic farming through agri-environment schemes on species-rich grasslands in some of the new Member States is helping to safeguard those habitats from damaging intensification. However, converting a substantial proportion of conventional farms in highly-productive EU regions to organic systems could have significant impacts on overall EU food production as a result of the inevitable reduction in yields. The knock-on effects could include having to bring uncultivated wildlife habitats into production, and/or to increase food imports.

2.22 The project suggested that rather than trying to convert conventional farms to organic systems, an alternative would be to use agri-environment schemes to set intensively-managed fields on conventional farms within a landscape of wildlife-friendly field margins and non-cropped areas managed primarily for biodiversity. The environmental benefits would be enhanced by adopting 'no-till' or 'low-input' approaches on the cropped land. The project indicated that these benefits could also be substantially enhanced by encouraging neighbouring farmers to co-ordinate their actions so as to benefit biodiversity at a landscape scale, beyond that of the individual arm considered in isolation.

3. Agri-environment schemes and the challenges of scale

What spatial scales are appropriate for planning and management?

3.1 There is little consensus as to the optimum scale for managing different ecosystem services. As agri-environment schemes operate through contracts with individual farm managers, it is not surprising that the scale for planning and delivery is generally that of the farm holding. This may be appropriate for some services but not others. For example: arable weeds require sensitive management of vegetation at a field scale; farmland birds require a mix of habitats at a landscape scale; water quality may best be considered at a catchment scale; a regional scale is appropriate in considering how to improve the resilience of habitats to climate change; and strategies for protecting carbon sinks may best be developed at a national scale.

3.2 Findings from the SCALE project reinforce these observations. The project studied biodiversity on paired organic and conventional farms in similar landscapes at landscape, farm, field and within-field scales. It showed that farmland biodiversity is influenced by management at several scales: within-field for many arthropods, between-farm for plants, at the landscape scale for solitary bees and birds, and for many groups also at a regional scale. Different species groups respond to their environment not only at different scales, but also at multiple scales. This suggests that there is neither a 'right' scale of conservation management nor a single strategy that is best for all species groups.

3.3 The project suggested that if agri-environment schemes are not targeted at appropriate scales, they risk being ineffective, and thereby wasting money. They should be applied at multiple spatial scales to maximise effectiveness. This is particularly important for mobile species such as butterflies and birds. For maximum beneficial effect, the project suggested that it is necessary to manage at a spatial scale beyond the farm. Multiple farmers within a landscape need to be encouraged to adopt management options under agri-environment schemes in concert, so that landscape-level benefits can be effectively delivered.

3.4 The SCALE project also suggested that agri-environment schemes should avoid promoting national 'one size fits all' management prescriptions. Although the effects of farm management practices on biodiversity were 'quite consistent for some species groups, such as plants and butterflies, for others such as birds and solitary bees, the effects (and effect sizes) varied considerably between regions'. A prescription which suits species in one area may be inappropriate in another. Management prescriptions should accordingly be adjusted to reflect regional differences in the range of target species and their requirements. Doing so may also help minimise a risk that applying the same set of management prescriptions across the countryside will promote greater uniformity in species assemblages on farms.

3.5 The Catchment Management project examined water management programmes across Europe, the USA and Australia. It also piloted a collaborative analysis and planning process in two UK catchments. The project noted that conflicts over how to 'scale' policy-making are particularly evident in the area of water policy. The best administrative level for planning and delivery is often unclear, raising issues of legitimacy, efficiency and effectiveness. Water protection programmes in the main New York City water-supply catchment, other international examples, and the UK experience, suggested that local solutions are needed to reflect the local basis of land use and diffuse pollution. These can best be developed by an adaptive and twin-track strategy of applied research and stakeholder deliberation, supported by multi-level partnerships and an enabling regulatory environment.

3.6 The Community Catchment Management project used a computerised mapping approach to explore the potential of land for entry into agri-environment schemes. This revealed a challenge arising from poor alignment between farm and catchment boundaries. Water managers may see the catchment as the appropriate unit for managing water quality, but farmers with several discrete parcels of land spread across two or more catchments may not. Such complexities may significantly affect the practical realisation of environmental goals.

How should stakeholders be involved in scheme design and delivery?

3.7 Relu projects have used innovative approaches to tap the perspectives of local stakeholders on land management, develop scenarios, model environmental issues, and deliberate on policy and delivery options. The interests involved include land managers, local communities, voluntary organisations, local authorities and public agencies.

3.8 Engaging stakeholders is valuable in understanding the existing pattern of entitlements and obligations in relation to land management, and revealing how different ecosystem services benefit, or impose costs on, different stakeholders. The success of policies designed to secure a wider range of services from any one area of land will depend critically on how these distributional aspects are handled (e.g. by offering incentives or compensation).

3.9 Lessons for involving stakeholders in the design and delivery of agri-environment schemes at a local scale within a parish, catchment, or landscape type, include:

- Systematically engage local farmers, resource managers and other stakeholders from the outset, and seek to maintain engagement, to encourage local 'ownership'.
- Use social research techniques to identify and involve apparent outsiders who may also be able to help.
- Negotiate the intended outcomes from involving stakeholders with them from the outset.
- Share and seek to understand the perspectives and priorities of different stakeholders, what motivates them to collaborate, and what barriers to collaboration may exist.
- Encourage participants to be open to, and to respect, different perspectives. Building mutual trust will encourage people to share information, ideas and solutions openly.
- Actively source evidence and opinion from scientific and non-scientific sources alike, and ensure that all inputs are considered seriously.
- Develop proposals adapted to local conditions, and use innovative approaches, rather than 'blueprints'.
- Use Geographical Information System tools to aid discussion and create an agreed understanding of problems, opportunities and constraints, fully informed by local knowledge.
- Use face-to-face meetings, field workshops and discussions to develop trust and share information.
- Use independent facilitators to bring people together, because they may be better able to build trust than public officials.
- Monitor and report regularly on the outcomes of engagement and collaboration, to help sustain commitment.
- Recognise that it often takes substantial time to build trust and understanding among stakeholders.

Examples of stakeholder engagement in local projects

The Catchment Management project has developed an analytic-deliberative approach to catchment management. This:

- Adopts a twin-track approach, combining scientific research with deliberative stakeholder engagement.
- Is inclusive and collaborative, involving all relevant stakeholders.
- Creates a shared understanding of problems and shared commitment to developing solutions.
- Delivers iterative, adaptive management, with the capability for 'social learning'.

Critical features are:

- Models are essential to the deliberation to make complexity comprehensible and manageable.
- Deliberation is essential in constructing and using models for setting priorities and goals, and resolving trade-offs in outcomes.
- We need to manage stakeholder expectations and build trust in models.
- We need to be able to incorporate stakeholder knowledge.

The Deer project has developed novel approaches to engage stakeholders using participatory Geographical Information Systems ('participatory GIS').

These have been used to:

- Link knowledge across a landscape.
- Adopt a landscape-scale approach which takes into account the actions of neighbours.
- Incorporate multiple objectives, and map these across the landscape to identify conflict.

This approach can be extended to map ecosystem services in a landscape and provide a platform for deliberation on the trade-offs between land management objectives and ecosystem services.

The Deer project suggested that it is important for public officials to develop skills in using participatory GIS. These systems have the potential to facilitate collaboration among land managers at a landscape scale and to provide a basis for resolving conflicts often characterised by polarised stances among different interests.

How should co-ordinated action across farms be encouraged and supported?

3.10 Several Relu projects have emphasised the need to co-ordinate public investment in land management if ecosystem services are to be delivered effectively. The Hill Farming project suggested that ecological effectiveness could be improved by designing incentives which encourage spatial co-ordination across several farms. The SCALE project suggested that the benefits of requiring farmers to co-ordinate their choices with those of their neighbours would be 'greater than additive'. The Community Catchment Management scoping study illustrated the risks of failing to secure collaboration. Farmers within the catchment used agri-environment payments to rent or buy additional summer grazing land outside it. This resulted in larger numbers of cattle being over-wintered in sheds within the catchment, and an increased risk of water pollution from livestock waste.

3.11 A major problem in trying to secure collaboration, to provide landscape-level benefits, is that agri-environment schemes are usually delivered through voluntary agreements with individual farmers, within legal frameworks which respect and uphold their private property rights and individual freedom of choice. The challenge for policy-makers is to find ways of incentivising farmers to act as a community, rather than simply as individuals within these frameworks. The situation is further complicated where land is leased by a landowner to a farmer under a formal agreement. In such situations, any new policy mechanisms will need to respect and accommodate the specific rights and responsibilities of both parties.

3.12 Securing collaborative action among farmers is not simply a matter of designing new schemes and delivery mechanisms. Winning participation may often depend on convincing farmers that the individual benefits will strongly outweigh the costs of collaboration, both perceived and real. For example, the Deer project showed that landowners with hunting estates were reluctant to join schemes if this meant relinquishing control over the management of their land. On the other hand, the Community Catchment Management project has found that farmers will work together to secure agri-environment agreements if they consider that this will help to secure the continued viability of their individual farms.

3.13 Equally, there are many examples of farmers collaborating in relation to 'provisioning' ecosystem services: witness the growth of farmers' markets, and of local and regional food marketing schemes. Co-operative purchasing of inputs, sharing of machinery, training of farmers, harvesting and storing of produce, and marketing of crops and added-value products are integral parts of everyday agriculture in many parts of the EU. If farmers can collaborate successfully to maximise rewards from the market, why should they not also work together to secure rewards from the CAP for the provision of environmental public goods?

What practical approaches will encourage collaborative working?

3.14 One option might be to reward farmers for voluntarily tackling local land management issues as a group, agreeing co-ordinated actions across several farms, and delivering these through group agreements. The Sustainable Uplands and Catchment Management projects have both promoted such approaches through their deep engagement with local interests in analysing and deliberating on land management issues. Such an approach could:

— Bring together representatives of farmers and other stakeholders, with advisors within the target area (e.g. parish, catchment, landscape type).

— Foster negotiations on changes in land use and management to deliver a range of ecosystem services at the selected scale.

— Identify the locations which could most efficiently and sustainably provide different ecosystem services, by drawing on computer models and secondary data.

— Bring together and deliberate on scientific evidence, and critical knowledge from local land managers and others, to deliver local rather than 'one-size-fits-all' solutions.

— Inform and validate the menu of ecosystem services to be rewarded in the area, and advise on how to target investment, in the interests of efficiency and effectiveness.

— Reconfigure or create new incentives to deliver the desired ecosystem services as efficiently as possible.

3. Agri-environment schemes and the challenges of scale

3.15 The Sustainable Uplands project also suggested that, in time, this sort of approach could lead to the channelling of increasing amounts of financial support through local groups, rather than through agreements with individual farmers. Hence farmers would indeed be incentivised to act as a community, rather than simply as individuals. The local groups could bid for funding from national sources. There are close parallels here with the approach adopted in other countries through local 'land care' groups and programmes.

3.16 Such collaborative approaches could succeed at various spatial scales. Intuitively, the chosen scale in any situation should reflect the nature of the environmental issues, and natural limits. Hence it could embrace farms within a river catchment (or sub-catchment), or involved in managing habitats of a particular type, or operating particular mixes of farm enterprises. Such a scale might equate to that of an administrative parish, involving dozens of land managers, rather than hundreds.

3.17 Other suggestions from Relu projects to maximise the benefits of agri-environment schemes by co-ordinating their actions across several farms, include:

- SCALE: Enhancing the 'points' awarded to farmers if a co-ordinated approach is adopted with neighbours.
- Hill Farming: Offering a financial incentive, such as a 'collaboration' bonus, where a scheme involves more than a defined minimum proportion of land, or of land managers, within a specific targeted area.
- Community Catchment Management: Building on precedents for collaboration, such as agri-environment agreements in the UK negotiated with groups of farmers who graze livestock on shared ('common') grazing land in upland areas.

3.18 Priorities for developing collaborative approaches through agri-environment schemes at a landscape scale could include:

- Enhancing farmland bird populations across arable and pastoral landscapes alike.
- Enhancing populations of butterflies and moths, which are increasingly threatened.
- Managing the impacts of deer (e.g. damaging woodland, and causing traffic accidents).
- Encouraging wide-ranging species which provide critical services, such as bees (pollination), hoverflies (biocontrol), and earthworms (decomposition).
- Managing water quality and water resources at a catchment scale.
- Managing communal grazing land over which many people have different rights of use.
- Creating linked networks of specific wildlife habitats to facilitate adaptation to climate change.
- Managing distinctive landscapes (e.g. upland areas) for multiple objectives (e.g. producing livestock, managing game, storing carbon, gathering water, enhancing wildlife, protecting cultural features, and providing recreational opportunities).
- Minimising fire risks on extensive grassland, heathland, moorland, scrub, wood pasture and woodland habitats.

How can long-term environmental benefits be secured?

3.19 Agri-environment schemes typically operate through five-year or 10-year agreements. When they end, there is no obligation on either side to renew them. These arrangements provide flexibility: the public avoids a long-term financial commitment, and farmers can keep their future options open. Equally, though, the public risks losing the benefits purchased (e.g. habitat re-creation, landscape protection, reduced nutrient levels in water, or public access); and the farmer risks losing a secure flow of income.

3.20 Increasingly, environmental policy objectives are being set at EU and/or national level over periods of decades, rather than years (e.g. in relation to climate change, water quality and biodiversity). Purchasing environmental services for periods of only five or 10 years seems inadequate given the need to secure enduring benefits. For example, there is little value in paying a farmer to store carbon by converting arable land to grassland between 2010 and 2015 if at the end of the agreement the farmer simply returns the land to arable.

3.21 Relu projects have drawn on international experience in examining this challenge. For example, the Catchment management project is developing a catchment management 'template' which reflects experience across Europe, the USA and Australia. Approaches used elsewhere include: the public purchase of long-term easements or covenants which restrict how land can be used; sale-and-leaseback arrangements; outright public purchase and management of land; the use of tenders whereby managers specify what services they will provide, at what cost, over what period, and bid competitively for a share of the funds; 'cap and trade' schemes for pollutants; or 'mitigation banking', where developers purchase credits from a 'bank' which uses these to fund the purchase and management of land (or agreements with land managers) to yield long-term environmental gains.

Could providing formal training help to deliver the schemes?

3.22 The Agri-environment project is examining the potential benefits of providing formal training to land managers to help them deliver management options under agri-environment schemes. In some Member States, a short training scheme is compulsory for scheme participants (e.g. in Ireland). Elsewhere, training courses may be available, but are not necessarily tied to participation in the schemes. It is often assumed, perhaps mistakenly, that farmers innately possess the skills required to deliver optimum environmental outcomes.

3.23 The Agri-environment project found that most farmers are attracted to the schemes by a combination of the payments available and scheme compatibility with their existing farming system, so that they need make only minimal adjustments to current farming practices. Their success will depend to a large extent on how well they engage with the aims and objectives of the scheme. Farmers may follow the prescriptions slavishly, without fully understanding the reasoning behind them, and thereby fail to deliver optimum management. Or they may 'cut corners', either deliberately, or inadvertently, so that critical elements are not properly implemented, resulting in poor results, and technical breaches of the schemes.

3.24 The project identified a need for farmers to understand why certain actions are required, and how to undertake appropriate management. It assessed how well farmers understood the requirements of two relatively demanding scheme options: sowing field margins with crops to provide winter food for wild birds, or sources of nectar for butterflies and bees. It then assessed the experience of farmers participating in training events.

3.25 Farmers receiving training reported that it had helped to address their concerns about the management options and provided useful practical knowledge of management techniques. It also boosted their confidence in their ability to deliver environmental benefits through their actions. This is important, because other research suggests that raising awareness, and providing information and education, will not by themselves bring about required changes in behaviour; believing that one's actions will make a difference is also critical.

3.26 These results are helpful in understanding how training is important. The project is currently examining whether training has an enduring and measurable effect on environmental outcomes. The initial findings suggest: that it cannot be assumed that land managers necessarily possess the requisite skills to deliver specific services; and that deliberate investment in training, perhaps targeted on the more novel or technically-difficult options, may improve effectiveness. The research should show whether investment in training can be justified because it improves the overall value-for-money provided by the schemes.

3.27 The Pest Management project identified adoption of Integrated Pest Management approaches as one specific area in which greater training may be helpful. In particular, farmers need: information about alternatives and support during the adoption process, including details of the efficacy of alternative control products and how they complement each other; and training programmes on pesticides that incorporate the latest research on Integrated Pest Management, and any resulting revisions to agri-environment schemes.

4. Valuing and measuring land management actions

How should the benefits of ecosystem services be valued?

4.1 Several Relu projects have examined the valuation of ecosystem services. This is a critical concern in determining how much of any one service society should seek to secure from any one piece of land (e.g. 'How much food, biodiversity, or carbon storage?'). In turn, it is also necessary to determine how to prioritise the several different services which could be provided to deliver the optimum mix for society (e.g. 'So much food, biodiversity, and carbon storage'). If that optimum mix is not currently being delivered, the challenge then is to determine how best to secure the necessary changes in land management practice (e.g. 'What advice, regulation, or incentive is needed?'). Where an economic incentive appears to be necessary, a further challenge is to decide how to calculate the amount.

4.2 The Floodplains project showed that the services provided by floodplains are valued to different extents by different stakeholders. Three approaches were used in quantifying the value of floodplain biodiversity: pre-defining targets for biodiversity; considering stakeholder preferences; and assessing monetary values.

The project found that:

- Different methods emphasise different aspects of conservation value, potentially leading to different rankings of alternative land uses on any one site. Therefore, care has to be taken to use a valuation method that suits the purpose of the assessment.

- Where required and appropriate, monetary values can be based on estimates of citizens' willingness to pay for nature conservation, or alternatively their willingness to pay famers 'compensation' for not farming intensively.

- When the views of stakeholders are important, particularly at the local scale, stakeholder-choice techniques or stakeholder-derived criteria can be used.

- An 'Ecological Impact Assessment', using pre-defined targets to prioritise particular habitats and species, is appropriate where ecological objectivity is the key concern.

4.3 The Hill Farming project assessed what people wanted from upland landscapes and whether they would be willing to pay to achieve that vision.

The project found that:

- Visitors to the Peak District National Park would be willing to pay an additional parking fee to support greater conservation of key habitats. This was especially the case for moorland, where people would be willing to pay an average of £4 per visit.

- Residents of towns surrounding the National Park are willing to pay to maintain current levels of conservation.

- Estimates of people's willingness to pay can be affected when respondents are given time to reflect on their choices, taken to visit exemplar sites, or provided with expert witness testimony regarding the National Park.

4.4 The Sustainable Uplands and Deer projects both studied the relative value of different services by investigating stakeholder preferences for different land management actions. For example, the Sustainable Uplands project considered the value to society of restoring peat soils to regulate water flows, provide wildlife habitats, store carbon, and produce livestock and game extensively. It suggested that payments could be based on spatially explicit, modelled relationships between management activities and ecosystem services. The Water Framework Directive project used innovative models to value the likely social benefits to recreational water users of improving outdoor water quality by changing land management. The models used also took account of economic impacts on farm gross margins.

4.5 It is widely recognised that valuation techniques for non-market benefits all have weaknesses, and are better used to inform rather than determine decisions. A pragmatic suggestion is that the 'appropriate value' to place on any desired service is that which brings about whatever specific action or change in behaviour is required. Hence, society should ask not 'What is the value of clean water?' but rather 'How much will it cost (in regulatory effort, incentives, or through other means), to persuade land managers to change their mindsets and adopt practices which deliver clean water?'

4.6 There is also scope to develop alternative economic instruments, including mechanisms to tap private sector funds, to support the provision of certain ecosystem services and create new income streams for farmers which are not associated with food production and the CAP. For example, there are proposals to raise funds for restoring peatlands, initially through a Corporate Social Responsibility scheme and potentially, in the future, through an accredited carbon offset scheme (CREDIT 2010). Equally, funds for land management could be raised from consumers as visitors and tourists, and through local community and charity initiatives.

How should successful land management be measured?

4.7 Agri-environment schemes have often been criticised for not achieving their objectives or providing value for public money. Although monitoring and evaluation frameworks have become more sophisticated in recent years, they have tended to focus on the number and proportion of eligible farmers who participate in the schemes, and the total area of land which they cover, rather than on their environmental impact. Implicit assumptions have been that the scheme prescriptions: will be applied in the right places; will be correctly implemented; and will deliver the expected outcomes. Hence, if a farmer participates in a scheme, it is assumed that the environmental benefits will follow automatically.

4.8 Findings from the Hill Farming project challenged this assumption. The project found mixed evidence from ecological surveys that agri-environment agreements improve the status of upland bird populations: the types of land management actions specified in the schemes explained little of the variation in patterns of bird species richness (diversity); and farms with agreements, if anything, had fewer, not more, species, than those outside them. However, the influence of the schemes became clearer when looking at individual species of conservation concern. Greater densities (abundance) of these key species were found on fields where more of the farm, and of the surrounding area, was covered by agreements.

4.9 The assumption that participation will automatically lead to desired outcomes fails to allow for variations in soils, climate, and local biodiversity, so that prescriptions which work on one farm will not work on another. It also fails to allow for poor implementation, through a lack of understanding or technical skill, among farmers. Some observers have suggested that it would be better to pay farmers only when the desired outcomes have been achieved. However, the same challenges apply. For example, a farmer may create a perfect breeding habitat for wading birds; but if none are found in the vicinity, they are unlikely to nest there. Similarly, if there are no seed sources nearby, trees are unlikely to regenerate naturally on grassland from which livestock have been excluded. In both cases it would seem unfair not to reward the farmer for faithfully implementing the desired management actions.

4.10 Some outcomes are difficult and costly to quantify. A desired outcome for schemes on arable land is often to improve populations of farmland birds, but these are difficult to measure, not least because birds are mobile. The Biodiverse farming project suggests that it would be easier, and just as valuable, to monitor certain arable weed species, because of their value as a food source for birds in their own right, and as hosts for insect food sources. It might also be easier for farmers to monitor weed species than birds, thereby enabling them to check and adjust their management practices to create the desired conditions.

4.11 The SCALE project similarly questioned the assumption that participation in an organic agri-environment scheme will automatically deliver certain environmental outcomes, or more effectively than on a conventional farm. For example, an organic farmer might be less able than a conventional farmer to follow prescriptions for managing arable field margins to benefit birds. It would accordingly be better to reward both types of farmers simply on the basis of the diversity and/or abundance of weed species present in the crop, taking no account of whether or not the farm is being managed under an organic regime.

4.12 Several projects have shown that the management of neighbouring land can have a significant impact on the environmental outcomes achieved on any specific farm. If several farmers agree to manage contiguous land in a similar way, so that the overall benefit is greater than the sum of the parts, it would seem reasonable to pay them all a premium for delivering those additional benefits. Equally, there would be little value in paying one farmer to participate in a scheme if land management actions on neighbouring farms negated the benefits of doing so. These observations underline the potential value of designing and delivering agri-environment schemes through collaborative approaches at a landscape scale.

4.13 The Sustainable Uplands project noted that cost-effective monitoring technologies still need to be developed to monitor ecosystem service provision more comprehensively and over larger areas. However, targeted spot-checks of the provision of specific services might be practicable and affordable. In line with general trends in environmental regulation, it would be useful if the outcome measures were designed so that farmers could monitor and report on these themselves, subject to periodic auditing of those reports.

Should agri-environment payments change if other support is reduced?

4.14 Agri-environment schemes provide an important source of income, over the term of the agreement, but they are only one part of the public subsidy: the farmers involved will also be receiving the Single Farm Payment. Two questions arise: 'How would the delivery of ecosystem services be affected by the loss of the Single Farm Payment?' and 'Would any adjustment in agri-environment payments need to be made as a result?'

4.15 One Relu project has provided important insights in this area in relation to upland farms. The Hill Farming project used detailed information from a sample of 44 upland farms of six types in the UK Peak District to model how farm income, land use and biodiversity might change under six policy scenarios. Of particular interest are the modelled comparisons between the 'current' situation, with the 'decoupled' Single Farm Payment, and a possible future situation with no decoupled payments. In each case, the study also modelled the impact of providing additional support from agri-environment schemes. The findings reported below exclude the contribution to incomes made from off-farm sources and farm diversification.

4.16 The project found that even though the modelled effects of the policy scenarios varied substantially across the six farm types, it was still possible to establish some general trends. A shift from decoupled payments to no payments, without any additional support from agri-environment schemes, would lead to considerable areas of land being taken out of farming on three farm types (which can be described as 'abandonment' or 'releasing land for new uses' depending on one's perspective). In addition, this change would mean that five out of six farm types would have a negative net farm income, and thus be financially unsustainable.

4.17 If agri-environment payments continued to be available after the removal of decoupled payments, net farm income would still fall considerably on all farm types, and become negative in four out of six cases. This finding underlines the importance of the decoupled payments to the long-term viability of hill farms in the study area. If they were removed, and the same number and types of farms were to be retained, there would need to be a corresponding increase in the level of payments under agri-environment schemes to keep the businesses viable. Further adjustments in payments might also be necessary to ensure that beef and/or sheep enterprises could continue on some of the farm types.

4.18 This study did not allow for possible structural changes in the number and mix of farms. For example, there might be changes in farm ownership and the number of active farmers, or switches between farm types (as distinct from changes in the intensity and mix of livestock enterprises within each farm type). Such behavioural changes cannot be excluded. If they happened, it might not be necessary to secure farm viability by increasing agri-environment payments to the same extent as the study implies, to compensate for the loss of some or all of the Single Farm Payments which currently underpin economic viability for these farms.

The importance of CAP payments to farmer income in the uplands

The Community Catchment Management project found that receipts from the Single Farm Payment and agri-environment schemes accounted for between 42% and 68% of farmer income in the catchment. The viability of the one farm without an agri-environment agreement depended on receipts from the Single Farm Payment. Farm holding sizes in the catchment had increased over time as the number of farmers had fallen.

The project found some evidence that landscape features such as hedges and walls, key attributes of the local cultural landscape, were less well-managed on larger holdings. The project underlined the importance of capital payments, as distinct from annual revenue payments, for restoring these landscape features.

5. Where next for agri-environment schemes in the CAP?

5.1 Relu research offers important scientific evidence to inform the continuing debate at both UK and EU levels about the future of the CAP and the place of agri-environment schemes within it. In particular, the research findings will assist policy-makers in developing the schemes so that they improve the ability of land managers to deliver a wide range of ecosystem services which would not otherwise be provided through the market ('environmental public goods').

5.2 On the basis of the research findings reported here, and taking account of the wider policy context, the following recommendations are offered for consideration by policy-makers:

1. An ecosystem services framework: Agri-environment schemes should be retained as a critical delivery mechanism within the CAP. They should be explicitly designed and implemented within the framework provided by the 'ecosystem services approach'. This embraces services rewarded by the market (e.g. producing food and fibre) and the provision of environmental public goods. The framework will assist in managing the varied demands on land, setting priorities, and identifying and tackling conflicts.

2. Funding: The resources made available at EU level to support the schemes should be increased radically, to recognise their critical role in delivering environmental commitments. The schemes should receive a higher proportion of the EU CAP budget and/or be supported at a higher rate of EU co-financing. Payments for scheme options should be increased as necessary to ensure that desired environmental public goods can continue to be delivered following any reductions in the Single Farm Payment.

3. Developing scheme options: The menu of scheme options, in any one area, should be based on a systematic assessment of all the environmental public goods which could be provided by farms. Management options should be developed at the most appropriate scale (e.g. 'catchment' for water quality, or 'landscape' for farmland birds). Management prescriptions should be tailored, as far as possible, to local conditions.

4. New priorities: The schemes should include actions to: promote carbon storage, and integrated pest management; reduce risks to public health from livestock waste in water; and respond to new pest and disease threats. The use of the schemes to convert conventional farms in highly-productive EU regions to organic farming systems should be reviewed. An alternative might be to use the schemes to create networks of areas managed primarily for biodiversity around intensively-managed fields on conventional farms, enhancing the benefits by using 'no-till' or 'low-input' approaches.

5. Promoting collaborative approaches: The scale at which scheme agreements are planned, negotiated, funded and delivered should shift, over time, from the individual farm to the local community of farms. This will help to ensure that: farmers are fairly rewarded for the added benefits of co-ordinated action; farmers outside agreements cannot negate the work of those within agreements; and different environmental public goods are delivered at the most appropriate scale.

6. Involving stakeholders: Advice from local farmers and other stakeholders on scheme options, their delivery, and how to co-ordinate action between farmers, should become far more important in designing and delivering the schemes. More use should be made of tools to support deliberation on objectives and priorities, and to help resolve conflicts. Participatory Geographical Information Systems offer one useful approach.

7. Securing long-term benefits: The schemes should incorporate, or be supplemented by, new contractual mechanisms which will secure the long-term public interest in land management, over periods of decades rather than years. This will be particularly important in managing carbon, and in restoring, re-creating or linking wildlife habitats.

8. Calculating payments: The payments offered under the schemes to secure changes in land management reflect income foregone and additional costs incurred. World trade rules preclude the inclusion of any incentive element. There are some differences between Member States in the approach taken to calculating income foregone. This experience should be shared with the aim of establishing consistent practices which provide appropriate rewards for the provision of environmental public goods.

9. Payment by results: Where scheme outcomes are easy to measure, some element of the payment should be based on results, rather than on mere participation. Prescribing the desired outputs rather than the inputs (e.g. 'a sward of a certain composition and height' rather than 'the timing and density of grazing') would enable farmers to measure outcomes themselves, and to check and adjust management practices accordingly.

10. Supporting farmers with training: Investment in formal training, targeted on novel or technically-difficult options, should become an integral part of all schemes, to help improve their effectiveness. This will help farmers to understand scheme objectives, and to support them in exercising their skills to deliver appropriate management.

Further Information

The Rural Economy and Land Use Programme is a £25 million interdisciplinary research programme, funded by the UK research councils with additional support from Defra and the Scottish Government. It runs from 2003 to 2011 to investigate the strategic challenges facing the UK countryside.

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Relu Projects reviewed

The short titles in italics are those used for reference in this paper. Relu Policy and Practice Notes (PPNs) may all be downloaded, free of charge, from: www.relu.ac.uk/news/policyandpracticenotes.htm

Agri-environment (Improving the Success of Agri-environment Schemes): studying how well wildlife habitats are created under agri-environment schemes and whether training for farmers improves the outcomes. James Bullock. jmbul@ceh.ac.uk

Animal and Plant Diseases (Assessing the Potential Rural Impact of Plant Disease): developing an inter-disciplinary appraisal of the potential impacts of plant diseases on land use and the rural economy; and (The Governance of Livestock Disease): considering how decisions are made in controlling animal diseases. Peter Mills, Graham Medley. peter.mills@warwick.ac.uk, graham.medley@warwick.ac.uk (see PPN16)

Animal Disease Risks (Assessing and Communicating Animal Disease Risks for Countryside Users): examining the risks associated with tick-borne diseases, how to reduce them and what information people need to keep themselves safe. Chris Quine. Chris.Quine@forestry.gsi.gov.uk

Biodiverse Farming (Management Options for Biodiverse Farming): examining the social, economic and political factors underlying farming practice, and the implications for biodiversity when farmers decide to change what they do or how they do it. Bill Sutherland. w.sutherland@zoo.cam.ac.uk

Catchment Management (Catchment Management for Protection of Water Resources): examining the means, the governance needs, and the costs and benefits of alternative approaches to tackle diffuse pollution. Laurence Smith. l.smith@soas.ac.uk (see PPN7)

Community Catchment Management (Testing a Community Approach to Catchment Management): investigating how scientists, institutional stakeholders, farmers and residents can share expertise and work together positively for the benefit of a specific lake catchment. Claire Waterton. c.waterton@lancaster.ac.uk

Deer (Collaborative Deer Management): using deer as a case study to investigate how well people involved in managing natural resources work together, and how this can be improved. Justin Irvine. j.irvine@macaulay.ac.uk (see PPN18)

Floodplains (Integrated Management of Floodplains): exploring solutions to join up multiple objectives such as managing flood risk and water resources, enhancing biodiversity, and supporting rural livelihoods, focusing on a selection of agricultural flood defence schemes. Joe Morris. j.morris@cranfield.ac.uk (see PPN15)

Hill Farming (The Sustainability of Hill Farming): modelling the responses of hill farming communities in the Peak District in England to policy changes, and how their responses affect the dynamics of change in moorland landscapes and upland bird populations. Paul Armsworth. parmsworth@utk.edu (see PPN13)

Livestock Waste (Sustainable and Safe Recycling of Livestock Waste): determining the implications for farmers, the food industry and tourism of changing land management practices to reduce pathogen transfers to the food chain from farm waste. David Chadwick. david.chadwick@bbsrc.ac.uk (see PPN4)

Pest Management (Overcoming Market and Technical Obstacles to Alternative Pest Management in Arable Systems): developing effective tools to evaluate and promote the adoption of biochemical control technology into agricultural systems in the UK. Alastair Bailey. a.bailey@kent.ac.uk (see PPN10)

SCALE (The Effects of Scale in Organic Agriculture): examining what causes organic farms to be arranged in clusters, and how the environmental, social and economic impacts of organic farming may vary due to neighbourhood effects at a variety of scales. Sigrid Stagl, Tim Benton (Biodiversity work package leader). Sigrid.Stagl@wu.ac.at, T.G.Benton@leeds.ac.uk

Sustainable Uplands (Sustainable Uplands: Learning to Manage Future Change): combining knowledge from policy-makers, scientists and local stakeholders to anticipate, monitor and manage change in the uplands. Klaus Hubacek, Mark Reed. hubacek@env.leeds.ac.uk, m.reed@abdn.ac.uk (see PPN14, PPN17)

Water Framework Directive (Modelling the Impacts of the Water Framework Directive): examining how changes in land use to reduce pollution are likely to impact upon farming communities, and attempting to value the likely benefits of improving outdoor water quality. Ian Bateman. i.bateman@uea.ac.uk

See www.relu.ac.uk for further information on specific Relu projects and links to their web sites.

Useful resources

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